SPEC® CPU2017 Integer Rate Result

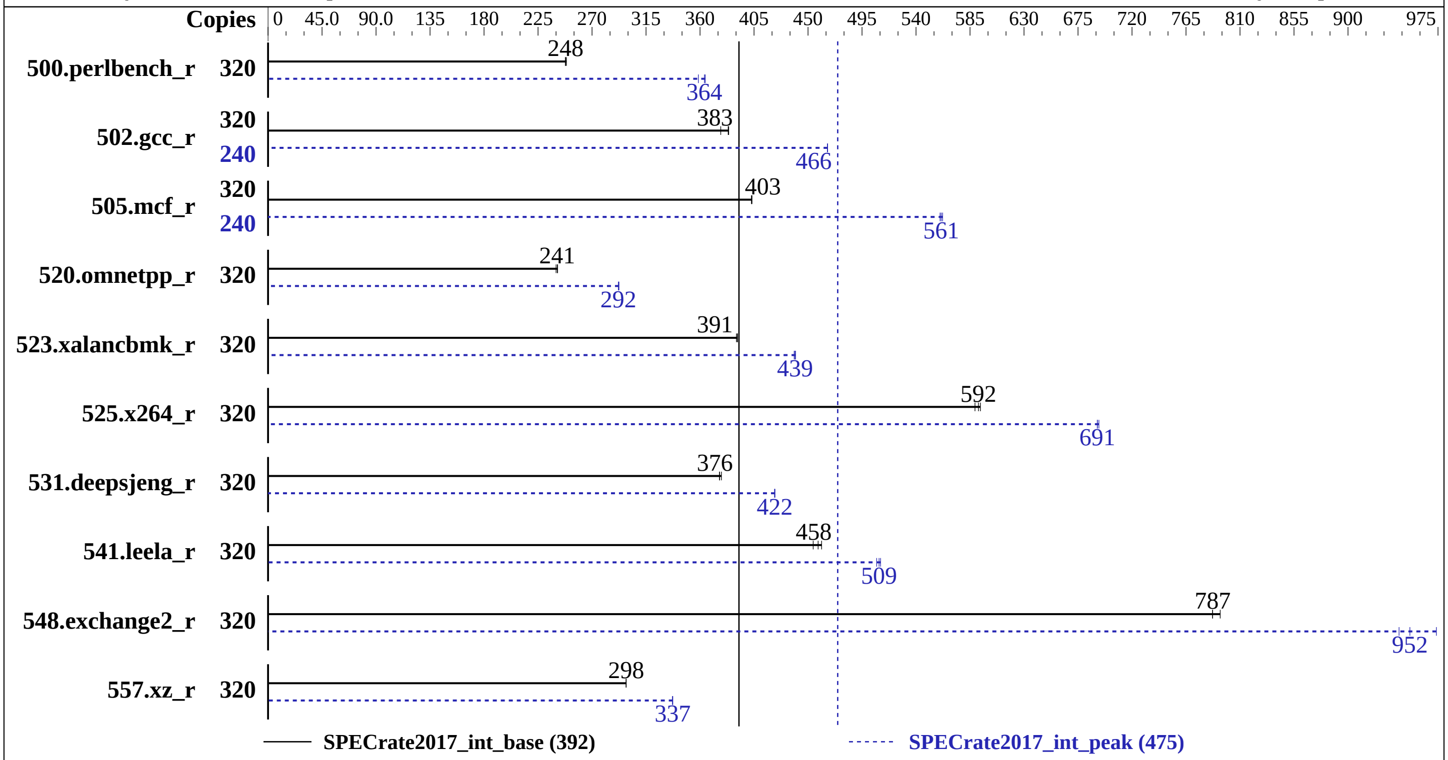
IBM Corporation

SPECrate2017_int_base = 392

IBM Power E950 (3.4 - 3.8 GHz, 40 core, SLES)

SPECrate2017_int_peak = 475

CPU2017 License:	11	**Test Date:**	Jul-2018
Test Sponsor:	IBM Corporation	**Hardware Availability:**	Aug-2018
Tested by:	IBM Corporation	**Software Availability:**	Apr-2018



