Fujitsu Server PRIMERGY Performance Report PRIMERGY RX1440 M2

This document provides an overview of benchmarks executed on the Fujitsu Server PRIMERGY RX1440 M2.

Explains PRIMERGY RX1440 M2 performance data in comparison to other PRIMERGY models. In addition to the benchmark results, the explanation for each benchmark and benchmark environment are also included.

Version
1.2 2024-12-10

Contents

Technical data 3
SPEC CPU2017 6
Benchmark description 6
Benchmark environment 8
Benchmark results 9
STREAM 11
Benchmark description 11
Benchmark environment 12
Benchmark results 13
SPECpower_ssj2008 15
Benchmark description 15
Benchmark environment 16
Benchmark results (EPYC 9754) 17
Benchmark results (EPYC 9845) 18
Comparison with prev-generation CPU (EPYC 9845 vs EPYC 9754) 19
Disk I/O: Performance of storage media 20
Benchmark description 20
Benchmark environment 23
Benchmark results 28
Literature 34

Technical data

PRIMERGY RX1440 M2

In this document, the power of 10 (example: 1 GB = 10^9 bytes) is used to indicate the capacity of the internal storage, and the power of 2 (example: 1 GB = 2^{30} bytes) is used to indicate the capacity of the cache or memory module. Any other exceptional notation will be specified separately.

Model	PRIMERGY RX1440 M2
Form factor	Rack server
Number of sockets	1
Number of processors orderable	1
Processor type	AMD EPYC 9004 Series Processors AMD EPYC 9005 Series Processors
Number of memory slots	24
Maximum memory configuration	6,144 GB
Maximum number of internal storage disks	12
Maximum number of PCI slots	PCI Express 5.0 : 4

Processor							
Model	Number of cores	Number of threads	L3 Cache [MB]	Rated frequency [GHz]	Maximum turbo frequency [GHz]	Maximum memory transfer rate [MT/s]	TDP [W]
AMD EPYC 9004 Series Processors							
EPYC 9754	128	256	256	2.25	3.10	4,800	360
EPYC 9634	84	168	384	2.25	3.70	4,800	290
EPYC 9534	64	128	256	2.45	3.70	4,800	280
EPYC 9384X	32	64	768	3.10	3.90	4,800	320
EPYC 9274F	24	48	256	4.05	4.30	4,800	320
EPYC 9254	24	48	128	2.90	4.15	4,800	200
EPYC 9224	24	48	64	2.50	3.70	4,800	200
EPYC 9184X	16	32	768	3.55	4.20	4,800	320
EPYC 9174F	16	32	256	4.10	4.40	4,800	320
EPYC 9124	16	32	64	3.00	3.70	4,800	200
EPYC 9654P	96	192	384	2.40	3.70	4,800	360
EPYC 9554P	64	128	256	3.10	3.75	4,800	360
EPYC 9454P	48	96	256	2.75	3.80	4,800	290
EPYC 9354P	32	64	256	3.25	3.80	4,800	280
AMD EPYC 9005 Series Processors *							
EPYC 9845	160	320	320	2.10	3.70	6,000	390
EPYC 9745	128	256	256	2.40	3.70	6,000	400
EPYC 9655	96	192	384	2.60	4.50	6,000	400
EPYC 9575F	64	128	256	3.30	5.00	6,000	400
EPYC 9555	64	128	256	3.20	4.40	6,000	360
EPYC 9355	32	64	256	3.55	4.40	6,000	280
EPYC 9135	16	32	64	3.65	4.30	6,000	200
EPYC 9015	8	16	64	3.60	4.10	6,000	125

* Maximum memory transfer rate on the RX1440 M2 is 4,800 MT/s

All processors that can be ordered with the PRIMERGY RX1440 M2 support AMD Turbo Core Technology. This technology allows you to operate the processor with higher frequencies than the rated frequency. The maximum frequency that can actually be achieved depends on the type of applications and the processing load.

The turbo functionality can be set in the BIOS option. Generally, Fujitsu recommends leaving the [Core Performance Boost] option set at the standard setting of [Enabled], as performance is substantially increased by the higher frequencies. However, the higher frequencies depend on the operating conditions mentioned above and is not always guaranteed. If you need stable performance or want to reduce power consumption, it may be beneficial to set [Core Performance Boost] to [Disabled] to disable Turbo function.

Memory modules Type	Capacity [GB]	Number of ranks	Bit width of the memory chips	Memory transfer rate [MT/s]	3DS	Registered	ECC
DDR5-4800 *1							
16 GB (1x16 GB) 1Rx8 DDR5-4800 RDIMM	16	1	8	4,800		✓	✓
32 GB (1x32 GB) 2Rx8 DDR5-4800 RDIMM	32	2	8	4,800		✓	✓
32 GB (1x32 GB) 1Rx4 DDR5-4800 RDIMM	32	1	4	4,800		✓	✓
64 GB (1x64 GB) 2Rx4 DDR5-4800 RDIMM	64	2	4	4,800		✓	✓
128 GB (1x128 GB) 4Rx4 DDR5-4800 RDIMM 3DS	128	4	4	4,800	✓	✓	✓
256 GB (1x64 GB) 8Rx4 DDR5-4800 RDIMM 3DS	256	8	4	4,800	✓	✓	✓
DDR5-5600 *2							
16 GB (1x16 GB) 1Rx8 DDR5-5600 RDIMM	16	1	8	5,600		✓	✓
32 GB (1x32 GB) 2Rx8 DDR5-5600 RDIMM	32	2	8	5,600		✓	✓
32 GB (1x32 GB) 1Rx4 DDR5-5600 RDIMM	32	1	4	5,600		✓	✓
64 GB (1x64 GB) 2Rx4 DDR5-5600 RDIMM	64	2	4	5,600		✓	✓
96 GB (1x96 GB) 2Rx4 DDR5-5600 RDIMM	96	2	4	5,600		✓	✓
256 GB (1x256 GB) 8Rx4 DDR5-5600 RDIMM 3DS	256	8	4	5,600	✓	✓	✓

*1 Supported by AMD EPYC 9004 Series processors

*2 Supported by AMD EPYC 9005 Series processors

Power supplies		Maximum number
Modular redundant PSU	900W platinum PSU	2
	900W titanium PSU	2
	1,600W platinum PSU	2
	1,600W titanium PSU	2
	2,200W platinum PSU	2
	2,400W titanium PSU	2
DC PSU	1,300W PSU DC	2
	1,600W PSU HVDC	2

Includes components that will be supported after the system release. Also, some components may not be available in all countries or sales regions.

Detailed technical information is available in the data sheet PRIMERGY RX1440 M2.

SPEC CPU2017

Benchmark description

SPEC CPU2017 is a benchmark which measures the system efficiency with integer and floating-point operations. It consists of an integer test suite (SPECrate 2017 Integer, SPECspeed 2017 Integer) containing 10 applications and a floating-point test suite (SPECrate 2017 Floating Point, SPECspeed 2017 Floating Point) containing 14 applications. Both test suites are extremely computing-intensive and concentrate on the CPU and the memory. Other components, such as Disk I/O and network, are not measured by this benchmark.

SPEC CPU2017 is not tied to a special operating system. The benchmark is available as source code and is compiled before the actual measurement. The used compiler version and their optimization settings also affect the measurement result.

SPEC CPU2017 contains two different performance measurement methods. The first method (SPECspeed 2017 Integer or SPECspeed 2017 Floating Point) determines the time which is required to process a single task. The second method (SPECrate 2017 Integer or SPECrate 2017 Floating Point) determines the throughput, i.e. the number of tasks that can be handled in parallel. Both methods are also divided into two measurement runs, "base" and "peak." They differ in the use of compiler optimization. When publishing the results, the base values are always used and the peak values are optional.

Benchmark	Number of single benchmarks	Arithmetic	Compiler optimization	Measurement result	
SPECspeed2017_int_peak	10	Integer	Aggressive (peak)	Speed	Performance
SPECspeed2017_int_energy_peak					Power efficiency
SPECspeed2017_int_peak	10		Conservative (base)		Performance
SPECspeed2017_int_energy_peak					Power efficiency
SPECspeed2017_int_peak	10		Aggressive (peak)	Throughput	Performance
SPECspeed2017_int_energy_peak					Power efficiency
SPECspeed2017_int_peak	10		Conservative (base)		Performance
SPECspeed2017_int_energy_peak					Power efficiency
SPECspeed2017_int_peak	10	Floating point	Aggressive (peak)	Speed	Performance
SPECspeed2017_int_energy_peak					Power efficiency
SPECspeed2017_int_peak	10		Conservative (base)		Performance
SPECspeed2017_int_energy_peak					Power efficiency
SPECspeed2017_int_peak	13		Aggressive (peak)	Throughput	Performance
SPECspeed2017_int_energy_peak					Power efficiency
SPECspeed2017_int_peak	13		Conservative (base)		Performance
SPECspeed2017_int_energy_peak					Power efficiency

The measurement results are the geometric average from normalized ratio values which have been determined for individual benchmarks. The geometric average - in contrast to the arithmetic average - means that there is a weighting in favor of the lower individual results. "Normalized" means that the measurement is how fast is the test system compared to a reference system. For example, value "1" was defined for the SPECspeed2017_int_base, SPECrate2017_int_base, SPECspeed2017_fp_base, and SPECrate2017_fp_base results of the reference system. A SPECspeed2017_int_base value of 2 means that the measuring system has handled this benchmark twice as fast as the reference system. A SPECrate2017_fp_base value of 4 means that the measuring system has handled this benchmark about 4/[# base copies] times faster than the reference system. "# base copies" specifies how many parallel instances of the benchmark have been executed.

Not every SPEC CPU2017 measurement is submitted by Fujitsu for publication at SPEC. This is why the SPEC web pages do not have every result. As Fujitsu archives the log files for all measurements, it is possible to prove the correct implementation of the measurements at any time.

