IBM Power Systems Performance Capabilities Reference

IBM i operating system 7.4

July 2020

This document is intended for use by qualified performance related programmers or analysts from IBM, IBM Business Partners and IBM customers using the IBM Power™ Systems platform running IBM i operating system. Information in this document may be readily shared with IBM i customers to understand the performance and tuning factors in IBM i operating system 7.4 and earlier where applicable.

For the latest updates and for the latest IBM i performance information, please refer to the Performance section of the IBM i 7.4 IBM Knowledge Center:

https://www.ibm.com/support/knowledgecenter/ssw_ibm_i_74/rzahx/rzahx1.htm

Requests for use of performance information by the technical trade press or consultants should be directed to POWER Systems Performance.

Note!

Before using this information, be sure to read the general information under “Special Notices.”

Fifty-second Edition (July 2020)
This edition applies to IBM i operating system 7.4 running on IBM Power Systems.

The February 2017 version of this document is available at: IBM Power Systems Performance Capabilities Reference (Forty-sixth Edition February 2017)

The document is viewable/downloadable in Adobe Acrobat (.pdf) format and is approximately 0.8 MB in size.
Adobe Acrobat reader plug-in is available at: http://www.adobe.com .

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Special Notices

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All performance data contained in this publication was obtained in the specific operating environment and under the conditions described within the document and is presented as an illustration. Performance obtained in other operating environments may vary and customers should conduct their own testing. Information is provided "AS IS" without warranty of any kind.

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Purpose of this Document

The purpose of this document is to help provide guidance in terms of IBM i operating system performance, capacity planning information, and tips to obtain optimal performance on IBM i operating system.
This document is typically updated with each new release or more often if needed. This new edition of the IBM i 7.4 Performance Capabilities Reference Guide is an update to previous editions in order to reflect new products announced on October 8, 2019.

This edition includes performance information on newly announced IBM Power Systems featuring POWER9 technology.

All POWER8 and POWER9 results in this document reflect performance with firmware and Operating System updates to mitigate Common Vulnerabilities and Exposures issue numbers CVE-2017-5715, CVE-2017-5753 and CVE-2017-5754 known as Spectre and Meltdown.

The wide variety of applications available makes it extremely difficult to describe a “typical” workload. The data in this document is the result of measuring or modeling certain application programs in very specific and unique configurations and should not be used to predict specific performance for other applications. The performance of other applications can be predicted using a system sizing tool such as IBM Systems Workload Estimator.

IBM i Performance Tips and Techniques

For performance tips and techniques for IBM i systems, guidance is available at the following websites:

IBM i performance white papers and resources:

IBM Power Systems literature
IBM i White Papers

IBM i performance tips and techniques document:

IBM i on Power – Performance FAQ

IBM developerWorks

IBM developerWorks provides a wide variety of information on topics for IBM i including performance. Refer to the website: developerWorks

CPW Rating Description

"Due to road conditions and driving habits, your results may vary." "Every workload is different." These are two hallmark statements of measuring performance in two very different industries. They are both absolutely correct. For systems that run IBM i, IBM has provided a measure called the CPW rating to represent the relative computing power (more specifically, transactional capacity) of these systems in a commercial environment. The type of caveats listed above are always included because no prediction can be made that a specific workload will perform in the same way that the workload used to generate CPW information performs.

The CPW rating provides a measure to show how on-line transactions processing (OLTP) workloads perform on systems that run IBM i. The CPW rating is built using workloads that can utilize the full processing power of the system. This includes processor capabilities such as SMT (simultaneous multi-threading) and optionally enabled features such as Workload Optimized Frequency (WOF).

Many, but clearly not all, IBM i applications tend to follow the same patterns as the CPW rating - which stands for **Commercial Processing Workload rating**. These applications tend to have many jobs running brief transactions in an environment that is dominated by IBM system code performing database operations. The CPW rating is not intended to represent workloads that are single-threaded ("batch" jobs can be a subset of this class of applications). Single-threaded workloads tend to consume a single processor or processor thread for an extended period of time and utilize different CPU pathlengths and I/O characteristics from OLTP workloads. Therefore single-threaded workloads that are typically found in batch environments tend to have different characteristics than what is represented by the CPW rating. The CPW rating is also not intended to represent applications which spend a large portion of their overall processor pathlength in application code. These applications tend to have different scaling behaviors than the CPW rating due to longer pathlength per transaction and less I/O processing.

The CPW rating is a self-referential capacity metric. Because of this, it should be used for representing the relative capacity of different systems running IBM i. Such capacity metrics cannot be used to represent the execution speed of any given thread of execution. Use the IBM Systems Workload Estimator sizing tool for assistance in sizing systems for specific workloads.

CPW Rating

The CPW rating of a system is generated using measurements of a specific workload that is maintained internally within the IBM i Systems Performance group. The CPW rating is designed to evaluate a computer system and associated software in the commercial environment. It is rigidly defined as a relative capacity metric for rough model comparisons and relative CPU consumption. It is NOT representative of any specific environment, but it is generally applicable to the commercial computing environment.