Hardware

CPU Name:	POWER9
Max MHz.:	3800
Nominal:	3400
Enabled:	40 cores, 4 chips, 8 threads/core
Orderable:	2, 4 Chips
Cache L1:	64 KB I + 64 KB D on chip per core
L2:	512 KB I+D on chip per core
L3:	100 MB I+D on chip per chip shared NUCA / 10 cores
Other:	16 MB I+D off chip per 2 DIMMs
Memory:	1 TB (64 x 16 GB 1Rx4 PC4-2666V-R, running at 1600)
Storage:	1 x 1.8 TB 10K RPM 4K SAS HDD
Other:	None

Software

OS:	SUSE Linux Enterprise Server 12 SP3 4.4.114-94.11-default
Compiler:	C/C++: Version 16.1.0 of IBM XL C/C++ for Linux; Fortran: Version 16.1.0 of IBM XL Fortran for Linux
Parallel:	No
Firmware:	Version VM920_034 Released Jul-2018
File System:	xfs
System State:	Run level 5 (multi-user, graphical)
Base Pointers:	64-bit
Peak Pointers:	64-bit
Other:	Post-Link Optimization (fdprpro) for Linux on POWER, version 5.6.4.0; Advance Toolchain 11.0-0

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Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
500.perlbench_r	320	2049	249	**2055**	**248**	2056	248	320	1398	364	1421	359	**1401**	**364**
502.gcc_r	320	1201	377	**1182**	**383**	1180	384	240	729	466	**729**	**466**	729	466
505.mcf_r	320	1282	403	**1283**	**403**	1284	403	240	690	562	693	560	**691**	**561**
520.omnetpp_r	320	1749	240	1740	241	**1742**	**241**	320	1436	292	**1438**	**292**	1438	292
523.xalancbmk_r	320	864	391	**864**	**391**	866	390	320	769	440	771	438	**769**	**439**
525.x264_r	320	**946**	**592**	951	589	944	594	320	**811**	**691**	811	691	809	692
531.deepsjeng_r	320	975	376	**974**	**376**	971	378	320	868	422	**869**	**422**	869	422
541.leela_r	320	1166	454	**1156**	**458**	1149	461	320	**1041**	**509**	1045	507	1038	510
548.exchange2_r	320	**1065**	**787**	1065	787	1057	794	320	**881**	**952**	890	943	861	974
557.xz_r	320	**1158**	**298**	1158	298	1158	298	320	1025	337	**1025**	**337**	1026	337

SPECrate2017_int_base = **392**

SPECrate2017_int_peak = **475**

Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

Compiler Notes

```
Binaries were compiled on a system with 2x POWER9 CPU + 512GB Memory using SUSE Linux Enterprise Server 12 SP3
```

Peak Tuning Notes

```
The FDPR post compiler binary optimizer was used
500.perlbench fdpr options: -O3 -noasd
502.gcc fdpr options: -RC -nop -bp -bf -A 2 -ihf 20 -isf 12
505.mcf fdpr options: -O4 -RC -nop -bf  -tlo -pto  -rt 0 -kr -hr -RD -las
520.omnetpp fdpr options: -O4 -A 2 -rcl 2 -sls -dir -vrox
523.xalan fdpr options: -O3
525.x264 fdpr options: -O3 -RC -nop -bf  -tlo -pto  -rt 0 -kr -hr -RD -las -vrox
-lux -1  -lu 9 -isf 12  -si -ihf 20  -sidf 50 -bp
531.deepsjeng fdpr options: -O3 -noasd
541.leela fdpr options: -RC -nop -bp -bf -hr
557.xz fdpr options: -O4
```

Submit Notes

```
The config file option 'submit' was used
to assign benchmark copies to specific kernel thread using
the "numactl" command (see flags file for details).
```

Operating System Notes

```
Stack size is set to unlimited
ulimit -s unlimited
Number of huge pages alloted are 32000
echo 32000 > /proc/sys/vm/nr_hugepages
drop cache is used before invoking runcpu command
sync; echo 3 > /proc/sys/vm/drop_caches
```