Benchmark environment

System Under Test (SUT)	
Hardware	
• Model	PRIMERGY RX1440 M2
• Processor	1 x AMD EPYC 9004 Series Processors 1 x AMD EPYC 9005 Series Processors
• Memory	**AMD EPYC 9004 Series Processors** 12 x 32GB (1x32GB) 2Rx8 DDR5-4800 R ECC **AMD EPYC 9005 Series Processors** 12 x 32GB (1x32GB) 2Rx8 DDR5-5600 R ECC or 12 x 64GB (1x64GB) 2Rx4 DDR5-5600 R ECC * * Only measurement of SPECrate2017_int_base with EPYC 9845
Software	
• BIOS settings	Pleaes refer to the site below: https://www.spec.org/cgi-bin/osgresults?conf=cpu2017&op=fetch&field=SYSTEM&pattern=RX1440%20M2
• Operating system	**AMD EPYC 9004 Series Processors** **SPECrate2017_int_base, SPECspeed2017_fp_base:** SUSE Linux Enterprise Server 15 SP4 5.14.21-150400.22-default **SPECrate2017_fp_base, SPECspeed2017_int_base:** Red Hat Enterprise Linux 9.0 (Plow) 5.14.0-70.13.1.el9_0.x86_64 **AMD EPYC 9005 Series Processors** SUSE Linux Enterprise Server 15 SP6 6.4.0-150600.21-default
• Operating system settings	Pleaes refer to the site below: https://www.spec.org/cgi-bin/osgresults?conf=cpu2017&op=fetch&field=SYSTEM&pattern=RX1440%20M2
• Compiler	**AMD EPYC 9004 Series Processors** C/C++/Fortran: Version 4.0.0 of AOCC **AMD EPYC 9005 Series Processors** C/C++/Fortran: Version 5.0.0 of AOCC

Benchmark results

For processors, the benchmark results depend primarily on the size of the processor cache, the support for Hyper-Threading, the number of processor cores, and the processor frequency. In the case of processors with Turbo mode, the number of cores which are loaded by the benchmark determines the maximum processor frequency that can be achieved. In the case of single-threaded benchmarks, which mainly load only one core, the maximum processor frequency that can be achieved is higher than with multi-threaded benchmarks.

Results with "est." are estimated values.

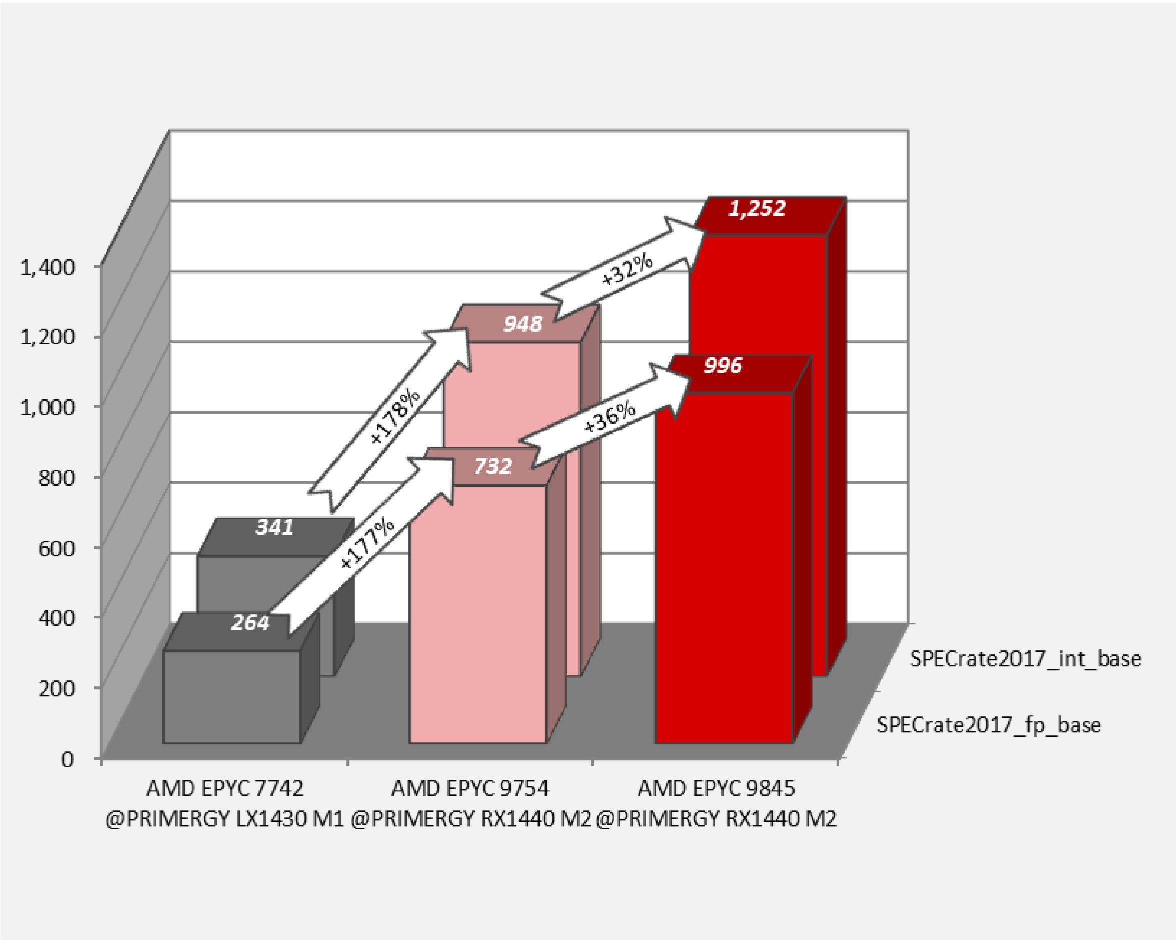
Processor model	Number of cores	L3 Cache [MB]	Rated frequency [GHz]	Memory transfer rate [MT/s]	Number of processors	SPECrate2017 int_base	SPECrate2017 fp_base
AMD EPYC 9004 Series Processors							
EPYC 9754	128	256	2.25	4,800	1	**948**	**732**
EPYC 9654P	96	384	2.40	4,800	1	**846**	**718**
EPYC 9634	84	384	2.25	4,800	1	**705**	**639**
EPYC 9554P	64	256	3.10	4,800	1	**660**	**615**
EPYC 9534	64	256	2.45	4,800	1	**624**	**584**
EPYC 9454P	48	256	2.75	4,800	1	**521**	**538**
EPYC 9384X	32	768	3.10	4,800	1	**408**	**477**
EPYC 9354P	32	256	3.25	4,800	1	**372**	**447**
EPYC 9274F	24	256	4.05	4,800	1	**316**	**399**
EPYC 9254	24	128	2.90	4,800	1	**295**	**366**
EPYC 9224	24	64	2.50	4,800	1	**256**	**289**
EPYC 9184X	16	768	3.55	4,800	1	**232**	**296**
EPYC 9754	128	256	2.25	4,800	1	**948**	**732**
EPYC 9224	24	64	2.50	4,800	1	**256**	**289**
AMD EPYC 9005 Series Processors							
EPYC 9845	160	320	2.10	4,800	1	**1,230**	**996**
EPYC 9745	128	256	2.40	4,800	1	1,090 est.	923 est.
EPYC 9655	96	384	2.60	4,800	1	991 est.	898 est.
EPYC 9575F	64	256	3.30	4,800	1	**800**	**797**
EPYC 9555	64	256	3.20	4,800	1	788 est.	795 est.
EPYC 9355	32	256	3.55	4,800	1	**466**	**552**
EPYC 9135	16	64	3.65	4,800	1	**233**	**349**
EPYC 9015	8	64	3.60	4,800	1	**118**	**191**

Processor model	Number of cores	L3 Cache [MB]	Rated frequency [GHz]	Memory transfer rate [MT/s]	Number of processors	SPECspeed2017 int_base	SPECspeed2017 fp_base
AMD EPYC 9004 Series Processors							
EPYC 9754	128	256	2.25	4,800	1	-	**306**
EPYC 9654	96	384	2.40	4,800	1	-	**315**
EPYC 9174F	16	256	4.10	4,800	1	**16.4**	-
AMD EPYC 9005 Series Processors							
EPYC 9845	160	320	2.10	4,800	1	-	**373**
EPYC 9575F	64	256	3.30	4,800	1	**21.0**	**379**

The following graphs compare the throughputs of PRIMERGY RX1440 M2 and its older model, PRIMERGY LX1430 M1, with maximum performance configurations.

EPYC 9754, which is the highest performance model in EPYC 9004 series processors, scored 178% (2.78 times) higher on SPECrate2017_int_base and 178% (2.77 times) higher on SPECrate2017_fp_base than EPYC 7742, which is the highest performance model in EPYC 7002 series processors.

Moreover, EPYC 9845, which is the highest performance model in EPYC 9005 series processors supported by PRIMERGY RX1440 M2, scored 32% higher on SPECrate2017_int_base and 36% higher on SPECrate2017_fp_base than EPYC 9754.



SPECrate2017: Comparison of PRIMERGY LX1430 M1 and PRIMERGY RX1440 M2

STREAM

Benchmark description

STREAM is a synthetic benchmark that has been used for many years to determine memory throughput and was developed by John McCalpin during his professorship at the University of Delaware. Today STREAM is supported at the University of Virginia, where the source code can be downloaded in either Fortran or C. STREAM continues to play an important role in the HPC environment in particular. It is for example an integral part of the HPC Challenge benchmark suite.

The benchmark is designed in such a way that it can be used both on PCs and on server systems. The unit of measurement of the benchmark is GB/s, i.e. the number of gigabytes that can be read and written per second.

STREAM measures the memory throughput for sequential accesses. These can generally be performed more efficiently than accesses that are randomly distributed on the memory, because the processor caches are used for sequential access.