What the CPW rating is:

- Test of a range of database applications, including various complexity updates and various complexity queries with commitment control and journaling
- Test of concurrent data access by users running a single group of programs.
- Reasonable approximation of a steady-state, database oriented commercial application's relative performance.

What the CPW rating is not:

- An indication of the performance capabilities of a system for any specific customer situation
- A test of "ad-hoc" (query) database performance
- A test of single-threaded (batch) application throughput (e.g. batch processing steps per minute)
- A test of single-threaded (batch) application run time or "batch window" (e.g. job completes in 4 hour batch window)

When to use the CPW rating results:

Approximate product positioning between different systems running IBM i where the primary application is expected to be oriented to traditional commercial business uses (order entry, payroll, billing, etc.).

CPW Rating vs Public Benchmarks

Specific choices were made in creating the CPW rating to try to best represent the relative positioning of IBM i systems. Some of the differences between the CPW rating and public benchmarks are:
The code base for public benchmarks is constantly changing to try to obtain the best possible results, while an attempt is made to keep the base for the CPW rating as constant as possible to better represent relative improvements from release to release and system to system.

Public benchmarks typically do not require full security, but since IBM customers tend to run on secure systems, Security Level 50 is specified for the CPW rating.

Public benchmarks are super-tuned to obtain the best possible results for that specific benchmark, whereas for the CPW rating we tend to use more of the system defaults to better represent the way the system is shipped to our customers.

Public benchmarks can use different applications for different sized systems and take advantage of all of the resources available on a particular system, while the CPW rating has been designed to run as the same application at all levels with approximately the same disk and memory resources per simulated user on all systems

Public benchmarks require extensive, sophisticated driver and middle tier configurations. In order to simplify the environment and add a small computational component into the workload, all the required components to drive the CPW rating have been included as a part of the overall workload.

The net result is that the CPW rating is an application model that IBM believes provides an excellent indicator of multi-user transaction processing performance capacity when comparing between members of the IBM i system families. As indicated above, the CPW rating is not intended to be a guarantee of performance, but can be viewed as a good indicator for multi-user transaction processing workloads

CPW Rating deployment

For all systems rated after October 2011, a workload called COPR (COmercial Performance Rating) is used to provide performance results that produce the CPW rating.

COPR (COmmercial Performance Rating)

COPR is a relative-performance workload, not a benchmark. Although roughly based upon a public benchmark, it is to be used to assist in determining the relative performance capacity of various commercial POWER based systems. It is not unduly optimized to produce the very best performance ratings - as would be the case in a benchmark - but instead uses capabilities expected to be used by customers. As the name COPR - Commercial Performance Rating - implies, its purpose is to provide guidance for gauging system capacity. Since it is an OLTP workload, the focus of COPR is on many jobs that run simultaneously and execute relatively short transactions.

The COPR workload accesses the database tables using a higher level query language (e.g., SQL, JDBC) and stored procedures.

COPR acts primarily as a database server with a set of jobs - “Job Sets” in COPR nomenclature - acting independently to drive the random high-level database requests. The number of jobs accepting such input

is set to exceed the number of "processors" (i.e., the number of processor cores multiplied by the SMT - Simultaneous Multi-Threading - capability of each core) by enough to tend to keep all "processors" busy much of the time. This also means that the many database tables and indexes are frequently being concurrently accessed, strongly and intentionally driving database contention and integrity capabilities.

The types of transactions executed by COPR tend to be of light to moderate complexity in comparison to many customer workloads, with an emphasis on database transactions. COPR spends much of its processing time doing what you would expect it to be doing, executing within the IBM i componentry supporting such database accesses.

The COPR workload allows IBM to be effective in providing CPW rating information. The nature of the COPR workload also helps IBM better leverage performance insights for our operating system and firmware development teams.

IBM i Sizing and Performance Data Collection Tools

The following section presents some of the tools available for sizing and capacity planning. (Note: There are products from vendors not included here that perform similar functions.) All of the tools discussed here support the current range of IBM i products, and include the capability to model logical partitions, partial processors (micropartitions) and server workload consolidation.

Performance Data Collection Services

This tool which is part of the operating system collects system and job performance data which is the input for many of the performance tools that are available today. Collection Services is started automatically when subsystem QSYSWRK is started.
The default collection library is QPFRDATA but QMPGDATA may still be used if set up in a prior release. Collected data is stored in Management Collection Objects (type *MGTCOL). The CRTPFRDTA command is used to process that data and produce the performance database files used by other tools. CRTPFRDTA may be run manually or configured within collection services to run automatically during collection. For more information on Collection Services see the IBM i information center website at: Collection Services

IBM Systems Workload Estimator

The wide variety of applications available makes it extremely difficult to describe a "typical" workload. The data in this document is the result of measuring or modeling certain application programs in very specific and unique configurations, and should not be used to predict specific performance for other applications. The performance of other applications can be predicted using a system sizing tool such as IBM Systems Workload Estimator.

The IBM Systems Workload Estimator (WLE) is a web-based sizing tool for IBM Power Systems. WLE is available at: https://wle.mybluemix.net/wle/EstimatorServlet

IBM i Batch Model

Batch model was introduced in IBM i 7.2. The purpose of this new function is to help you analyze batch job performance characteristics as well as predict batch workload run times after changes are made to disk, processor, or workload volumes. This new function is found in IBM Navigator for i under the Performance category and uses Collection Services data as input.