General Notes

```
Environment variables set by runcpu before the start of the run:
HUGETLB_MORECORE = "yes"
HUGETLB_VERBOSE = "0"
LD_LIBRARY_PATH = "$LD_LIBRARY_PATH:/opt/FDPR"
LD_PRELOAD = "/opt/at11.0/lib64/libhugetlbfs.so"
MALLOC_MMAP_MAX_ = "0"
TCMALLOC_MEMFS_MALLOC_PATH = "/dev/hugepages/"
XLFRTEOPTS = "intrinthds=1"
XLSMPOPTS = "spins=0:yields=0:schedule=STATIC:stack=8000000"

 Yes: 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.
Post-Link Optimizer (fdprpro): sources available at https://developer.ibm.com/linuxonpower/sdk-packages/
Advance Toolchain 11.0-0: sources available at https://ibm.biz/AdvanceToolchain
8 memory riser cards were used, with 8 DIMMs per card
```

Platform Notes

```
Firmware configuration:
Idle Power Saver mode is disabled

Sysinfo program /home/CPU2017/v1.0.5/bin/sysinfo
Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9
running on linux-xo92 Tue Jul 31 04:34:14 2018

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
  'clock : ' reported by /proc/cpuinfo may not be reliable. Use with caution.
   cpu : POWER9 (architected), altivec supported
   clock : 3000.000000MHz
```

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Platform Notes (Continued)

```
    machine : CHRP IBM,9040-MR9
    model : IBM,9040-MR9
    platform : pSeries
    revision : 1.2 (pvr 004e 2102)

 Number of cores, from 'ppc64_cpu --cores-present' :  40

 WARNING regarding the output of 'lscfg':  this utility reports resources for the system,
 not the current partition.  Therefore, for a partition that has a subset of the full
 system resources:
    (1) The tester may need to adjust the sysinfo-supplied 'hw_ncores'.
    (2) The tester may need to adjust the sysinfo-supplied 'hw_nchips'.

 Processors, from lscfg -vp

    ^^^Note: sum of ways = 0, differs from 'ppc64_cpu --cores-present'
       320 "processors"

 From numactl --hardware  WARNING: a numactl 'node' might or might not correspond to a
 physical chip.
   available: 4 nodes (0-3)
   node 0 cpus: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
   28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56
   57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79
   node 0 size: 258194 MB
   node 0 free: 129217 MB
   node 1 cpus: 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102
   103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124
   125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146
   147 148 149 150 151 152 153 154 155 156 157 158 159
   node 1 size: 249103 MB
   node 1 free: 120692 MB
   node 2 cpus: 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177
   178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199
   200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221
   222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239
   node 2 size: 258559 MB
   node 2 free: 130216 MB
   node 3 cpus: 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257
   258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279
   280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301
   302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319
   node 3 size: 258802 MB
   node 3 free: 130467 MB
   node distances:
   node   0   1   2   3
     0:  10  40  40  40
```

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Platform Notes (Continued)

```
     1:  40  10  40  40
     2:  40  40  10  40
     3:  40  40  40  10

 From /proc/meminfo
    MemTotal:       1049251776 kB
    HugePages_Total:   32000
    Hugepagesize:      16384 kB

 /usr/bin/lsb_release -d
    SUSE Linux Enterprise Server 12 SP3

 From /etc/*release* /etc/*version*
    SuSE-release:
       SUSE Linux Enterprise Server 12 (ppc64le)
       VERSION = 12
       PATCHLEVEL = 3
       # This file is deprecated and will be removed in a future service pack or release.
       # Please check /etc/os-release for details about this release.
    os-release:
       NAME="SLES"
       VERSION="12-SP3"
       VERSION_ID="12.3"
       PRETTY_NAME="SUSE Linux Enterprise Server 12 SP3"
       ID="sles"
       ANSI_COLOR="0;32"
       CPE_NAME="cpe:/o:suse:sles:12:sp3"

 uname -a:
    Linux linux-xo92 4.4.114-94.11-default #1 SMP Thu Feb 1 19:28:26 UTC 2018 (4309ff9)
    ppc64le ppc64le ppc64le GNU/Linux

 Kernel self-reported vulnerability status:

 CVE-2017-5754 (Meltdown):          Mitigation: RFI Flush
 CVE-2017-5753 (Spectre variant 1): Not affected
 CVE-2017-5715 (Spectre variant 2): Not affected

 run-level 5 Jul 30 13:21

 SPEC is set to: /home/CPU2017/v1.0.5
    Filesystem     Type  Size  Used Avail Use% Mounted on
    /dev/sda4      xfs   1.6T  426G  1.2T  28% /home
 BIOS Version: VM920_034

 (End of data from sysinfo program)
sysinfo output is not correct for the disk information. A 1.8 TB capacity disk was used.
```