Before execution the source code is adapted to the environment to be measured. Therefore, the size of the data area must be at least 12 times larger than the total of all last-level processor caches so that these have as little influence as possible on the result. The OpenMP program library is used to enable selected parts of the program to be executed in parallel during the runtime of the benchmark. This provides optimal load distribution for the available processor cores.

In the STREAM benchmark, a data area consisting of 8-byte elements is continuously copied to four operation types. Arithmetic operations are also performed on operation types other than COPY.

Arithmetics type	Arithmetics	Bytes per step	Floating-point calculation per step
COPY	a(i) = b(i)	16	0
SCALE	a(i) = q × b(i)	16	1
SUM	a(i) = b(i) + c(i)	24	1
TRIAD	a(i) = b(i) + q × c(i)	24	2

The throughput is output in GB/s for each type of calculation. The differences between the various values are usually only minor on modern systems. In general, only the determined TRIAD value is used as a comparison.

The measured results primarily depend on the clock frequency of the memory modules. The processors influence the arithmetic calculations.

In this chapter, throughputs are indicated as a power of 10. (1 GB/s = 10^9 Byte/s)

Benchmark environment

System Under Test (SUT)	
Hardware	
• Model	PRIMERGY RX1440 M2
• Processor	1x AMD EPYC 9004 Series Processors 1x AMD EPYC 9005 Series Processors
• Memory	**AMD EPYC 9004 Series Processors** 12 x 32GB (1x32GB) 2Rx8 DDR5-4800 R ECC **AMD EPYC 9005 Series Processors** 12 x 32GB (1x32GB) 2Rx8 DDR5-5600 R ECC
Software	
• BIOS settings	• SMT Control = Disabled • Power Profile Selection = High Performance • NUMA nodes per socket = NPS4 * * NPS2 in EPYC 9845, EPYC 9015
• Operating system	**AMD EPYC 9004 Series Processors** Red Hat Enterprise Linux 9.0 (Plow) 5.14.0-70.13.1.el9_0.x86_64 **AMD EPYC 9005 Series Processors** SUSE Linux Enterprise Server 15 SP6 6.4.0-150600.21-default

Benchmark results

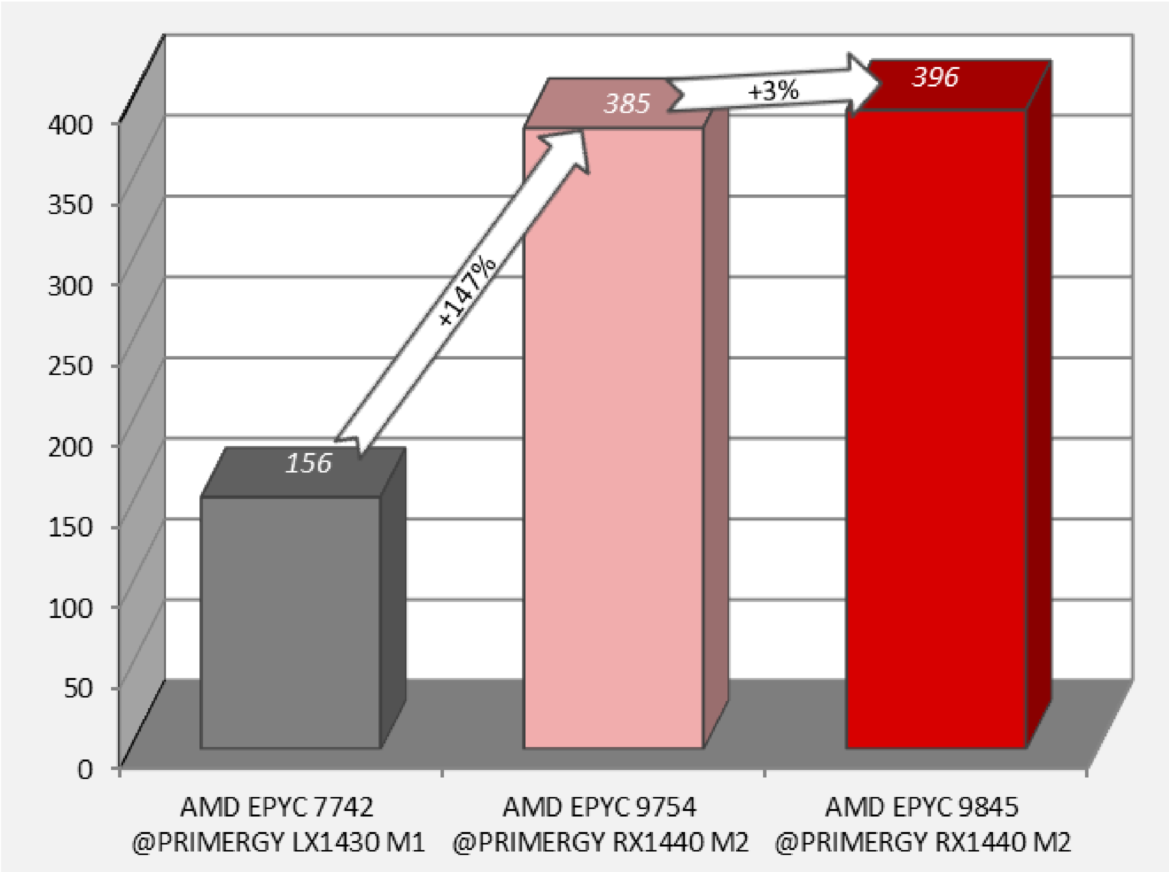
Processor model	Memory transfer rate [MT/s]	Maximum memory bandwidth [GB/s]	Number of cores	Rated frequency [GHz]	Number of processors	TRIAD [GB/s]
AMD EPYC 9004 Series Processors						
EPYC 9754	4,800	460.8	128	2.25	1	**385**
EPYC 9654P	4,800	460.8	96	2.40	1	**382**
EPYC 9634	4,800	460.8	84	2.25	1	**383**
EPYC 9554P	4,800	460.8	64	3.10	1	**390**
EPYC 9534	4,800	460.8	64	2.45	1	**389**
EPYC 9454P	4,800	460.8	48	2.75	1	**391**
EPYC 9384X	4,800	460.8	32	3.10	1	**394**
EPYC 9354P	4,800	460.8	32	3.25	1	**360**
EPYC 9274F	4,800	460.8	24	4.05	1	**395**
EPYC 9254	4,800	460.8	24	2.90	1	**321**
EPYC 9224	4,800	460.8	24	2.50	1	**257**
EPYC 9184X	4,800	460.8	16	3.55	1	**398**
EPYC 9174F	4,800	460.8	16	4.10	1	**397**
EPYC 9124	4,800	460.8	16	3.00	1	**266**
AMD EPYC 9005 Series Processors						
EPYC 9845	4,800	460.8	160	2.10	1	**396**
EPYC 9745	4,800	460.8	128	2.40	1	T.B.D.
EPYC 9655	4,800	460.8	96	2.60	1	**411**
EPYC 9575F	4,800	460.8	64	3.30	1	**407**
EPYC 9555	4,800	460.8	64	3.20	1	407 est.
EPYC 9355	4,800	460.8	32	3.55	1	**413**
EPYC 9135	4,800	460.8	16	3.65	1	**392**
EPYC 9015	4,800	460.8	8	3.60	1	**242**

The following graphs compare the throughputs of PRIMERGY RX1440 M2 and its older model, PRIMERGY LX1430 M1, with maximum performance configurations.

PRIMERGY RX1440 M2 showed significant performance improvements over the previous generation.

EPYC 9754, which is the highest performance model in EPYC 9004 series processors, scored 147% (2.47 times) higher than EPYC 7742, which is the highest performance model in EPYC 7002 series processors.

On the other hand, EPYC 9845, which is the highest performance model in EPYC 9005 series processors supported by PRIMERGY RX1440 M2, scored almost same as EPYC 9754.



STREAM: Comparison of PRIMERGY LX1430 M1 and PRIMERGY RX1440 M2

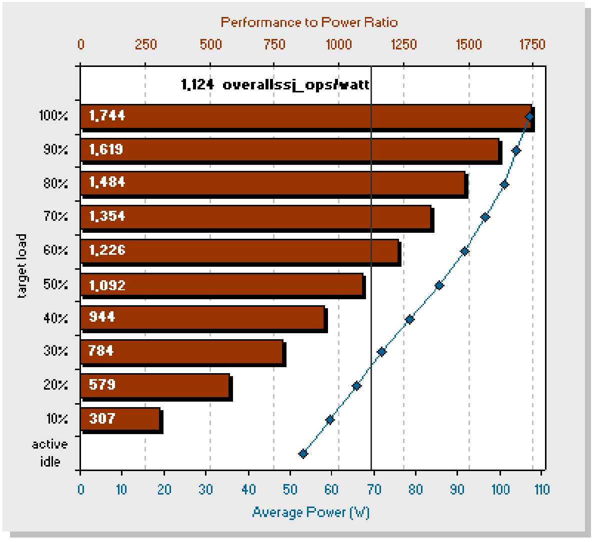
SPECpower_ssj2008

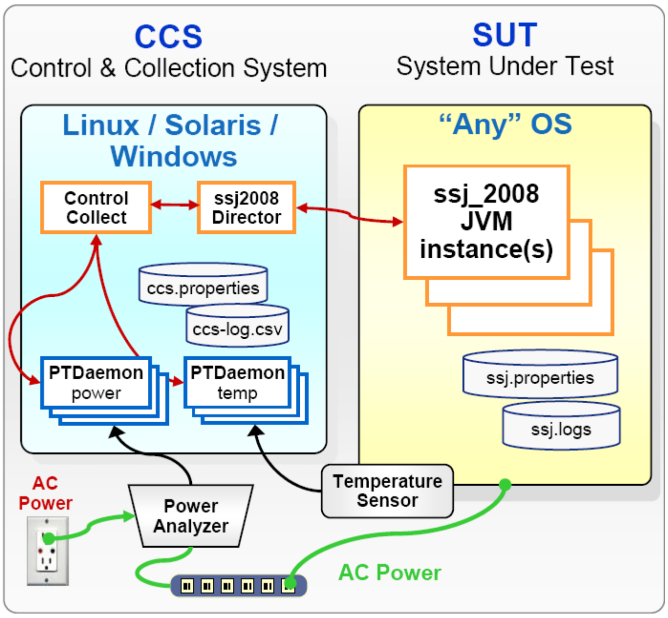
Benchmark description

SPECpower_ssj2008 is the first industry-standard SPEC benchmark that evaluates the power and performance characteristics of a server. With SPECpower_ssj2008 SPEC has defined standards for server power measurements in the same way they have done for performance.