To use Batch Model, you must have the Manager feature (option 1) of the Performance Tools Licensed Program Product (5770PT1) installed. You do need to have a 7.2 or newer partition in order to access the Batch Model function in IBM Navigator for i. However, you can use Batch Model on Collection Services data from the 6.1 or 7.1 releases – by moving this data to the 7.2 partition.

Additional usage information can be found here:

developerWorks - How to use the Batch Model

IBM Knowledge Center - Batch Model

For more information on other IBM i Performance Tools, see the Performance Management tab on the IBM i system management website at the following link:
http://www-03.ibm.com/systems/power/software/i/management/
and the IBM Redbook End to End Performance Management on IBM I SG24-7808-00 at the following link:
http://publib-b.boulder.ibm.com/abstracts/sg247808.html?Open

CPW Rating Relative Performance Values for IBM i

This reference details the relative system performance values using the CPW rating:

- Commercial Processing Workload (**CPW**). CPW rating values are relative system performance metrics and reflect the relative system capacity for the OLTP workloads. CPW rating values can be used with caution in a capacity planning analysis (e.g., to scale CPU-constrained capacities, CPU time per transaction). However, these values may not appropriately reflect the performance of workloads than OLTP because of differing detailed characteristics (e.g., cache miss ratios, average cycles per instruction, software contention, I/O characteristics, memory requirements, and application performance characteristics). The CPW rating values shown in the tables are based on IBM internal tests. Actual performance in a customer environment may vary significantly. Use the "IBM Systems Workload Estimator" for assistance with sizing.

This reference does not address the following:

- User-based Licensing. For assistance in determining the required number of user licenses, see the product website: http://www-03.ibm.com/systems/power/software/i/licensing/ Note that user-based licensing is not a performance statement or a replacement for system sizing; instead, user-based licensing only enables appropriate user connectivity to the system. Application environments differ in their requirements for system resources. Use the "IBM Systems Workload Estimator" for assistance with sizing based on performance.
- rPerf (Relative Performance) is an estimate of commercial processing performance relative to other IBM UNIX® systems. It is derived from an IBM analytical model which uses characteristics from IBM internal workloads, TPC and SPEC benchmarks. The rPerf model is not intended to represent any specific public benchmark results and should not be reasonably used in that way. The model simulates some of the system operations such as CPU,cache and memory. However, the model does not simulate disk or network I/O operations. IBM i systems that run AIX can be expected to produce the same performance as equivalent IBM UNIX® systems given the same memory, disk, I/O, and workload configurations. The relative capacity of IBM UNIX® systems is often expressed in terms of rPerf values.

For more information on rPerf see the website:
IBM Power Systems Performance Report

1 IBM i 7.4 Addition (July 2020)

New POWER9 processor based system models were announced in July 2020.

- IBM Power System S914
- IBM Power System S922
- IBM Power System S924

1.1 IBM Power System S914

The S914 by default will have its Power Management mode set to Dynamic Performance. This mode dynamically optimizes the processor frequency at any given time based on CPU utilization and operating environmental conditions. Please consult the "IBM EnergyScale for POWER9 Processor-Based Systems" document for a description of this feature as well as other power management options available for this server.

1.1.1 CPW values for IBM Power System S914

CPW values for IBM Power System S914				
Model	Processor Feature	Chip Speed GHz	CPUs	Processor CPW
S914 (9009-41G)	EP50	2.3 – 3.8	4	52500
S914 (9009-41G)	EP51	2.3 – 3.8	6	78500
S914 (9009-41G)	EP52	2.8 – 3.8	8	122500

*Note:

1. These configurations were run with SMT8 enabled.
2. These configurations were run with Dynamic Performance mode enabled.

1.2 IBM Power System S922

The S922 by default will have its Power Management mode set to Maximum Performance. This mode dynamically optimizes the processor frequency at any given time based on CPU utilization and operating environmental conditions. Please consult the "IBM EnergyScale for POWER9 Processor-Based Systems" document for a description of this feature as well as other power management options available for this server.

1.2.1 CPW values for IBM Power System S922 EP5Y

CPW values for IBM Power System S922				
Model	Processor Feature	Chip Speed GHz	CPUs	Processor CPW
S922 (9009-22G)	EP5Y	2.8 – 3.8	1	19000

*Note:

1. This configuration was run with SMT8 enabled.
2. This configuration was run with Maximum Performance mode enabled.

1.2.2 CPW values for IBM Power System S922 EP58

CPW values for IBM Power System S922 EP58				
			Processor CPW	
Model	Processor Feature	Chip Speed GHz	8 cores	16 cores(4)
S922 (9009-22G)	EP58	3.4 – 3.9	145500	268500

*Note:

1. These configurations were run with SMT8 enabled
2. These configurations were run with Maximum Performance mode enabled.
3. This processor feature has 8 cores per chip
4. The 16 core system was configured as 1 16-core partition.

