

SAP on AIX Best Practices

Planning Guide

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Focus: SAP on AIX

Target:

- SAP NetWeaver with database and application servers on AIX
- SAP application server on AIX for S/4HANA

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2.0	Updated version focusing on AIX only, February 2021
1.0	Initial version covering SAP on AIX and IBM i, November 2012

Preface

AIX is a vital platform for core business applications such as SAP. Traditionally, AIX has been and is still widely being used as an SAP database and application server platform for SAP's NetWeaver® software. The available SAP database platforms on AIX include – among others - IBM Db2 and Oracle. A large number of non-NetWeaver products from SAP are also available and supported on AIX.

In addition, AIX is one of SAP's strategic application server platforms for S/4 HANA®.

This document was written by the IBM team supporting the SAP on AIX platform and aims to provide guidance on how to optimally configure AIX to run SAP software.

Read about IBM's commitment to AIX and the roadmap through 2030 in the **Strategy and roadmap for the AIX Operating System** white paper which is available from:

<https://www.ibm.com/it-infrastructure/power/os/aix>.

About This Document

This document is intended for architects and specialists planning or maintaining SAP software on POWER processor based systems running the AIX operating system. The intent is to provide a number of recommendations and best practices to setup these systems for SAP. Several of the recommendations are not really SAP specific and would apply to other applications as well.

The document is a loose collection of recommendations and hints, the order of the presented topics should not imply any level of importance or priority. We recommend studying the complete document and considering all of the recommendations.

The focus areas of this paper are the PowerVM, the AIX and the SAP related configuration aspects. It is intentionally kept short to provide a concise summary of the most important topics, so that one can use it as a checklist for system setup and for future planning considerations. A number of topics are already explained in detail in other papers or at other places. In these cases, we provide a short summary and reference the more detailed documentation.

Note: to access the SAP Notes that are linked in this paper you require an SAP user id.

The previous version of this paper contained recommendations for SAP on the IBM i platform as well, whereas the current version focusses on AIX only. For IBM i related information please refer to [SAP on IBM i Recommendations and Review](#).

The latest version of this document can be downloaded from <https://www.ibm.com/support/pages/node/6355545>.

We are interested in any feedback you have.

Please send your comments to Enable.SAP@de.ibm.com.

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Scope and Audience

People reading this document should have a comprehensive background in PowerVM virtualization topics, IBM AIX performance tuning, and SAP Basis administration and configuration. The document addresses customer personnel and IBM practitioners involved in the planning, implementation, and performance monitoring and analysis of SAP landscapes on IBM Power Systems. We assume that the reader is familiar with PowerVM virtualization terminology as for example logical partitions, physical processors, virtual processors, logical processors, shared processor pool, entitlements, etc. We will not explain the detailed meaning of each PowerVM term mentioned in this paper and refer to the available Redbooks (see references section) for a detailed introduction in PowerVM technologies.

Introduction

Many SAP customers are exploiting the benefits of the advanced virtualization technologies provided by PowerVM on IBM Power Systems. IBM Power Servers are available in a broad range of configurations starting with small blades or 1U rack mounted servers with four processor cores and a few gigabytes of main memory all the way up to large servers with 192 processor cores and multiple terabytes of main memory. Each of those configurations allows for the full usage of the available PowerVM virtualization technologies.¹

While there exist some rare scenarios where virtualization is not the best choice, the most popular, flexible and in many cases preferred setup for SAP system landscapes today is to configure fully virtualized environments running with

- Dual Virtual I/O Server servers to virtualize I/O connectivity and provide redundancy for I/O component failures and Virtual I/O Server maintenance
- Fully virtualized partitions running uncapped to fully share the available physical processor cores in a shared processor pool

When defining and subsequently activating uncapped shared processor partitions, there are only very few restrictions in place²

- Defining a desired number of virtual processors sets the maximum amount of capacity a partition can use.
- Defining the desired entitlement sets the guaranteed amount of capacity. The POWER Hypervisor will ensure that the partition will always get at least that amount of capacity (assuming that it needs it), even if the shared processor pool is fully utilized.
- For each defined virtual processor, you need to set a minimum desired entitlement of 0.05 processor cores.

¹ Based on the purchased PowerVM license features and the size of the systems, some restrictions may apply to certain configurations.