The benchmark workload represents typical server-side Java business applications. The workload is scalable, multi-threaded, portable across a wide range of platforms, and easy to run. The benchmark tests CPUs, caches, the memory hierarchy, and scalability of symmetric multiprocessor systems (SMPs), as well as the implementation of Java Virtual Machine (JVM), Just In Time (JIT) compilers, garbage collection, threads, and some aspects of the operating system.

SPECpower_ssj2008 reports power consumption for servers at different performance levels — from 100% to "active idle" in 10% segments — over a set period of time. The graduated workload recognizes the fact that processing loads and power consumption on servers vary substantially over the course of days or weeks. To compute a power-performance metric across all levels, measured transaction throughputs for each segment are added together and then divided by the sum of the average power consumed for each segment. The result is a figure of merit called "overall ssj_ops/watt". This ratio provides information about the energy efficiency of the measured server. The defined measurement standard enables customers to compare it with other configurations and servers measured with SPECpower_ssj2008. The diagram shows a typical graph of a SPECpower_ssj2008 result.





The benchmark runs on a wide variety of operating systems and hardware architectures and does not require extensive client or storage infrastructure. The minimum equipment for SPEC-compliant testing is two networked computers, plus a power analyzer and a temperature sensor. One computer is the System Under Test (SUT) which runs one of the supported operating systems and the JVM. The JVM provides the environment required to run the SPECpower_ssj2008 workload which is implemented in Java. The other computer is a "Control & Collection System" (CCS) which controls the operation of the benchmark and captures the power, performance, and temperature readings for reporting. The diagram provides an overview of the basic structure of the benchmark configuration and the various components.

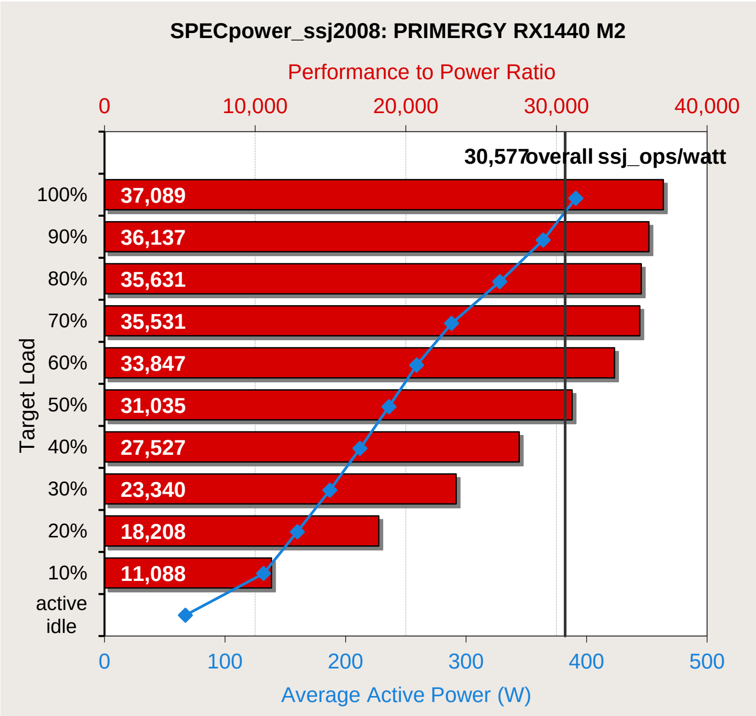
Benchmark environment

System Under Test (SUT)	
Hardware	
• Model	PRIMERGY RX1440 M2
• Processor	1 x EPYC 9754 1 x EPYC 9845
• Memory	**EPYC 9754** 12 x 32GB (1x32GB) 2Rx8 DDR5-4800 R ECC **EPYC 9845** 12 x 32GB (1x32GB) 2Rx8 DDR5-5600 R ECC
• Network interface	1Gbit/s (RJ45) Intel i210 on Motherboard
• Disk subsystem	1 x SSD SATA M.2 drive for booting, non hot-plug 240GB
• Power Supply Unit	1 x 900W titanium PSU
Software	
• BIOS settings	See “Details”
• Operating system	Windows Server 2022 Standard
• Operating system settings	See “Details”
• JVM	**EPYC 9754** Oracle Java HotSpot(TM) 64-Bit Server VM 18.9 (build 17.0.1+12-LTS-39, mixed mode) **EPYC 9845** Oracle Java HotSpot(TM) 64-Bit Server VM (build 17.0.12+8-LTS-286, mixed mode, sharing)
• JVM settings	See “Details”
Details	
• See disclosure	**EPYC 9754** https://www.spec.org/power_ssj2008/results/res2024q1/power_ssj2008-20240130-01364.html **EPYC 9845** https://www.spec.org/power_ssj2008/results/res2024q4/power_ssj2008-20241118-01476.html

Benchmark results (EPYC 9754)

The PRIMERGY RX1440 M2 in Microsoft Windows Server 2022 Standard achieved the following result:

SPECpower_ssj2008 = 30,577 overall ssj_ops/watt



The adjoining diagram shows the result of the configuration described above. The red horizontal bars show the performance to power ratio in ssj_ops/watt (upper x-axis) for each target load level tagged on the y-axis of the diagram. The blue line shows the run of the curve for the average power consumption (bottom x-axis) at each target load level marked with a small rhomb. The black vertical line shows the benchmark result of 30,577 overall ssj_ops/watt for the PRIMERGY RX1440 M2. This is the quotient of the sum of the transaction throughputs for each load level and the sum of the average power consumed for each measurement interval.

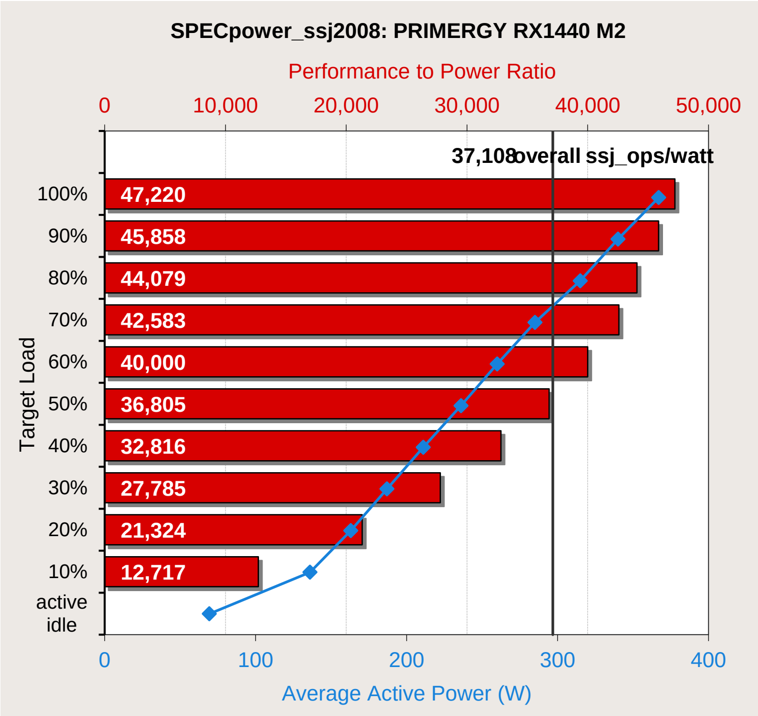
The following table shows the benchmark results for the throughput in ssj_ops, the power consumption in watts and the resulting energy efficiency for each load level.

Performance		Power	Energy Efficiency
Target Load	ssj_ops	Average Power (W)	ssj_ops/watt
100%	14,502,555	391	37,089
90%	13,141,631	364	36,137
80%	11,691,615	328	35,631
70%	10,223,568	288	35,531
60%	8,761,721	259	33,847
50%	7,311,572	236	31,035
40%	5,849,339	212	27,527
30%	4,374,037	187	23,340
20%	2,920,243	160	18,208
10%	1,460,384	132	11,088
Active Idle	0	67.1	0
			Σ ssj_ops / Σ power = 30,577

Benchmark results (EPYC 9845)

The PRIMERGY RX1440 M2 in Microsoft Windows Server 2022 Standard achieved the following result:

SPECpower_ssj2008 = 37,108 overall ssj_ops/watt



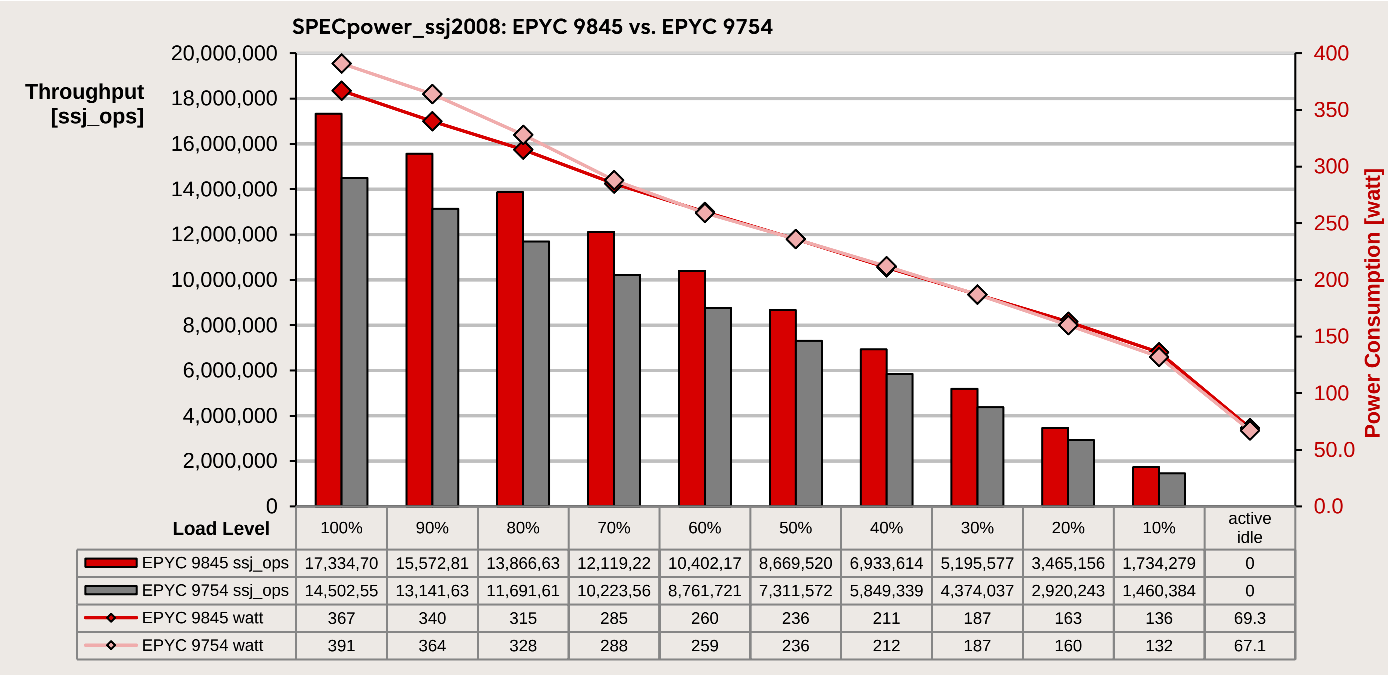
The adjoining diagram shows the result of the configuration described above. The red horizontal bars show the performance to power ratio in ssj_ops/watt (upper x-axis) for each target load level tagged on the y-axis of the diagram. The blue line shows the run of the curve for the average power consumption (bottom x-axis) at each target load level marked with a small rhomb. The black vertical line shows the benchmark result of 37,108 overall ssj_ops/watt for the PRIMERGY RX1440 M2. This is the quotient of the sum of the transaction throughputs for each load level and the sum of the average power consumed for each measurement interval.

The following table shows the benchmark results for the throughput in ssj_ops, the power consumption in watts and the resulting energy efficiency for each load level.

Performance		Power	Energy Efficiency
Target Load	ssj_ops	Average Power (W)	ssj_ops/watt
100%	17,334,708	367	47,220
90%	15,572,811	340	45,858
80%	13,866,636	315	44,079
70%	12,119,223	285	42,583
60%	10,402,174	260	40,000
50%	8,669,520	236	36,805
40%	6,933,614	211	32,816
30%	5,195,577	187	27,785
20%	3,465,156	163	21,324
10%	1,734,279	136	12,717
Active Idle	0	69.3	0
			Σ ssj_ops / Σ power = 37,108

Comparison with prev-generation CPU (EPYC 9845 vs EPYC 9754)

The following diagram shows for each load level (on the x-axis) the throughput (on the left y-axis) and the power consumption (on the right y-axis) of the PRIMERGY RX1440 M2 equipped with EPYC 9845 compared to the PRIMERGY RX1440 M2 equipped with the predecessor EPYC 9754.

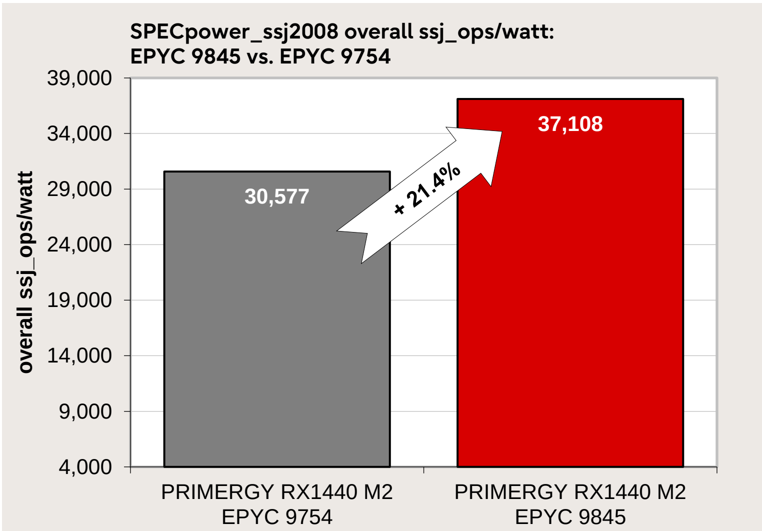


Load Level	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%	active idle
EPYC 9845 ssj_ops	17,334,70	15,572,81	13,866,63	12,119,22	10,402,17	8,669,520	6,933,614	5,195,577	3,465,156	1,734,279	0
EPYC 9754 ssj_ops	14,502,55	13,141,63	11,691,61	10,223,56	8,761,721	7,311,572	5,849,339	4,374,037	2,920,243	1,460,384	0
EPYC 9845 watt	367	340	315	285	260	236	211	187	163	136	69.3
EPYC 9754 watt	391	364	328	288	259	236	212	187	160	132	67.1

The average throughput of the PRIMERGY RX1440 M2 equipped with EPYC 9845 is 9,529,370 ssj_ops, an improvement of 19.6% over the 8,023,667 ssj_ops of the one equipped with EPYC 9754.

On the other hand, the average power consumption of the PRIMERGY RX1440 M2 equipped with EPYC 9845 is 234 W, which is almost same as the 239 W of the one equipped with EPYC 9754.

The energy efficiency of the PRIMERGY RX1440 M2 equipped with EPYC 9845 has improved by 18.8% due to almost the same power consumption and a 21.4% improvement in performance.



Disk I/O: Performance of storage media

Benchmark description

Performance measurements of disk subsystems for PRIMERGY servers are carried out with a defined measurement method, which models the accesses of real application scenarios on the basis of specifications.

The essential specifications are as follows.

- Random access / sequential access ratio
- Read / write access ratio
- Block size (kiB)
- Queue Depth (number of IO requests to issue at one time)

A given value combination of these specifications is known as "load profile." The following five standard load profiles can be allocated to typical application scenarios.

Standard load profile	Access	Type of access		Block size [kiB]	Application
		read	write		
Filecopy	Random	50%	50%	64	Copying files
Fileserver	Random	67%	33%	64	Fileserver
Database	Random	67%	33%	8	Database (data transfer) Mail server
Streaming	Sequential	100%	0%	64	Database (log file), Data backup, Video streaming (partial)
Restore	Sequential	0%	100%	64	Restoring files

In order to model applications that access in parallel with a different load intensity the Queue Depth is increased from 1 to 512 (in steps to the power of two).

The measurements of this document are based on these standard load profiles.

The main measurement items are as follows.

- Throughput [MiB/s] Throughput in megabytes per second
- Transactions [IO/s] Transaction rate in I/O operations per second
- Latency [ms] Average response time in ms

The data throughput has established itself as the normal measurement variable for sequential load profiles, whereas the measurement variable "transaction rate" is mostly used for random load profiles with their small block sizes. Data throughput and transaction rate are directly proportional to each other and can be transferred to each other according to the following formula.

Data throughput [MiB/s]	*= Transaction rate [IO/s] x Block size [MiB]*
Transaction rate [IO/s]	*= Data throughput [MiB/s] / Block size [MiB]*

In this section, a power of 10 (1 TB = 10^{12} bytes) is used to indicate the capacity of the hard storage medium, and a power of 2 (1 MiB / s = 2^{20} bytes) is used to indicate the capacity of other media, file size, block size, and throughput.

All the details of the measurement method and the basics of disk I/O performance are described in the white paper "Basics of Disk I/O Performance."

Controller

PRIMERGY server can use the following controllers.

Controller name	Cache	Supported interfaces			RAID levels
		host	drive	port	
PSAS CP600i	-	PCIe 4.0 x8	SATA 6G SAS 12G	16	-
PSAS CP 2100-8i	-	PCIe 3.0 x8	SATA 6G SAS 12G	8	0, 1, 10, 5
PSAS CP 2200-16i	-	PCIe 4.0 x8	SATA 6G SAS 12G	16	0, 1, 10, 5
			PCIe 4.0 x4	4	
PRAID CP600i	-	PCIe 4.0 x8	SATA 6G SAS 12G	8	0, 1, 10
PRAID EP640i	4GB	PCIe 4.0 x8	SATA 6G SAS 12G	8	0, 1, 1E, 10, 5, 50, 6, 60
PRAID EP 3252-8i	2GB	PCIe 4.0 x8	SATA 6G SAS 12G SAS 24G	8	0, 1, 10, 5, 50, 6, 60
PRAID EP 3254-8i	4GB	PCIe 4.0 x8	SATA 6G SAS 12G SAS 24G	8	0, 1, 10, 5, 50, 6, 60
PRAID EP680i	8GB	PCIe 4.0 x8	SATA 6G SAS 12G	16	0, 1, 1E, 10, 5, 50, 6, 60
			PCIe 4.0 x4	4	
PRAID EP 3258-16i	8GB	PCIe 4.0 x8	SATA 6G SAS 12G SAS 24G	16	0, 1, 10, 5, 50, 6, 60
			PCIe 4.0 x4	4	
Retimer card for 2.5" NVMe SSD	-	PCIe 5.0 x16	PCIe 5.0 x4	4	-
Onboard controller M.2 slot	-	PCIe 5.0 x16	SATA 6G	2	-
		PCIe 5.0 x8	PCIe 5.0 x4	2	
PDUAL CP300	-	PCIe 4.0 x8	SATA 6G	2	0, 1
			PCIe 4.0 x4	2	

Storage media

When selecting the type and number of storage media you can move the weighting in the direction of storage capacity, performance, security or price. The following types of HDD and SSD storage media can be used for PRIMERGY servers.