1.2.3 CPW values for IBM Power System S922 EP59

CPW values for IBM Power System S922 EP59				
			Processor CPW	
Model	Processor Feature	Chip Speed GHz	10 cores	20 cores(4)
S922 (9009-22G)	EP59	2.9 – 3.8	174500	318000

*Note:

1. These configurations were run with SMT8 enabled
2. These configurations were run with Maximum Performance mode enabled.
3. This processor feature has 10 cores per chip
4. The 20 core system was configured as 1 20-core partition.

1.2.4 CPW values for IBM Power System S922 EP5B

CPW values for IBM Power System S922 EP5B				
			Processor CPW	
Model	Processor Feature	Chip Speed GHz	11 cores	22 cores(4)
S922 (9009-22G)	EP5B	2.8 – 3.8	195200	350000

*Note:

1. These configurations were run with SMT8 enabled
2. These configurations were run with Maximum Performance mode enabled.
3. This processor feature has 11 cores per chip
4. The 22-core system was configured as 1 22-core partition.

1.3 IBM Power System S924

The S924 by default will have its Power Management mode set to Maximum Performance. This mode dynamically optimizes the processor frequency at any given time based on CPU utilization and operating environmental conditions. Please consult the "IBM EnergyScale for POWER9 Processor-Based Systems" document for a description of this feature as well as other power management options available for this server.

1.3.1 CPW values for IBM Power System S924 EP5E

CPW values for IBM Power System S924 EP5E				
			Processor CPW	
Model	Processor Feature	Chip Speed GHz	8 cores	16 cores(4)
S924 (9009-42G)	EP5E	3.8 – 4.0	145500	268500

*Note:

1. These configurations were run with SMT8 enabled
2. These configurations were run with Maximum Performance mode enabled.
3. This processor feature has 8 cores per chip
4. The 16 core system was configured as 1 16-core partition.

1.3.2 CPW values for IBM Power System S924 EP5F

CPW values for IBM Power System S924 EP5F				
			Processor CPW	
Model	Processor Feature	Chip Speed GHz	10 cores	20 cores(4)
S924 (9009-42G)	EP5F	3.5 – 3.9	174500	318000

*Note:

1. These configurations were run with SMT8 enabled
2. These configurations were run with Maximum Performance mode enabled.
3. This processor feature has 10 cores per chip
4. The 20 core system was configured as 1 20-core partition.

1.3.3 CPW values for IBM Power System S924 EP5H

CPW values for IBM Power System S924 EP5H				
			Processor CPW	
Model	Processor Feature	Chip Speed GHz	11 cores	22 cores(4)
S924 (9009-42G)	EP5H	3.45 – 3.9	195200	350000

*Note:

1. These configurations were run with SMT8 enabled
2. These configurations were run with Maximum Performance mode enabled.
3. This processor feature has 11 cores per chip
4. The 22-core system was configured as 1 22-core partition.

1.3.4 CPW values for IBM Power System S924 EP5G

CPW values for IBM Power System S924 EP5G				
			Processor CPW	
Model	Processor Feature	Chip Speed GHz	12 cores	24 cores(4)
S924 (9009-42G)	EP5G	3.4 – 3.9	209000	370700

*Note:

1. This configuration was run with SMT8 enabled.

2. This configuration was run with Maximum Performance mode enabled.
3. This processor feature has 12 cores per chip
4. The 24 core system was configured with one 24-core partition.

2 IBM i 7.4 Addition (October 2019)

A new POWER9 processor based system model was announced in October 2019.

- IBM Power System S924, processor feature EP1H

2.1 IBM Power System S924

The S924 by default will have its Power Management mode set to Maximum Performance. This mode dynamically optimizes the processor frequency at any given time based on CPU utilization and operating environmental conditions. Please consult the "IBM EnergyScale for POWER9 Processor-Based Systems" document for a description of this feature as well as other power management options available for this server.

2.1.1 CPW values for IBM Power System S924 EP1H

CPW values for IBM Power System S924 EP1H				
			Processor CPW	
Model	Processor Feature	Chip Speed GHz	11 cores	22 cores(4)
S924 (9009-42A)	EP1H	3.45 – 3.9	195200	350000

*Note:

1. These configurations were run with SMT8 enabled
2. These configurations were run with Maximum Performance mode enabled.
3. This processor feature has 11 cores per chip
4. The 22-core system was configured as 1 22-core partition.

3 IBM i 7.3 Addition (August 2019)

A new POWER9 processor based system model was announced in August 2019.

- IBM Power System E980

3.1 IBM Power System E980

The E980 by default will have its Power Management mode set to Maximum Performance. This mode dynamically optimizes the processor frequency at any given time based on CPU utilization and operating environmental conditions. Please consult the "IBM EnergyScale for POWER9 Processor-Based Systems" document for a description of this feature as well as other power management options available for this server.

3.1.1 CPW values for IBM Power System E980 EFP0

CPW values for IBM Power System E980 EFP0						
			Processor CPW			
Model	Processor Feature	Chip Speed GHz	24 cores	2x24 cores(4)	3x24 cores(5)	4x24 cores(6)
E980 (9080-M9S)	EFP0	3.58-3.9	381000	759000	1140000	1522000

*Note:

1. These configurations were run with SMT8 enabled.
2. These configurations were run with Maximum Performance mode enabled.
3. This processor feature has 6 cores per chip
4. The 48 core system was configured as 2 24-core partitions.
5. The 72 core system was configured as 3 24-core partitions.
6. The 96 core system was configured as 4 24-core partitions.