² In this document, we do not specifically deal with partition configuration parameters like minimum and maximum virtual processors or entitlements. Those are mostly important for DLPAR operations or at the time of the activation of a partition, when you are already using a major percentage of the available resources. Therefore, when we talk about number of virtual processors or processor entitlement, we assume that this is the desired value and that the partition would get this desired value during partition activation.

The hypervisor does not provide any additional safeguards in this area. For example, it is possible to define a large production partition with 32 virtual processors (which depending on the server model already provides capacity of more than 100,000 SAPS) with an entitlement of as little as 3.2 processor cores. As long as there is still unused entitled capacity available, the hypervisor will activate such a partition and will not warn you that the system might be heavily utilized already.

Unfortunately, this approach has become a common practice, using the assumption that together with another partition attribute called “Weight”, the hypervisor will always favor this partition and allow for unanticipated (or maybe quite anticipated) growth of a factor of 10. This practice simplified the setup of new partitions. However, it was never a best practice and it has certainly become more problematic with newer POWER systems. Relying on such a setup means that your most important partitions might not always get the processor cycles when they need them. This leads to potential performance problems. This is especially true for the Virtual I/O Server.

Best Practices and Recommendations

A good starting point for general recommendations for AIX is the [IBM AIX Operating System Service Strategy and Best Practices](#) white paper. It gives a broad overview of the AIX service strategy and explains many of the technical terms used in this paper.

The following sections concentrate on the specific topics that play an important role when setting up your AIX system to run SAP.

In June 2020, a new option for deploying POWER servers for SAP has become available. With the SAP Infrastructure as a Service (IaaS) certification for SAP HANA and SAP Applications on AIX and Linux for the IBM Power System Virtual Servers offering, you now have the choice of running AIX servers in your own datacenter or on Power System Virtual Servers co-located to the IBM cloud. See this [blog](#) and more details in SAP Notes [2855850](#) and [2923984](#).

For Power System Virtual Servers, the following chapters that require direct access to the Hardware Management Console (HMC) or to the Virtual I/O Server (VIOS) do not apply.

PowerVM and Virtual I/O Server

As a first step, make sure your Hardware Management Console (HMC), PowerVM and Virtual I/O Server (VIOS) configurations are suitable for the subsequent definition of logical partitions (LPARs) on which you want to run SAP.

System Firmware Updates

The POWER Hypervisor is integrated with all Power Servers and is part of the Power Systems firmware. The hypervisor manages system virtualization and makes decisions about logical partition placement at activation and during dynamic LPAR operations. The current POWER8 and POWER9 machines introduced a number of significant changes compared to previous generations (more cores per CPU, SMT8, larger systems, etc.). Since the initial shipment, a lot of experience was gained through customer implementations especially with running large workloads in partitions with dozens of configured virtual processors and large memory footprints. Based on these experiences the POWER and OS developers have enhanced overall system performance by improving performance relevant areas in the hypervisor and the OS kernels and have fixed a number of bugs.

For configuration and setup of POWER9 servers see [Hints and Tips for Migrating Workload to IBM POWER9 Processor-Based Systems](#).

We recommend using the Fix Level Recommendation Tool (FLRT) regularly to check the recommended firmware and software levels for your system landscape. Please see the [Fix Level Recommendation Tool](#).

You should plan to upgrade your firmware if newer levels with stability or security fixes become available. From the AIX command line, the firmware level can be displayed with the `lsmcode` command.

The following support matrix lists all POWER servers with supported HMC and firmware levels: <https://www14.software.ibm.com/support/customer/care/flrt/mtm>.

To check that the microcode installed on your IBM POWER systems is at the latest levels, please see the [Microcode Discovery Service](#) from IBM.

Virtual I/O Server Processor Configuration

Even more important than the production partitions are the Virtual I/O Servers as they provide the bridge to disk subsystems and the outside network. SAP implementations are typically communication intensive and higher network latencies will easily affect end-user response times by adding time to the front-end communication itself or also increasing the database request time in 3-tier implementations. For many business processes there could be also additional communication between multiple SAP systems, which will also add to the end user response time. Network traffic requires CPU cycles on the Virtual I/O Servers, which is sensitive to potentially delayed scheduling of virtual processors in cases where the entitlement per virtual processor is set too low.