Model	Storage media type	Interface	Form factor
3.5 inch model(*1)	HDD	SAS 12G	3.5 inch
		SATA 6G	3.5 inch
	SSD	SAS 12G / SAS 24G	2.5 inch(*2)
		SATA 6G	2.5 inch(*2)
2.5 inch model	HDD	SAS 12G	2.5 inch
	SSD	SAS 12G / SAS 24G	2.5 inch
		SATA 6G	2.5 inch
		PCIe 4.0 / PCIe 5.0	2.5 inch
model common	SSD	SATA 6G	M.2
		PCIe 4.0	M.2

*(*1) Upgrade kit of Rear 2.5 inch bay enables you to use 2.5 inch model storage.*

*(*2) It is available with a 3.5 inch cage.*

HDDs and SSDs are operated via host bus adapters, usually RAID controllers, with a SATA or SAS interface. The interface of the RAID controller to the chipset of the system board is typically PCIe or, in the case of the integrated onboard controllers, an internal bus interface of the system board.

Of all the storage medium types SSDs offer by far the highest transaction rates for random load profiles as well as the shortest access times. In return, however, the price per gigabyte of storage capacity is substantially higher.

Cache settings

In most cases, the cache of HDDs has a great influence on disk I/O performance. It is frequently regarded as a security problem in case of power failure and is thus switched off. On the other hand, it was integrated by hard disk manufacturers for the good reason of increasing the write performance. For performance reasons it is therefore advisable to enable the hard disk cache. To prevent data loss in case of power failure you are recommended to equip the system with a UPS.

For the purpose of easy and reliable handling of the settings for RAID controllers and hard disks it is advisable to use the RAID-Manager software "ServerView RAID" that is supplied for PRIMERGY servers. All the cache settings for controllers and hard disks can usually be made en bloc - specifically for the application - by using the pre-defined mode "Performance" or "Data Protection." The "Performance" mode ensures the best possible performance settings for the majority of the application scenarios.

Benchmark environment

The following hardware and software components were used for benchmarking.

Hardware

3.5 inch model

Storage media	Category	Drive name
HDD	NL-SAS HDD (SAS 12Gbps, 7.2k rpm) [512e]	MG08SDA600E MG08SDA800E ST12000NM004J ST14000NM004J ST16000NM004J ST18000NM004J ST20000NM002D
	NL-SAS HDD (SAS 12Gbps, 7.2k rpm) [512n]	ST2000NM001B ST4000NM001B
	BC-SATA HDD (SATA 6Gbps, 7.2k rpm) [512e]	MG08ADA600E MG08ADA800E
	BC-SATA HDD (SATA 6Gbps, 7.2k rpm) [512n]	ST2000NM000B ST4000NM000B

Storage media	Category	Drive name
SSD	SAS SSD (SAS 12Gbps, Write Intensive)	XS400ME70045 XS800ME70084 XS1600ME70045
	SAS SSD (SAS 12Gbps, Mixed Use)	XS800LE70045 XS1600LE70045 XS3200LE70045
	SAS SSD (SAS 12Gbps, Read Intensive)	XS960SE70045 XS1920SE70045 XS3840SE70045 XS7680SE70045
	SATA SSD (SATA 6Gbps, Mixed Use)	MTFDDAK480TGB MTFDDAK960TGB MTFDDAK1T9TGB MTFDDAK3T8TGB MZ7L3480HELT MZ7L3960HELA MZ7L31T9HENA MZ7L33T8HENA
	SATA SSD (SATA 6Gbps, Read Intensive)	MTFDDAK240TGA MTFDDAK480TGA MTFDDAK960TGA MTFDDAK1T9TGA MTFDDAK3T8TGA MTFDDAK7T6TGA MZ7L3480HEJD MZ7L3960HELT MZ7L31T9HELA MZ7L33T8HELA MZ7L37T6HELA
	SAS SSD (SAS 24Gbps, Write Intensive)	PM7800G10DN PM71T6010DN PM7800G10DF PM71T6010DF
	SAS SSD (SAS 24Gbps, Mixed Use)	PM71T6003DN PM73T2003DN PM76T4003DN
	SAS SSD (SAS 24Gbps, Read Intensive)	PM71T9201DN PM73T8401DN PM77T6801DN PM715T301DN PM77T6801DF PM715T301DF MZILG960HCHQ MZILG1T9HCJR MZILG3T8HCLS MZILG7T6HBLA MZILG15THBLA

2.5 inch model

Storage media	Category	Drive name
HDD	SAS HDD (SAS 12Gbps, 10k rpm) [512e]	AL15SEB18EQ AL15SEB24EQ
	SAS HDD (SAS 12Gbps, 10k rpm) [512n]	AL15SEB030N AL15SEB060N AL15SEB120N

Storage media	Category	Drive name
SSD	SAS SSD (SAS 12Gbps, Write Intensive)	XS400ME70045 XS800ME70084 XS1600ME70045
	SAS SSD (SAS 12Gbps, Mixed Use)	XS800LE70045 XS1600LE70045 XS3200LE70045 XS6400LE70045
	SAS SSD (SAS 12Gbps, Read Intensive)	XS960SE70045 XS1920SE70045 XS3840SE70045 XS7680SE70045
	SATA SSD (SATA 6Gbps, Mixed Use)	MTFDDAK480TGB MTFDDAK960TGB MTFDDAK1T9TGB MTFDDAK3T8TGB MZ7L3480HELT MZ7L3960HELA MZ7L33T8HENA MZ7L31T9HENA
	SATA SSD (SATA 6Gbps, Read Intensive)	MTFDDAK240TGA MTFDDAK480TGA MTFDDAK960TGA MTFDDAK1T9TGA MTFDDAK3T8TGA MTFDDAK7T6TGA MZ7L3480HEJD MZ7L3960HELT MZ7L31T9HELA MZ7L33T8HELA MZ7L37T6HELA
	SAS SSD (SAS 24Gbps, Write Intensive)	PM7800G10DN PM71T6010DN
	SAS SSD (SAS 24Gbps, Mixed Use)	PM71T6003DN PM73T2003DN PM76T4003DN
	SAS SSD (SAS 24Gbps, Read Intensive)	PM71T9201DN PM73T8401DN PM77T6801DN PM715T301DN PM77T6801DF PM715T301DF MZILG960HCHQ MZILG1T9HCJR MZILG3T8HCLS MZILG7T6HBLA MZILG15THBLA

Storage media	Category	Drive name
SSD	PCIe 4.0 SSD (Write Intensive)	SSDPF21Q400GB SSDPF21Q800GB SSDPF21Q016TB
	PCIe 5.0 SSD (Mixed Use)	KCMY1VUG1T60 KCMY1VUG3T20 KCMY1VUG6T40 KCMY1VUG12T8
	PCIe 5.0 SSD (Read Intensive)	KCMY1RUG1T92 KCMY1RUG3T84 KCMY1RUG7T68 KCMY1RUG15T3

Model common

Storage media	Category	Drive name
M.2 SSD	SATA M.2 drive	MTFDDAV240TGA MTFDDAV480TGA MTFDDAV960TGA
	PCIe M.2 drive	MTFDKBA480TFR MTFDKBA960TFR

Software

Operating system	Microsoft Windows Server
Measuring tool	Iometer 1.1.0 (icf: benchmark version 3.0)

Logical drive settings to measure

Target Drive		Type RAID 0 logical drive consisting of 1 drive
Stripe size		HDD：256KB、SSD：64 KB
Measurement area	HDD, SSD (Except M.2)	RAW file system is used. The first 32GB of available LBA space is used for sequential access. The following 64GB is used for random access.
	SSD(M.2)	NTFS file system is used. The first 32GB of available LBA space is used for sequential access. The following 64GB is used for random access.
Number of Iometer worker		Sequential Access: 1 Random Access: 1 (except SAS 24G and PCIe 5.0 SSD), 4 (SAS 24G SSD), 16 (PCIe 5.0 SSD)
Alignment of Iometer accesses		Aligned to access block size

Some components may not be available in all countries or sales regions.

Benchmark results

The results shown here are intended to help you select the appropriate storage media under the aspect of disk-I/O performance. For this purpose, a single storage medium was measured in the configuration specified in the subsection "Benchmark environment."

Performance values

The performance values are summarized in the following tables. In each case specifically for a single storage medium and with various access types and block sizes. The established measurement variables, as already mentioned in the subsection "Benchmark description" are used here. Thus, transaction rate is specified for random accesses and data throughput for sequential accesses.

The table cells contain the maximum achievable values. This means that each value is the maximum achievable value of the whole range of load intensities (number of Outstanding I/Os). In order to also visualize the numerical values each table cell is highlighted with a horizontal bar, the length of which is proportional to the numerical value in the table cell. All bars shown in the same scale of length have the same color. In other words, a visual comparison only makes sense for table cells with the same colored bars. Since the horizontal bars in the table cells depict the maximum achievable performance values, they are shown by the color getting lighter as you move from left to right. The light shade of color at the right end of the bar tells you that the value is a maximum value and can only be achieved under optimal prerequisites. The darker the shade becomes as you move to the left, the more frequently it will be possible to achieve the corresponding value in practice.

Values in rows with "est." are predicted values.