4 IBM i 7.3 Addition (August 2018)

A new POWER9 processor based system model was announced in August 2018.

- BM Power System E980

4.1 IBM Power System E980

The E980 by default will have its Power Management mode set to Maximum Performance. This mode dynamically optimizes the processor frequency at any given time based on CPU utilization and operating environmental conditions. Please consult the "IBM EnergyScale for POWER9 Processor-Based Systems" document for a description of this feature as well as other power management options available for this server.

4.1.1 CPW values for IBM Power System E980 EFP1

CPW values for IBM Power System E980 EFP1						
			Processor CPW			
Model	Processor Feature	Chip Speed GHz	32 cores	2x32 cores(4)	3x32 cores(5)	4x32 cores(6)
E980 (9080-M9S)	EFP1	3.9-4.0	508900	1012000	1521000	2030000

*Note:

1. These configurations were run with SMT8 enabled.
2. These configurations were run with Maximum Performance mode enabled.
3. This processor feature has 8 cores per chip
4. The 64 core system was configured as 2 32-core partitions.
5. The 96 core system was configured as 3 32-core partitions.
6. The 128 core system was configured as 4 32-core partitions.

4.1.2 CPW values for IBM Power System E980 EFP2

CPW values for IBM Power System E980 EFP2						
			Processor CPW			
Model	Processor Feature	Chip Speed GHz	40 cores	2x40 cores(4)	3x40 cores(5)	4x40 cores(6)
E980 (9080-M9S)	EFP2	3.7-3.9	611300	1216000	1827000	2439000

*Note:

1. These configurations were run with SMT8 enabled.
2. These configurations were run with Maximum Performance mode enabled.
3. This processor feature has 10 cores per chip
4. The 80 core system was configured as 2 40-core partitions.
5. The 120 core system was configured as 3 40-core partitions.
6. The 160 core system was configured as 4 40-core partitions.

4.1.3 CPW values for IBM Power System E980 EFP4

CPW values for IBM Power System E980 EFP4						
			Processor CPW			
Model	Processor Feature	Chip Speed GHz	44 cores	2x44 cores(4)	3x44 cores(5)	4x44 cores(6)
E980 (9080-M9S)	EFP4	3.58-3.9	639000	1271000	1910000	2549000

Note:

1. These configurations were run with SMT8 enabled.
2. These configurations were run with Maximum Performance mode enabled.
3. This processor feature has 11 cores per chip
4. The 88 core system was configured as 2 44-core partitions.
5. The 132 core system was configured as 3 44-core partitions.
6. The 176 core system was configured as 4 44-core partitions.

4.1.4 CPW values for IBM Power System E980 EFP3

CPW values for IBM Power System E980 EFP3						
			Processor CPW			
Model	Processor Feature	Chip Speed GHz	48 cores	2x48 cores(4)	3x48 cores(5)	4x48 cores(6)
E980 (9080-M9S)	EFP3	3.55-3.9	687500	1368000	2055600	2743000

*Note:

1. These configurations were run with SMT8 enabled.
2. These configurations were run with Maximum Performance mode enabled.
3. This processor feature has 12 cores per chip
4. The 96 core system was configured as 2 48-core partitions.
5. The 144 core system was configured as 3 48-core partitions.
6. The 192 core system was configured as 4 48-core partitions.

5 IBM i 7.3 Addition (February 2018)

New POWER9 processor based system models were announced in February 2018.

- IBM Power System S914
- IBM Power System S922
- IBM Power System S924

5.1 IBM Power System S914

The S914 by default will have its Power Management mode set to Dynamic Performance. This mode dynamically optimizes the processor frequency at any given time based on CPU utilization and operating environmental conditions. Please consult the "IBM EnergyScale for POWER9 Processor-Based Systems" document for a description of this feature as well as other power management options available for this server.

5.1.1 CPW values for IBM Power System S914

CPW values for IBM Power System S914				
Model	Processor Feature	Chip Speed GHz	CPUs	Processor CPW
S914 (9009-41A)	EP10	2.3 – 3.8	4	52500
S914 (9009-41A)	EP11	2.3 – 3.8	6	78500
S914 (9009-41A)	EP12	2.8 – 3.8	8	122500

*Note:

1. These configurations were run with SMT8 enabled.
2. These configurations were run with Dynamic Performance mode enabled.

5.2 IBM Power System S922

The S922 by default will have its Power Management mode set to Maximum Performance. This mode dynamically optimizes the processor frequency at any given time based on CPU utilization and operating environmental conditions. Please consult the "IBM EnergyScale for POWER9 Processor-Based Systems" document for a description of this feature as well as other power management options available for this server.