Running 3-tier systems with application and database servers on different systems might amplify this problem, because for each round-trip a network packet has to go through two Virtual I/O Servers twice. Let us assume the entitlement of a Virtual I/O Server is set to 0.1, which means in the worst case, the Virtual I/O Server might send a network packet, gets pre-empted because it has exceeded its entitlement and then has to wait nine milliseconds before the hypervisor schedules it again and can take the network interrupt. If this happens for a database request on both Virtual I/O Servers on the way to the database server and then on the way back, we would add a 36 milliseconds network delay to the database response time (typically SAP expects a communication latency in the range of a few hundred microseconds).

This is an extreme example and it probably would never be this bad in real life, but it should just illustrate the potential problem of using too low entitlements for the Virtual I/O Servers.

Therefore, we recommend configuring the virtual processors for the Virtual I/O Servers as dedicated donating processors. With such a setup, the Virtual I/O Server will always immediately get a physical core back when needed and it will still donate spare capacity to the shared processor pool. Customer experiences show that changing from shared processor configuration to dedicated donating processor actually reduced the number of physical cores consumed and improved the network times. For very large systems, you might even consider dedicated processors. If you still want to use virtual processors instead, then make sure they are configured with an entitlement of at least 0.8 or 0.9 per virtual CPU.

VIOS Performance Advisor

The Virtual I/O Server performance advisor is an application that runs within the customer's Virtual I/O Server for a user specified amount of time (hours). It polls and collects key performance metrics before analyzing results and providing a health check report and proposes changes to the environment or areas to investigate further. The goal of the Virtual I/O Server performance advisor is to enable the customer to make assessments about the status of the Virtual I/O Server and implement recommendations based on the expertise and experience available from the IBM systems performance group.

Please follow the instructions at the following web site to download and run the Virtual I/O Server Performance Advisor for all VIOS related performance issues: [Virtual IO Server Performance Advisor](#). See also VIOS Performance Advisor product documentation for your POWER server, for example for [IBM Power System E980](#).

Ethernet Architectures

Network connectivity is an important aspect that has a major influence on the responsiveness and the throughput of your SAP system and therefore requires careful planning. A discussion of currently available network options can be found in the IBM Redbook [IBM Power Systems Infrastructure I/O for SAP Applications](#).

An excellent overview of network tuning and latest network technologies on AIX is given in the “Network Performance” presentation in the [Power Systems Virtual User Group](#).

While dedicated or physically shared Ethernet adapters deliver the best performance in terms of latency, they do not offer the flexibility of virtualized network attachments. For network speeds up to 10 Gbps, Shared Ethernet Adapter (SEA) configurations are still widely used and represent a good compromise between network performance and flexibility, enabling you to perform Live Partition Migration and Live Update (see [AIX Live Update](#) on page 18) operations on your LPAR.

For higher network speeds, consider using Single-Root I/O Virtualization (SR-IOV) or virtual Network Interface Controller (vNIC) network technologies and see:

- [SR-IOV FAQs](#)
- [vNIC and vNIC Failover FAQs](#)

If your system has physical RoCE (RDMA over Converged Ethernet) adapters attached, exploiting the SMC-R feature of AIX might further optimize latency and reduce CPU load, see [Optimize network communication using SMC-R](#) on page 19.

Do not forget to take into account the internal connectivity inside a Power server. SAP application and database servers running on the same physical system communicating via Virtual Ethernet adapters can also experience some unnecessary network latencies because of non-optimum settings for the virtual network adapters or virtual Ethernet adapter buffers in the hypervisor. Please review the recommendations in [The native AIX largesend segmentation offload feature in virtual Ethernet environment](#).

LPAR definition and placement

Depending on the intended usage type of a logical partition (LPAR), be it an SAP database server, an SAP application server or a server for non-SAP applications, you need to make sure it is configured to deliver optimal functionality and performance.

A very concise guideline for choosing the correct CPU entitlement can be found in the article [Assigning the appropriate processor entitled capacity](#). The document explains in a nutshell how the hypervisor handles virtual processors and processor entitlement. It provides some hints about sizing and configuration of virtual processors, the processor folding feature, and how to monitor available processors.

Dedicated or Shared Processors

One of the first decisions that you have to make when deploying an LPAR for SAP is whether the LPAR should run with shared or with dedicated processors.

With the correct sizing and correct entitlement, dedicated processor LPARs will result in optimal performance for your SAP system. Therefore, you should consider using dedicated LPARs for your important SAP production systems.

On the other hand, shared processor LPARs allow for better exploitation of your hardware and using them can result in considerable cost savings in hardware and software. While the performance level of shared processor LPARs may not be as optimal as with dedicated LPARs you might consider using them for most of your non-production SAP systems.