3.5 inch model

HDDs

Capacity [GB]	Storage device	Interface	Transactions [IO/s] Database	Transactions [IO/s] Fileserver	Transactions [IO/s] Filecopy	Throughput [MiB/s] Streaming	Throughput [MiB/s] Restore
☐ NL-SAS 12Gbps HDD 7.2krpm [512e]							
6,000	MG08SDA600E	SAS 12G	545	455	442	234	234
8,000	MG08SDA800E	SAS 12G	542	449	449	250	250
12,000	ST12000NM004J	SAS 12G	609	578	534	266	266
14,000	ST14000NM004J	SAS 12G	616	589	524	270	269
16,000	ST16000NM004J	SAS 12G	610	586	548	270	270
18,000	ST18000NM004J	SAS 12G	603	578	522	265	262
20,000	ST20000NM002D	SAS 12G	642	593	502	271	271
☐ NL-SAS 12Gbps HDD 7.2krpm [512n]							
2,000	ST2000NM001B	SAS 12G	489	431	428	200	200
4,000	ST4000NM001B	SAS 12G	541	486	471	239	239
☐ BC-SATA HDD 7.2krpm [512e]							
6,000	MG08ADA600E	SATA 6G	497	452	447	239	239
8,000	MG08ADA800E	SATA 6G	477	429	430	248	248
☐ BC-SATA HDD 7.2krpm [512n]							
2,000	ST2000NM000B	SATA 6G	415	366	389	197	196
4,000	ST4000NM000B	SATA 6G	468	422	435	236	236

SSDs

Capacity [GB]	Storage device	Interface	Transactions [IO/s] Database	Fileserver	Filecopy	Throughput [MiB/s] Streaming	Restore
☐ SAS 12Gbps SSD (WI)							
400	XS400ME70045	SAS 12G	129,340	20,008	18,833	1,043	1,064
800	XS800ME70084	SAS 12G	123,357	23,784	19,429	1,052	872
1,600	XS1600ME70045	SAS 12G	129,571	20,051	20,744	1,043	1,069
☐ SAS 12Gbps SSD (MU)							
800	XS800LE70045	SAS 12G	129,684	20,041	18,837	1,043	1,065
1,600	XS1600LE70045	SAS 12G	129,624	20,040	20,803	1,043	1,068
3,200	XS3200LE70045	SAS 12G	129,555	20,045	20,735	1,043	1,063
6,400	XS6400LE70045	SAS 12G	129,369	20,052	20,767	1,043	1,066
☐ SAS 12Gbps SSD (RI)							
960	XS960SE70045	SAS 12G	129,567	20,014	18,805	1,043	1,064
1,920	XS1920SE70045	SAS 12G	129,710	20,045	20,819	1,043	1,068
3,840	XS3840SE70045	SAS 12G	129,573	20,023	20,733	1,043	1,064
7,680	XS7680SE70045	SAS 12G	129,861	20,046	20,762	1,043	1,068
☐ SATA SSD (MU)							
480	MTFDDAK480TGB	SATA 6G	43,705	5,729	5,839	491	449
960	MTFDDAK960TGB	SATA 6G	43,732	6,155	6,257	491	449
1,920	MTFDDAK1T9TGB	SATA 6G	43,735	6,394	6,513	490	449
3,840	MTFDDAK3T8TGB	SATA 6G	43,415	6,576	6,636	483	446
480	MZ7L3480HELT	SATA 6G	55,649	8,269	8,169	531	495
960	MZ7L3960HELA	SATA 6G	55,915	8,285	8,193	531	495
1,920	MZ7L31T9HENA	SATA 6G	55,829	8,283	8,190	531	495
3,840	MZ7L33T8HENA	SATA 6G	55,728	8,278	8,184	531	495
☐ SATA SSD (RI)							
240	MTFDDAK240TGA	SATA 6G	41,808	5,120	5,293	480	360
480	MTFDDAK480TGA	SATA 6G	43,618	5,625	5,761	490	450
960	MTFDDAK960TGA	SATA 6G	43,631	5,878	6,033	484	449
1,920	MTFDDAK1T9TGA	SATA 6G	43,688	6,334	6,447	491	450
3,840	MTFDDAK3T8TGA	SATA 6G	43,392	6,539	6,626	483	445
7,680	MTFDDAK7T6TGA	SATA 6G	42,940	7,065	7,278	491	446
480	MZ7L3480HEJD	SATA 6G	51,235	7,353	6,805	531	373
960	MZ7L3960HELT	SATA 6G	55,918	8,287	8,193	531	496
1,920	MZ7L31T9HELA	SATA 6G	55,918	8,288	8,195	531	496
3,840	MZ7L33T8HELA	SATA 6G	55,725	8,280	8,184	531	495
7,680	MZ7L37T6HELA	SATA 6G	55,798	8,253	8,169	531	496
☐ SAS 24Gbps SSD (WI)							
800	PM7800G10DN	SAS 12G	168,061	20,678	23,006	1,070	1,076
		SAS 24G	204,529	25,996	25,095	1,960	1,603
1,600	PM71T6010DN	SAS 12G	173,094	22,676	26,505	1,070	1,076
		SAS 24G	208,291	26,190	24,674	1,960	1,319
800	PM7800G10DF	SAS 12G	168,061	20,678	23,006	1,070	1,076
		SAS 24G	204,452	26,015	25,115	1,960	1,603
1,600	PM71T6010DF	SAS 12G	173,094	22,676	26,505	1,070	1,076
		SAS 24G	208,527	26,219	24,674	1,960	1,318
☐ SAS 24Gbps SSD (MU)							
1,600	PM71T6003DN	SAS 12G	168,200	20,700	22,800	1,070	1,076
		SAS 24G	204,400	26,000	25,100	1,963	1,603
3,200	PM73T2003DN	SAS 12G	173,000	22,600	26,500	1,070	1,076
		SAS 24G	208,200	26,100	24,600	1,960	1,318
6,400	PM76T4003DN	SAS 12G	171,200	21,400	23,200	1,070	1,076
		SAS 24G	190,700	23,900	22,500	1,963	1,175

Capacity [GB]	Storage device	Interface	Transactions [IO/s]			Throughput [MiB/s]	
			Database	Fileserver	Filecopy	Streaming	Restore
☐ SAS 24Gbps SSD (RI)							
1,920	PM71T9201DN	SAS 12G	168,283	20,710	22,880	1,070	1,076
		SAS 24G	204,491	26,066	25,188	1,963	1,603
3,840	PM73T8401DN	SAS 12G	173,000	22,600	26,500	1,070	1,076
		SAS 24G	208,200	26,100	24,600	1,960	1,318
7,680	PM77T6801DN	SAS 12G	171,279	21,408	23,284	1,070	1,076
		SAS 24G	190,784	23,941	22,542	1,963	1,175
15,360	PM715T301DN	SAS 12G	167,002	20,281	20,643	1,070	1,070
		SAS 24G	146,385	18,465	17,688	1,963	974
7,680	PM77T6801DF	SAS 12G	174,701	21,398	23,308	1,070	1,076
		SAS 24G	190,770	23,946	22,551	1,963	1,175
15,360	PM715T301DF	SAS 12G	167,002	20,281	20,643	1,070	1,070
		SAS 24G	146,212	18,490	17,662	1,963	974
960	MZILG960HCHQ	SAS 12G	168,803	20,856	25,149	1,075	1,062
		SAS 24G	180,407	33,362	25,733	2,049	1,290
1,920	MZILG1T9HCJR	SAS 12G	186,387	25,625	27,424	1,075	1,062
		SAS 24G	222,003	44,525	47,753	2,049	1,916
3,840	MZILG3T8HCLS	SAS 12G	187,273	25,619	33,914	1,075	1,062
		SAS 24G	244,313	45,247	54,927	2,049	1,912
7,680	MZILG7T6HBLA	SAS 12G	187,183	25,636	33,940	1,075	1,062
		SAS 24G	246,245	45,190	54,780	2,049	1,913
15,360	MZILG15THBLA	SAS 12G	187,298	25,653	33,915	1,075	1,062
		SAS 24G	229,145	45,292	54,954	2,048	1,909

2.5 inch model

HDDs

Capacity [GB]	Storage device	Interface	Transactions [IO/s]			Throughput [MiB/s]	
			Database	Fileserver	Filecopy	Streaming	Restore
☐ SAS 12Gbps HDD 10krpm [512e]							
1,800	AL15SEB18EQ	SAS 12G	767	631	624	255	249
2,400	AL15SEB24EQ	SAS 12G	754	620	617	264	260
☐ SAS 12Gbps HDD 10krpm [512n]							
300	AL15SEB030N	SAS 12G	641	547	557	231	230
600	AL15SEB060N	SAS 12G	682	558	568	232	231
1,200	AL15SEB120N	SAS 12G	732	603	593	230	225