5.2.1 CPW values for IBM Power System S922

CPW values for IBM Power System S922				
Model	Processor Feature	Chip Speed GHz	CPUs	Processor CPW
S922 (9009-22A)	EP18	3.4 – 3.9	4	68000
S922 (9009-22A)	EP19	2.9 – 3.8	4	60000

*Note:

1. These configurations were run with SMT8 enabled.
2. These configurations were run with Maximum Performance mode enabled.
3. S922 allows up to 4 cores per IBM i partition.
4. CPW values are for a 4-core partition with dedicated processors and a 1-core dedicated VIOS partition.

5.3 IBM Power System S924

The S924 by default will have its Power Management mode set to Maximum Performance. This mode dynamically optimizes the processor frequency at any given time based on CPU utilization and operating environmental conditions. Please consult the "IBM EnergyScale for POWER9 Processor-Based Systems" document for a description of this feature as well as other power management options available for this server.

5.3.1 CPW values for IBM Power System S924 EP1E

CPW values for IBM Power System S924 EP1E				
			Processor CPW	
Model	Processor Feature	Chip Speed GHz	8 cores	16 cores(4)
S924 (9009-42A)	EP1E	3.8 – 4.0	145500	268500

*Note:

1. These configurations were run with SMT8 enabled
2. These configurations were run with Maximum Performance mode enabled.
3. This processor feature has 8 cores per chip
4. The 16 core system was configured as 1 16-core partition.

5.3.2 CPW values for IBM Power System S924 EP1F

CPW values for IBM Power System S924 EP1F				
			Processor CPW	
Model	Processor Feature	Chip Speed GHz	10 cores	20 cores(4)
S924 (9009-42A)	EP1F	3.5 – 3.9	174500	318000

*Note:

1. These configurations were run with SMT8 enabled
2. These configurations were run with Maximum Performance mode enabled.
3. This processor feature has 10 cores per chip
4. The 20 core system was configured as 1 20-core partition.

5.3.3 CPW values for IBM Power System S924 EP1G

CPW values for IBM Power System S924				
Model	Processor Feature	Chip Speed GHz	CPUs	Processor CPW
S924 (9009-22A)	EP1G	3.4 – 3.9	24	370700

*Note:

1. This configuration was run with SMT8 enabled.
2. This configuration was run with Maximum Performance mode enabled.
3. This processor feature has 12 cores per chip
4. The 24 core system was configured with one 24-core partition.

6 IBM i 7.3 Addition (February 2017)

A new POWER8 processor based system model was announced in February 2017.

- IBM Power System S812

6.1 IBM Power System S812

6.1.1 CPW values for IBM Power System S812

CPW values for IBM Power System S812				
Model	Processor Feature	Chip Speed GHz	CPUs	Processor CPW
S812 (8284-21A)	EPXP	3.02	1	9360

*Note:

1. This configuration was run with SMT8 enabled.
2. Nominal system values were used for energy settings.
3. S812 allows 1 core for the IBM i partition.

7 IBM i 7.3 Addition (October 2016)

A new POWER8 processor based system model was announced in October 2016.

- IBM Power System S822

7.1 IBM Power System S822

7.1.1 CPW values for IBM Power System S822

CPW values for IBM Power System S822				
Model	Processor Feature	Chip Speed GHz	CPUs	Processor CPW
S822 (8284-22A)	EPXD	3.42	4	42470
S822 (8284-22A)	EPX1	3.89	4	45220
S822 (8284-22A)	EPXL	4.15	4	49960

*Note:

1. These configurations were run with SMT8 enabled.
2. Nominal system values were used for energy settings.
3. S822 allows up to 4 cores per partition for IBM i.
4. CPW values are for a 4-core partition with dedicated processors and a 0.5-core VIOS partition.

8 IBM i 7.3 Addition (September 2016)

New POWER8 processor based system models were announced in September 2016.

- IBM Power System E870C
- IBM Power System E880C

8.1 IBM Power System E870C

8.1.1 CPW values for IBM Power System E870C EPBA

CPW values for IBM Power System E870C EPBA				
			Processor CPW	
Model	Processor Feature	Chip Speed GHz	32 cores	2x32 cores(4)
E870C (9080-MME)	EPBA	4.02	340330	674020

*Note:

1. These configurations were run with SMT8 enabled
2. Nominal system values were used for energy settings.
3. This processor feature has 8 cores per chip
4. The 64 core system was configured as 2 32-core partitions

8.2 IBM Power System E880C

8.2.1 CPW values for IBM Power System E880C EPBB

CPW values for IBM Power System E880C EPBB						
			Processor CPW			
Model	Processor Feature	Chip Speed GHz	32 cores	2x32 cores(4)	3x32 cores(5)	4x32 cores(6)
E880C (9080-MHE)	EPBB	4.35	361180	715740	1084510	1443800

*Note:

1. These configurations were run with SMT8 enabled.
2. Nominal system values were used for energy settings.
3. This processor feature has 8 cores per chip.
4. The 64 core system was configured as 2 32-core partitions.
5. The 96 core system was configured as 3 32-core partitions.
6. The 128 core system was configured as 4 32-core partitions.