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Platform Notes (Continued)

```
After the volumes were created, the available capacity reported was 1.6 TB.
```

Compiler Version Notes

```
==============================================================================
 CC  500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base) 525.x264_r(base)
      557.xz_r(base)
------------------------------------------------------------------------------
IBM XL C/C++ for Linux, V16.1.0 (5725-C73, 5765-J13)
Version: 16.01.0000.0000
Driver Version: 16.1.0(C/C++) Level: 180412 ID: _cDgp0De0EeiRmNzegUH2Xw
C/C++ Front End Version: 16.1.0(C/C++) Level: 180412 ID:
  _d-hUqDz8EeiRm9zegUH2Xw
High-Level Optimizer Version: 16.1.0(C/C++) and 15.1.7(Fortran) Level: 180412
  ID: _rAOlVzzZEeiRm9zegUH2Xw
Low-Level Optimizer Version: 16.1.0(C/C++) and 15.1.7(Fortran) Level: 180412
  ID: _ayqxljzZEeiRm9zegUH2Xw
------------------------------------------------------------------------------

==============================================================================
 CXXC 520.omnetpp_r(base) 523.xalancbmk_r(base) 531.deepsjeng_r(base)
      541.leela_r(base)
------------------------------------------------------------------------------
IBM XL C/C++ for Linux, V16.1.0 (5725-C73, 5765-J13)
Version: 16.01.0000.0000
Driver Version: 16.1.0(C/C++) Level: 180412 ID: _cDgp0De0EeiRmNzegUH2Xw
C/C++ Front End Version: 16.1.0(C/C++) Level: 180412 ID:
  _d-hUqDz8EeiRm9zegUH2Xw
High-Level Optimizer Version: 16.1.0(C/C++) and 15.1.7(Fortran) Level: 180412
  ID: _rAOlVzzZEeiRm9zegUH2Xw
Low-Level Optimizer Version: 16.1.0(C/C++) and 15.1.7(Fortran) Level: 180412
  ID: _ayqxljzZEeiRm9zegUH2Xw
------------------------------------------------------------------------------

==============================================================================
CC   500.perlbench_r(peak) 502.gcc_r(peak) 505.mcf_r(peak) 525.x264_r(peak)
     557.xz_r(peak)
------------------------------------------------------------------------------
IBM XL C/C++ for Linux, V16.1.0 (5725-C73, 5765-J13)
Version: 16.01.0000.0000
Driver Version: 16.1.0(C/C++) Level: 180412 ID: _cDgp0De0EeiRmNzegUH2Xw
C/C++ Front End Version: 16.1.0(C/C++) Level: 180412 ID:
  _d-hUqDz8EeiRm9zegUH2Xw
High-Level Optimizer Version: 16.1.0(C/C++) and 15.1.7(Fortran) Level: 180412
  ID: _rAOlVzzZEeiRm9zegUH2Xw
Low-Level Optimizer Version: 16.1.0(C/C++) and 15.1.7(Fortran) Level: 180412
```