For a discussion of the differences between dedicated and shared LPARs see [How does Shared Processor Performance Compare to Dedicated Processors](#).

Running Partitions in correct Mode

As a general rule, an LPAR in a POWER9 processor-based server should be run in POWER9 mode and a likewise a POWER8 based LPAR in POWER8 mode. For details on processor modes, see for example: [Processor compatibility mode definitions](#).

If you plan on moving the LPAR using Live Partition Mobility (LPM) back and forth between POWER8 and POWER9 servers, you need to keep your LPAR in POWER8 mode.

Partition and System Sizing

Please perform thorough capacity planning and sizing exercises especially for your most important production systems. Try to focus on your daily or weekly peak hour requirements and look at the average system usage during that hour. The partition entitlement should then be set to a value that covers this average. For the virtual processor definition, round the entitlement up to the next whole number and then add a few more virtual processors to cover the occasional peak. For smaller partitions, this would probably be one or two additional virtual processors, but this could also be a larger number for partitions with a large entitlement.

Another way to look at this is to build the ratio between the capacity entitlement (CE) and the number of defined virtual processors (VP) for a partition.

(CE/VP)	Balance CE and VP
0.1	VP = 10.0 x CE
0.2	VP = 5.00 x CE
0.3	VP = 3.33 x CE
0.4	VP = 2.50 x CE
0.5	VP = 2.00 x CE
0.6	VP = 1.67 x CE
0.7	VP = 1.43 x CE
0.8	VP = 1.25 x CE
0.9	VP = 1.11 x CE
1	VP = 1.00 x CE

A CE/VP ratio of 0.2 means that for every virtual processor defined, there is a capacity entitlement of 0.2. An example for this would be a partition with an entitlement of 4.0 and 20 virtual processors. With such a setting, the partition could grow by a factor of five assuming it can get the resources from the shared processor pool.

Looking at the yellow values (CE/VP from 0.1 to 0.5), the performance for uncapped partitions might not be safe.

For an explanation of the negative performance impact of too many virtual processors see the blog entry [POWER CPU Memory Affinity 6 - Too Many Virtual Processors has a Bad Side Effect](#).

One can use these settings for less important test and development systems, but do not use it for response time sensitive production partitions. Performance for uncapped partitions gets better with an increasing CE/VP ratio and the most important partitions should run with a ratio of 0.8 or higher.

Running partitions with a CE/VP ratio of 1 looks almost like a configuration with dedicated processors. However, such a partition setup will still use the shared processor pool and give up unused capacity that other partitions can still exploit. So, this can certainly make sense for some configurations.

Once the partitions are right-sized, make sure that the combined entitlements fit in the available shared processor pool, otherwise you will not be able to start all you LPARs. On running partitions, monitor the values for the entitled capacity consumed and the available capacity in the processor pool. The *lparstat* command reports these figures as *%entc* and *app*. If Pool Utilization Authority (PUA) is not configured for the LPAR, the *app* column is not displayed. Ideally, the values for *%entc* should be below 100% and *app* should not drop below 1.0.

Some customers might have occasional peak capacity requirements (monthly, quarterly, yearly) that are significantly higher than accounted for with the settings based on daily or weekly averages. In such a case, we do not recommend running with these maximum settings during all times. It is preferable to use the maximum entitlement and number of virtual processor settings in the partition profile to allow for this additional growth and then use DLPAR operations to add the resources at the times needed. Of course, the shared processor pool must be large enough to allow for the additional required capacity. At the end of the peak, one should remove the added resources again. Please consider these requirements in continuous capacity planning exercises. Another possibility to free up capacity in the shared processor pool would be to shut down less important partitions for the duration of those peak hours or use Live Partition Mobility to move them temporarily to another server.

Very often, partitions are defined with a larger number of virtual processors than needed to allow for potential future growth. Same as with the monthly or yearly peaks it is preferable to configure the system for daily or weekly peak requirements and allow some headroom in the partition profiles for future growth. Then use DLPAR operations to add virtual processors and capacity entitlements when needed. This should be part of a routine monitoring, capacity verification and planning exercises.

A word of caution: please recheck the partition placement each time after performing DLPAR operations that add or remove large amounts of resources (see section [Partition Placement](#) on page 13).