8.2.2 CPW values for IBM Power System E880C EPBS

CPW values for IBM Power System E880C EPBS						
			Processor CPW			
Model	Processor Feature	Chip Speed GHz	40 cores	2x40 cores(4)	3x40 cores(5)	4x40 cores(6)
E880C (9080-MHE)	EPBS	4.19	436080	863620	1291170	1718720

*Note:

1. These configurations were run with SMT8 enabled.
2. Nominal system values were used for energy settings.
3. This processor feature has 10 cores per chip
4. The 80 core system was configured as 2 40-core partitions
5. The 120 core system was configured as 3 40-core partitions
6. The 160 core system was configured as 4 40-core partitions

8.2.3 CPW values for IBM Power System E880C EPBD and EPB0

A new processor feature for the E880C was announced in December 2018 – EPB0. This new processor feature can be combined with processor feature EPBD. Use the CPW ratings below as a guideline to mix and match any combinations chosen.

CPW values for IBM Power System E880C EPBD						
			Processor CPW			
Model	Processor Feature	Chip Speed GHz	48 cores	2x48 cores(4)	3x48 cores(5)	4x48 cores(6)
E880C (9080-MHE)	EPBD	4.02	491060	980230	1470340	1961410

*Note:

1. These configurations were run with SMT8 enabled.
2. Nominal system values were used for energy settings.
3. This processor feature has 12 cores per chip.
4. The 96 core system was configured as 2 48-core partitions.
5. The 144 core system was configured as 3 48-core partitions.
6. The 192 core system was configured as 4 48-core partitions.

CPW values for IBM Power System E880C EPB0					
			Processor CPW		
Model	Processor Feature	Chip Speed GHz	40 cores	2x40 cores(4)	3x40 cores(5)
E880C (9080-MHE)	EPB0	4.02	409500	817400	1226100

*Note:

1. These configurations were run with SMT8 enabled.
2. Nominal system values were used for energy settings.
3. This processor feature has 10 cores per chip.
4. The 80 core system was configured as 2 40-core partitions.
5. The 120 core system was configured as 3 40-core partitions.
6. This processor feature must be added to an existing 9080-MHE EPBD system so a maximum of 3x40cores can be added to the system.

9 IBM i 7.2 Addition (January 2016)

A new POWER8 processor based system model was announced in January 2016.

- IBM Power System E880 EPBS

9.1 IBM Power System E880 EPBS

9.1.1 CPW values for IBM Power System E880 EPBS

CPW values for IBM Power System E880 EPBS						
			Processor CPW			
Model	Processor Feature	Chip Speed GHz	40 cores	2x40 cores(4)	3x40 cores(5)	4x40 cores(6)
E880 (9119-MHE)	EPBS	4.19	436080	863620	1291170	1718720

*Note:

1. These configurations were run with SMT8 enabled.
2. Nominal system values were used for energy settings.
3. This processor feature has 10 cores per chip
4. The 80 core system was configured as 2 40-core partitions
5. The 120 core system was configured as 3 40-core partitions
6. The 160 core system was configured as 4 40-core partitions

10 IBM i 7.2 Addition (October 2015)

A new POWER8 processor based system model was announced in October 2015.

- IBM Power System S822

10.1 IBM Power System S822

10.1.1 CPW values for IBM Power System S822

CPW values for IBM Power System S822				
Model	Processor Feature	Chip Speed GHz	CPUs	Processor CPW
S822 (8284-22A)	EPXD	3.42	2	21800
S822 (8284-22A)	EPX1	3.89	2	24170
S822 (8284-22A)	EPXL	4.15	2	25600

*Note:

1. These configurations were run with SMT8 enabled.
2. Nominal system values were used for energy settings.
3. S822 allows up to 2 cores per partition for IBM i.
4. CPW values are for a 2-core partition with dedicated processors and a 0.5-core VIOS partition.

11 IBM i 7.2 Addition (April 2015)

New POWER8 processor based system models were announced in April 2015.

- IBM Power System E880

11.1 IBM Power System E880

11.1.1 CPW values for IBM Power System E880 EPBB

CPW values for IBM Power System E880 EPBB						
			Processor CPW			
Model	Processor Feature	Chip Speed GHz	32 cores(4)	2x32 cores(5)	3x32 cores(6)	4x32 cores(7)
E880 (9119-MHE)	EPBB	4.35	361180	715740	1084510	1443800

*Note:

1. These configurations were run with SMT8 enabled.
2. Nominal system values were used for energy settings.
3. This processor feature has 8 cores per chip.
4. Originally published October 2014.
5. Originally published October 2014.
   The 64 core system was configured as 2 32-core partitions.
6. The 96 core system was configured as 3 32-core partitions.
7. The 128 core system was configured as 4 32-core partitions.

11.1.2 CPW values for IBM Power System E880 EPBD and EPB0

A new processor feature for the E880 was announced in December 2018 – EPB0. This new processor feature can be combined with processor feature EPBD. Use the CPW ratings below as a guideline to mix and match any combinations chosen.

CPW values for IBM Power System E880 EPBD						
Model	Processor Feature	Chip Speed GHz	48 cores	2x48 cores(4)	3x48 cores(5)	4x48 cores(6)
E880 (9119-MHE)	EPBD	4.02	491060	980230	1470340	1961410

*Note:

1. These configurations were run with SMT8 enabled.
2. Nominal system values were used for energy settings.
3. This processor feature has 12 cores per chip.
4. The 96 core system was configured as 2 48-core partitions.
5. The 144 core system was configured as 3 48-core partitions.
6. The 192 core system was configured as 4 48-core partitions.