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Compiler Version Notes (Continued)

```
  ID: _ayqxljzZEeiRm9zegUH2Xw
------------------------------------------------------------------------------


==============================================================================
CXXC 520.omnetpp_r(peak) 523.xalancbmk_r(peak) 531.deepsjeng_r(peak)
     541.leela_r(peak)
------------------------------------------------------------------------------
IBM XL C/C++ for Linux, V16.1.0 (5725-C73, 5765-J13)
Version: 16.01.0000.0000
Driver Version: 16.1.0(C/C++) Level: 180412 ID: _cDgp0De0EeiRmNzegUH2Xw
C/C++ Front End Version: 16.1.0(C/C++) Level: 180412 ID:
  _d-hUqDz8EeiRm9zegUH2Xw
High-Level Optimizer Version: 16.1.0(C/C++) and 15.1.7(Fortran) Level: 180412
  ID: _rAOlVzzZEeiRm9zegUH2Xw
Low-Level Optimizer Version: 16.1.0(C/C++) and 15.1.7(Fortran) Level: 180412
  ID: _ayqxljzZEeiRm9zegUH2Xw
------------------------------------------------------------------------------


==============================================================================
 FC  548.exchange2_r(base)
------------------------------------------------------------------------------
IBM XL Fortran for Linux, V16.1.0 (5725-C75, 5765-J15)
Version: 16.01.0000.0000
Driver Version: 16.1.0(Fortran) Level: 180412 ID: _cDgp0De0EeiRmNzegUH2Xw
Fortran Front End and Run Time Version: 16.1.0(Fortran) Level: 180412 ID:
  _wxQgITwmEeiRm9zegUH2Xw
Fortran Transformer Version: 16.1.0(Fortran) Level: 180412 ID:
  _TCiCETnkEeiRm9zegUH2Xw
High-Level Optimizer Version: 16.1.0(C/C++) and 15.1.7(Fortran) Level: 180412
  ID: _rAOlVzzZEeiRm9zegUH2Xw
Low-Level Optimizer Version: 16.1.0(C/C++) and 15.1.7(Fortran) Level: 180412
  ID: _ayqxljzZEeiRm9zegUH2Xw
------------------------------------------------------------------------------


==============================================================================
FC   548.exchange2_r(peak)
------------------------------------------------------------------------------
IBM XL Fortran for Linux, V16.1.0 (5725-C75, 5765-J15)
Version: 16.01.0000.0000
Driver Version: 16.1.0(Fortran) Level: 180412 ID: _cDgp0De0EeiRmNzegUH2Xw
Fortran Front End and Run Time Version: 16.1.0(Fortran) Level: 180412 ID:
  _wxQgITwmEeiRm9zegUH2Xw
Fortran Transformer Version: 16.1.0(Fortran) Level: 180412 ID:
  _TCiCETnkEeiRm9zegUH2Xw
High-Level Optimizer Version: 16.1.0(C/C++) and 15.1.7(Fortran) Level: 180412
  ID: _rAOlVzzZEeiRm9zegUH2Xw
Low-Level Optimizer Version: 16.1.0(C/C++) and 15.1.7(Fortran) Level: 180412
```

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Compiler Version Notes (Continued)

```
  ID: _ayqxljzZEeiRm9zegUH2Xw
------------------------------------------------------------------------------
```

Base Compiler Invocation

C benchmarks:
`/opt/ibm/xlC/16.1.0/bin/xlc_at -qlanglvl=extc99`

C++ benchmarks:
`/opt/ibm/xlC/16.1.0/bin/xlC_at`

Fortran benchmarks:
`/opt/ibm/xlf/16.1.0/bin/xlf95_at`

Base Portability Flags

500.perlbench_r: `-DSPEC_LP64 -DSPEC_LINUX_PPC_LE`
502.gcc_r: `-DSPEC_LP64`
505.mcf_r: `-DSPEC_LP64`
520.omnetpp_r: `-DSPEC_LP64`
523.xalancbmk_r: `-DSPEC_LP64 -DSPEC_LINUX`
525.x264_r: `-DSPEC_LP64`
531.deepsjeng_r: `-DSPEC_LP64`
541.leela_r: `-DSPEC_LP64`
548.exchange2_r: `-DSPEC_LP64`
557.xz_r: `-DSPEC_LP64`

Base Optimization Flags

C benchmarks:
`-lhugetlbfs -qipa=noobject -qalias=noansi -O5 -qarch=pwr9 -qtune=pwr9`

C++ benchmarks:
`-lhugetlbfs -qipa=noobject -O4 -qarch=pwr9 -qtune=pwr9 -ltcmalloc`

Fortran benchmarks:
`-lhugetlbfs -qipa=noobject -O4 -qarch=pwr9 -qtune=pwr9 -qprefetch=dscr=1`