Finally, when configuring the number of processors for individual partitions, they should not exceed the number of physical processor cores in the system. In fact, if the partition is running in a shared processor pool, the number of virtual processors defined should not exceed the number of physical processor cores in the shared processor pool. The hypervisor will not warn about creating such a configuration, but it is not possible to use more virtual processors simultaneously than physical processor cores available in the system or the shared processor pool. Therefore, such a configuration does not make any sense and creates unnecessary overhead.

Partition Placement

Current versions of the PowerVM hypervisor and the AIX operating system have implemented enhanced affinity further optimizing performance for workloads running in a virtualized shared processor pool partition.

Please review the [IBM POWER Virtualization Best Practices Guide](#).

The document explains how the hypervisor handles virtual processors and processor entitlement. It provides some hints about sizing and configuration of virtual processors, explains the processor folding feature and covers the hypervisor strategies to achieve a higher memory affinity when placing the resources at partition activation time.

As a companion reading to this best practices guide, we recommend to check the AIXpert blog series that is available at <https://www.ibm.com/support/pages/node/1116387>.

Please scroll down to the section “CPU and Memory Affinity and CPU Scheduling” and find links to the parts 1 to 11 titled “POWER CPU Memory Affinity ...”.

This blog series provides many examples and a detailed introduction to affinity domains and the operating system and hypervisor strategies to schedule runnable threads in order to achieve the optimum performance.

Dynamic Platform Optimizer

To address some of the challenges associated with partition placement and memory affinity, IBM developed a feature called Dynamic Platform Optimizer (DPO).

DPO is supported since POWER7 and requires a minimum firmware level of FW760. The HMC must be at version 7.8.0 or later.

The *lsmemopt* command can also be used to check the affinity score of an LPAR.

In addition, DPO can be used by an administrator to re-balance system resources of an LPAR to improve memory affinity without requiring an outage.

Please check the IBM Power Systems Hardware Information Center, the firmware description, and the [IBM POWER Virtualization Best Practices Guide](#) for more information about the Dynamic Platform Optimizer.

Checking for Local Processors and Memory

The *lssrad* command allows for checking the partition placement of your partition. The *lssrad* output shows whether a partition spans multiple drawers or books. Partitions that span multiple drawers might be susceptible to some memory latency issues. If partitions that initially span multiple drawers and are re-balanced to run on a single drawer, then the system should show some performance improvements.

The following is an output from a well-balanced POWER7 system; each scheduler resource affinity domain has 32 logical processors defined (8 cores with SMT4) and has about 28 GB of local memory available.

```
# lssrad -av
REF1  SRAD      MEM      CPU
0
      0  29889.19   0-31
      1  29868.00  32-63
      2  29865.94  64-95
      3  27242.00  96-127
1
      4  29288.00  128-159
      5  29288.00  160-191
      6  29272.00  192-223
      7  29272.00  224-255
```

The next two examples show some problematic configurations.

The first one shows some processors in SRAD 2 with no memory. Software threads running on CPU 64 to 79 will always have to access distant memory, which increases the latency for accesses to all data that is not available in the processor caches.

```
# lssrad -av
REF1    SRAD      MEM      CPU
0
      0    51618.00    0-31
      1    47808.00    32-63
1
      2         0.00    64-79
```

The second output shows SRAD 3 and 4 with some memory, but no processors defined. Software threads that need to access data stored in SRAD 3 and 4 will experience some additional memory access latency as those accesses will be to distant memory.

```
# lssrad -av
REF1    SRAD      MEM      CPU
0
      0    29115.50    0-31
      1    12948.00    32-47
1
      2    31093.00    48-79
      3    14940.00
2
      4         249.00
```

In both cases the partition placement should be reviewed (refer to section [Partition Placement](#) on page 13).

The AIX Dynamic System Optimizer (DSO) or Active System Optimizer (ASO) might support you in eliminating these kind of affinity problems.

The Dynamic System Optimizer extends the features provided by the Active System Optimizer to automatically adjust some system settings to maximize the efficiency of your system. This automates the difficult job of manually tuning those system settings to optimize eligible workloads. For details refer to [IBM AIX Dynamic System Optimizer](#).

Scheduling and SMT setting

POWER8 and POWER9 processors have simultaneous multi-threading (SMT) capabilities and can be configured to run with a maximum of 8 threads (SMT8). Often, we get the question whether to turn SMT off, as an SAP ABAP application server is not a multi-threaded application. While this is mostly true, the NetWeaver basis environment itself is a multi-process implementation and works very well with multiple SMT threads.