SSDs

Capacity [GB]	Storage device	Interface	Transactions [IO/s]			Throughput [MiB/s]	
			Database	Fileserver	Filecopy	Streaming	Restore
☐ SAS 12Gbps SSD (WI)							
400	XS400ME70045	SAS 12G	129,340	20,008	18,833	1,043	1,064
800	XS800ME70084	SAS 12G	123,357	23,784	19,429	1,052	872
1,600	XS1600ME70045	SAS 12G	129,571	20,051	20,744	1,043	1,069
☐ SAS 12Gbps SSD (MU)							
800	XS800LE70045	SAS 12G	129,684	20,041	18,837	1,043	1,065
1,600	XS1600LE70045	SAS 12G	129,624	20,040	20,803	1,043	1,068
3,200	XS3200LE70045	SAS 12G	129,555	20,045	20,735	1,043	1,063
6,400	XS6400LE70045	SAS 12G	129,369	20,052	20,767	1,043	1,066
☐ SAS 12Gbps SSD (RI)							
960	XS960SE70045	SAS 12G	129,567	20,014	18,805	1,043	1,064
1,920	XS1920SE70045	SAS 12G	129,710	20,045	20,819	1,043	1,068
3,840	XS3840SE70045	SAS 12G	129,573	20,023	20,733	1,043	1,064
7,680	XS7680SE70045	SAS 12G	129,861	20,046	20,762	1,043	1,068
☐ SATA SSD (MU)							
480	MTFDDAK480TGB	SATA 6G	43,705	5,729	5,839	491	449
960	MTFDDAK960TGB	SATA 6G	43,732	6,155	6,257	491	449
1,920	MTFDDAK1T9TGB	SATA 6G	43,735	6,394	6,513	490	449
3,840	MTFDDAK3T8TGB	SATA 6G	43,415	6,576	6,636	483	446
480	MZ7L3480HELT	SATA 6G	55,649	8,269	8,169	531	495
960	MZ7L3960HELA	SATA 6G	55,915	8,285	8,193	531	496
1,920	MZ7L33T8HENA	SATA 6G	55,829	8,283	8,190	531	496
3,840	MZ7L31T9HENA	SATA 6G	55,728	8,278	8,184	531	495
☐ SATA SSD (RI)							
240	MTFDDAK240TGA	SATA 6G	41,808	5,120	5,293	480	360
480	MTFDDAK480TGA	SATA 6G	43,618	5,625	5,761	490	450
960	MTFDDAK960TGA	SATA 6G	43,631	5,878	6,033	484	449
1,920	MTFDDAK1T9TGA	SATA 6G	43,688	6,334	6,447	491	450
3,840	MTFDDAK3T8TGA	SATA 6G	43,392	6,539	6,626	483	445
7,680	MTFDDAK7T6TGA	SATA 6G	42,940	7,065	7,278	491	446
480	MZ7L3480HEJD	SATA 6G	51,235	7,353	6,805	531	373
960	MZ7L3960HELT	SATA 6G	55,918	8,287	8,193	531	496
1,920	MZ7L31T9HELA	SATA 6G	55,918	8,288	8,195	531	496
3,840	MZ7L33T8HELA	SATA 6G	55,725	8,280	8,184	531	495
7,680	MZ7L37T6HELA	SATA 6G	55,798	8,253	8,169	531	496
☐ SAS 24Gbps SSD (WI)							
800	PM7800G10DN	SAS 12G	168,061	20,678	23,006	1,070	1,076
		SAS 24G	204,529	25,996	25,095	1,960	1,603
1,600	PM71T6010DN	SAS 12G	173,094	22,676	26,505	1,070	1,076
		SAS 24G	208,291	26,190	24,674	1,960	1,319
☐ SAS 24Gbps SSD (MU)							
1,600	PM71T6003DN	SAS 12G	168,200	20,700	22,800	1,070	1,076
		SAS 24G	204,400	26,000	25,100	1,963	1,603
3,200	PM73T2003DN	SAS 12G	173,000	22,600	26,500	1,070	1,076
		SAS 24G	208,200	26,100	24,600	1,960	1,318
6,400	PM76T4003DN	SAS 12G	171,200	21,400	23,200	1,070	1,076
		SAS 24G	190,700	23,900	22,500	1,963	1,175

Capacity [GB]	Storage device	Interface	Transactions [IO/s] Database	Fileserver	Filecopy	Throughput [MiB/s] Streaming	Restore
☐ SAS 24Gbps SSD (RI)							
1,920	PM71T9201DN	SAS 12G	168,283	20,710	22,880	1,070	1,076
		SAS 24G	204,491	26,066	25,188	1,963	1,603
3,840	PM73T8401DN	SAS 12G	173,000	22,600	26,500	1,070	1,076
		SAS 24G	208,200	26,100	24,600	1,960	1,318
7,680	PM77T6801DN	SAS 12G	171,279	21,408	23,284	1,070	1,076
		SAS 24G	190,784	23,941	22,542	1,963	1,175
15,360	PM715T301DN	SAS 12G	167,002	20,281	20,643	1,070	1,070
		SAS 24G	146,385	18,465	17,688	1,963	974
7,680	PM77T6801DF	SAS 12G	174,701	21,398	23,308	1,070	1,076
		SAS 24G	190,770	23,946	22,551	1,963	1,175
15,360	PM715T301DF	SAS 12G	167,002	20,281	20,643	1,070	1,070
		SAS 24G	146,212	18,490	17,662	1,963	974
960	MZILG960HCHQ	SAS 12G	168,803	20,856	25,149	1,075	1,062
		SAS 24G	180,407	33,362	25,733	2,049	1,290
1,920	MZILG1T9HCJR	SAS 12G	186,387	25,625	27,424	1,075	1,062
		SAS 24G	222,003	44,525	47,753	2,049	1,916
3,840	MZILG3T8HCLS	SAS 12G	187,273	25,619	33,914	1,075	1,062
		SAS 24G	244,313	45,247	54,927	2,049	1,912
7,680	MZILG7T6HBLA	SAS 12G	187,183	25,636	33,940	1,075	1,062
		SAS 24G	246,245	45,190	54,780	2,049	1,913
15,360	MZILG15THBLA	SAS 12G	187,298	25,653	33,915	1,075	1,062
		SAS 24G	229,145	45,292	54,954	2,048	1,909
☐ PCIe SSD (WI)							
400	SSDPF21Q400GB	PCIe4 x4	303,783	91,576	84,727	6,693	4,562
800	SSDPF21Q800GB	PCIe4 x4	290,266	99,852	94,882	6,738	4,512
1,600	SSDPF21Q016TB	PCIe4 x4	304,687	108,995	110,292	6,682	4,382
☐ PCIe SSD (MU) (*1)							
1,600	KCMY1VUG1T60	PCIe4 x4	431,300	57,900	50,400	7,204	3,430
3,200	KCMY1VUG3T20	PCIe4 x4	557,564	95,486	86,744	7,219	5,079
6,400	KCMY1VUG6T40	PCIe4 x4	557,874	109,610	102,691	7,219	5,013
12,800	KCMY1VUG12T8	PCIe4 x4	558,473	103,865	98,998	6,728	5,111
☐ PCIe SSD (RI) (*1)							
1,920	KCMY1RUG1T92	PCIe4 x4	431,394	57,935	50,484	7,204	3,430
3,840	KCMY1RUG3T84	PCIe4 x4	557,352	95,493	86,690	6,963	4,406
7,680	KCMY1RUG7T68	PCIe4 x4	609,834	107,833	98,803	7,041	4,416
15,360	KCMY1RUG15T3	PCIe4 x4	557,277	103,784	100,005	7,183	4,429

(*1) Performance value for PRAID EP680i connection. The drive supports PCIe 5.0, but the interface operates at PCIe 4.0.

Common to all models

Capacity [GB]	Storage device	Interface	Transactions [IO/s] Database	Transactions [IO/s] Fileserver	Transactions [IO/s] Filecopy	Throughput [MiB/s] Streaming	Throughput [MiB/s] Restore
☐ M.2 SATA SSD (PDUAL CP300)							
240	MTFDDAV240TGA	SATA 6G	45,009	5,324	5,490	474	353
480	MTFDDAV480TGA	SATA 6G	48,771	5,870	6,022	501	484
960	MTFDDAV960TGA	SATA 6G	51,373	6,252	6,429	471	486
☐ M.2 NVMe SSD (PDUAL CP300)							
480	MTFDKBA480TFR	PCIe4 x4	75,126	15,502	12,241	4,923	682
960	MTFDKBA960TFR	PCIe4 x4	139,598	31,160	25,761	4,923	1,380
☐ M.2 SATA SSD (Onboard)							
240	MTFDDAV240TGA	SATA 6G	36,236	5,647	5,793	491	352
480	MTFDDAV480TGA	SATA 6G	46,629	6,561	6,714	513	502
960	MTFDDAV960TGA	SATA 6G	50,791	7,056	7,301	502	504
☐ M.2 NVMe SSD (Onboard)							
480	MTFDKBA480TFR	PCIe4 x4	77,153	15,643	12,066	4,923	689
960	MTFDKBA960TFR	PCIe4 x4	149,842	31,643	25,599	4,923	1,383

Literature

PRIMERGY Servers

https://www.fujitsu.com/global/products/computing/servers/primergy/

PRIMERGY RX1440 M2

This Whitepaper

https://docs.ts.fujitsu.com/dl.aspx?id=63d5b094-29ac-4514-83f7-d58d8261682c

https://docs.ts.fujitsu.com/dl.aspx?id=d934c6be-260b-467a-930f-ae7ad86582b5

Data sheet:

https://docs.ts.fujitsu.com/dl.aspx?id=adb22e20-17c3-475d-af28-1e4dc63d0702

PRIMERGY Performance

https://www.fujitsu.com/global/products/computing/servers/primergy/benchmarks/

SPEC CPU2017

https://www.spec.org/osg/cpu2017

Benchmark Overview SPECcpu2017

https://docs.ts.fujitsu.com/dl.aspx?id=20f1f4e2-5b3c-454a-947f-c169fca51eb1

STREAM

https://www.cs.virginia.edu/stream/

SPECpower_ssj2008

https://www.spec.org/power_ssj2008

Benchmark Overview SPECpower_ssj2008

https://docs.ts.fujitsu.com/dl.aspx?id=166f8497-4bf0-4190-91a1-884b90850ee0

Document change history

Version	Date	Description
1.2	2024-12-10	Update: • SPECpower_ssj2008 Measured with EPYC 9845
1.1	2024-11-26	Update: • Technical data • SPEC CPU2017, STREAM Measured with AMD EPYC 9005 Series Processor • Disk I/O Measured with 2.5 / 3.5 inch model
1.0	2024-04-30	New: • Technical data • SPEC CPU2017, STREAM Measured with AMD EPYC 9004 Series Processor • SPECpower_ssj2008 Measured with EPYC 9754 • Disk I/O Measured with 2.5 / 3.5 inch model

Contact

Fujitsu

Web site: https://www.fujitsu.com

PRIMERGY Performance and Benchmarks

mailto:fj-benchmark@dl.jp.fujitsu.com