Base Other Flags

C benchmarks:
-qsuppress=1500-036 -qsuppress=1500-029

C++ benchmarks:
-qsuppress=1500-036 -qsuppress=1500-029

Fortran benchmarks:
-qsuppress=1500-036 -qsuppress=1500-029

Peak Compiler Invocation

C benchmarks:
/opt/ibm/xlC/16.1.0/bin/xlc_at -qlanglvl=extc99

C++ benchmarks:
/opt/ibm/xlC/16.1.0/bin/xlC_at

Fortran benchmarks:
/opt/ibm/xlf/16.1.0/bin/xlf95_at

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

500.perlbench_r: -Wl,-q -lhugetlbfs -qpdf1(pass 1) -qpdf2(pass 2) -O3 -qarch=pwr9 -qtune=pwr9 -qinline=level=10 -qprefetch=dscr=1 -qipa=noobject -qalias=noansi -qstrict=nans -qfdpr

502.gcc_r: -Wl,-q -lhugetlbfs -qpdf1(pass 1) -qpdf2(pass 2) -O3 -qarch=pwr9 -qtune=pwr9 -ltcmalloc -Wl,-z,muldefs -qipa=noobject -qalias=noansi -qfdpr

505.mcf_r: -Wl,-q -lhugetlbfs -qpdf1(pass 1) -qpdf2(pass 2) -O5 -qarch=pwr9 -qtune=pwr9 -qdatasmall -qprefetch=dscr=4 -ltcmalloc -qipa=noobject -qfdpr

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Peak Optimization Flags (Continued)

525.x264_r: -Wl,-q -lhugetlbfs -qpdf1(pass 1) -qpdf2(pass 2) -O5 -qarch=pwr9 -qtune=pwr9 -qnounroll -qrestrict -qprefetch=dscr=7 -ltcmalloc -qipa=noobject -qfdpr

557.xz_r: -Wl,-q -lhugetlbfs -qpdf1(pass 1) -qpdf2(pass 2) -O5 -qarch=pwr9 -qtune=pwr9 -qpagesize=16M -qprefetch=dscr=7 -ltcmalloc -qipa=noobject -qfdpr

C++ benchmarks:

520.omnetpp_r: -Wl,-q -lhugetlbfs -qpdf1(pass 1) -qpdf2(pass 2) -O5 -qarch=pwr9 -qtune=pwr9 -qlibansi -qprefetch=dscr=1 -ltcmalloc -qipa=noobject -qfdpr

523.xalancbmk_r: -Wl,-q -lhugetlbfs -qpdf1(pass 1) -qpdf2(pass 2) -O5 -qarch=pwr9 -qtune=pwr9 -qpagesize=16M -qprefetch=dscr=7 -ltcmalloc -qipa=noobject -qfdpr

531.deepsjeng_r: -Wl,-q -lhugetlbfs -qpdf1(pass 1) -qpdf2(pass 2) -O2 -qarch=pwr9 -qtune=pwr9 -qipa -qrestrict -qprefetch=dscr=1 -qipa=noobject -qfdpr

541.leela_r: -Wl,-q -lhugetlbfs -qpdf1(pass 1) -qpdf2(pass 2) -O5 -qarch=pwr9 -qtune=pwr9 -qenum=small -funroll-all-loops -qinline=level=10 -qprefetch=dscr=6 -qipa=noobject -qfdpr

Fortran benchmarks:
-lhugetlbfs -qpdf1(pass 1) -qpdf2(pass 2) -O3 -qarch=pwr9 -qtune=pwr9:smt4 -qhot -qsimd=noauto -qsmallstack -qprefetch=dscr=9 -ltcmalloc -qipa=noobject

Peak Other Flags

C benchmarks:
-qsuppress=1500-036 -qsuppress=1500-029

C++ benchmarks:
-qsuppress=1500-036 -qsuppress=1500-029

Fortran benchmarks:
-qsuppress=1500-036 -qsuppress=1500-029 -qsuppress=cmpmsg

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/IBM_Linux_9040.html
http://www.spec.org/cpu2017/flags/IBM_XL_Linux_1610_flags.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/IBM_Linux_9040.xml
http://www.spec.org/cpu2017/flags/IBM_XL_Linux_1610_flags.xml

Tested with SPEC CPU2017 v1.0.5 on 2018-07-31 05:34:13-0400.
Report generated on 2018-10-31 18:41:16 by CPU2017 PS formatter v6067.
Originally published on 2018-08-21.