CPW values for IBM Power System E880 EPB0					
			Processor CPW		
Model	Processor Feature	Chip Speed GHz	40 cores	2x40 cores(4)	3x40 cores(5)
E880 (9119-MHE)	EPB0	4.02	409500	817400	1226100

*Note:

1. These configurations were run with SMT8 enabled.
2. Nominal system values were used for energy settings.
3. This processor feature has 10 cores per chip.
4. The 80 core system was configured as 2 40-core partitions.
5. The 120 core system was configured as 3 40-core partitions.
6. This processor feature must be added to an existing 9119-MHE EPBD system so a maximum of 3x40cores can be added to the system.

12 IBM i 7.2 Addition (October 2014)

New POWER8 processor based system models were announced in October 2014.

- IBM Power System E870
- IBM Power System E880

12.1 IBM Power System E870

12.1.1 CPW values for IBM Power System E870 EPBA

CPW values for IBM Power System E870 EPBA				
			Processor CPW	
Model	Processor Feature	Chip Speed GHz	32 cores	2x32 cores(4)
E870 (9119-MME)	EPBA	4.02	340330	674020

*Note:

1. These configurations were run with SMT8 enabled
2. Nominal system values were used for energy settings.
3. This processor feature has 8 cores per chip
4. The 64 core system was configured as 2 32-core partitions

12.1.2 CPW values for IBM Power System E870 EPBC

CPW values for IBM Power System E870 EPBC				
			Processor CPW	
Model	Processor Feature	Chip Speed GHz	40 cores	2x40 cores(4)
E870 (9119-MME)	EPBC	4.19	436080	863620

*Note:

1. These configurations were run with SMT8 enabled
2. Nominal system values were used for energy settings.
3. This processor feature has 10 cores per chip
4. The 80 core system was configured as 2 40-core partitions

12.2 IBM Power System E880

12.2.1 CPW values for IBM Power System E880 EPBB

CPW values for IBM Power System E880 EPBB				
			Processor CPW	
Model	Processor Feature	Chip Speed GHz	32 cores	2x32 cores(4)
E880 (9119-MHE)	EPBB	4.35	361180	715740

*Note:

1. These configurations were run with SMT8 enabled
2. Nominal system values were used for energy settings.
3. This processor feature has 8 cores per chip
4. The 64 core system was configured as 2 32-core partitions

13 IBM i 7.2 Addition (June 2014)

A new POWER8 processor based system model was announced in June 2014.

- IBM Power System S814 - 4c offering

13.1 IBM Power System S814

13.1.1 CPW values for IBM Power System S814

CPW values for IBM Power System S814				
Model	Processor Feature	Chip Speed GHz	CPUs	Processor CPW
S814 (8286-41A)	EPXK	3.02	4 (3)	37440

*Note:

1. This configuration was run with SMT8 enabled
2. Nominal system values were used for energy settings.
3. This processor feature has 2 cores per chip

14 IBM i 7.2 Additions (April 2014)

New POWER8 processor based system models were announced in April 2014.

- IBM Power System S814
- IBM Power System S824

14.1 IBM Power System S814

14.1.1 CPW values for IBM Power System S814

CPW values for IBM Power System S814				
Model	Processor Feature	Chip Speed GHz	CPUs	Processor CPW
S814 (8286-41A)	EPX0	3.02	6 (3)	56400
S814 (8286-41A)	EPX6	3.72	8 (4)	81050

*Note:

1. These configurations were run with SMT8 enabled
2. Nominal system values were used for energy settings.
3. This processor feature has 3 cores per chip
4. This processor feature has 4 cores per chip

14.2 IBM Power System S824

14.2.1 CPW values for IBM Power System S824 - EPXE

CPW values for IBM POWER System Model S824 - EPXE				
			Processor CPW	
Model	Processor Feature	Chip Speed GHz	6 cores	12 cores
S824 (8286-42A)	EPXE	3.89	68250	123240

*Note:

1. These configurations were run with SMT8 enabled
2. Nominal system values were used for energy settings.
3. This processor feature has 3 cores per chip and 2 chips per socket

14.2.2 CPW values for IBM Power System S824 - EPXF

CPW values for IBM POWER System Model S824 - EPXF				
			Processor CPW	
Model	Processor Feature	Chip Speed GHz	8 cores	16 cores
S824 (8286-42A)	EPXF	4.15	89580	164470

*Note:

1. These configurations were run with SMT8 enabled
2. Nominal system values were used for energy settings.
3. This processor feature has 4 cores per chip and 2 chips per socket

14.2.3 CPW values for IBM Power System S824 – EPXH

CPW values for IBM POWER System Model S824 - EPXH			
			Processor CPW
Model	Processor Feature	Chip Speed GHz	24 cores
S824 (8286-42A)	EPXH	3.52	218510

*Note:

1. This configuration was run with SMT8 enabled
2. Nominal system values were used for energy settings.
3. This processor feature has 6 core per chip and 2 chips per socket

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