We recommend running with a setting of SMT8 for POWER8 and POWER9 based systems, see SAP Note [2535891 - Run your SAP workload best on AIX and POWER8 or POWER9 in SMT8 mode](#). In fact, as of AIX 7.2 Technology Level 3 (TL 3), SMT8 has become the default for POWER9 based systems (see [Announcement of AIX 7.2 TL 3](#)).

As long as there is more than one user or batch job actively using the SAP instance, there is more than one runnable process in the system. The AIX dispatcher can schedule these

processes in parallel on separate SMT hardware threads just the same as they would schedule multiple software threads of a multi-threaded application. Running more than one software thread on a single core can have the effect of each single software thread running slightly slower than they would when they had a complete core for themselves. It does not matter whether the application is multi-threaded or single-threaded, when there is more than one thread actively running on a core, one might notice the software threads running slightly slower.

As a default, the AIX dispatcher runs in *raw throughput mode* which favors scheduling workloads to the primary threads of each virtual processor before starting to use the secondary, tertiary, and further SMT threads. Raw throughput mode is usually the best choice for production-type workload since it optimizes responsiveness of your application. The different throughput modes are described in the AIX PERFORMANCE MODE TUNING chapter of the [IBM POWER Virtualization Best Practices Guide](#).

When running with low CPU utilization, the cores will automatically run in single threaded (or ST) mode and one should not see a major difference compared to a partition where SMT is turned off completely. Once load starts to increase on the system, the second and subsequent threads are used and things might run a bit slower, but in most cases, this is not an issue. Where SMT really helps is when the system is running at utilization levels of 90% or more while still providing good response times. Running the same load with SMT disabled would most likely cause the response times to increase sharply.

A very detailed explanation and example of scheduling in SMT environments can be found in this AIXpert blog: <https://www.ibm.com/support/pages/power-cpu-memory-affinity-3-scheduling-processes-smt-and-virtual-processors>.

Turning SMT off might improve response times in special scenarios. In general, it does not make a significant difference. The downside to turning SMT off is that the partition would need 60-70% more processor cores to provide the same maximum capacity.

The [IBM Power Systems Performance Report](#) clearly shows the effects of the different SMT settings. All high-end SAP SD benchmarks on POWER were run with the highest SMT level that the hardware would allow. Native Db2 and Oracle workloads benefit significantly from SMT8 as shown in these reports:

- [IBM POWER9 and SMT performance for IBM Db2](#)
- [Oracle Database 11g and 12c on IBM Power Systems S924, S922 and S914 with POWER9 processors](#)

Virtual Processor Folding

The AIX kernel works together with the hypervisor to dynamically increase and decrease the use of virtual processors based on the utilization of the partition. In environments with many partitions running in the shared processor pool and a large number of virtual processors configured, this feature helps decreasing the virtual context switches and the shared pool utilization.

The OS dispatcher favors to distribute the workload over the primary threads of the available cores first. From a single partition point of view, this is a good strategy because it maximizes the exploitation of available physical processor and cache resources.

From a single partition perspective, this still makes sense. However, when running dozens of partitions in a shared processor pool one can easily end up in a situation where the ratio of active virtual processors to available physical processor cores is very high and this will have an impact on the overall system efficiency. At the same time, each partition might waste available processor resources, as they are not using the additional SMT threads. This is another reason why one should not configure too many virtual processors for partitions. In some cases, it might actually make sense to reduce the number of virtual processors defined to force the OS dispatcher to use all available SMT hardware threads first and thus increase the overall efficiency of the system.

In addition, practices that were used in the past need to be reconsidered. One common example is to look at the physical CPU consumption of a partition (some performance tools report this as *physc*) and compare this to the number of virtual processors configured to determine if a partition is CPU bound. One should never make a decision to add additional virtual processors to a partition based on the *physc* value alone and always check the actual utilization of the partition *physb*, where *physb* (as reported for example in *lparstat - m*) is the number of physical processors that are busy. Please do not add virtual processors if there are still idle times available. In fact, high idle times might be an indicator to consider reducing the number of virtual processors.

For more details see:

- the AIX Information Center for some more details about virtual processor folding: [Virtual processor management within a partition](#)
- the chapter “AIX VIRTUAL PROCESSOR MANAGEMENT - PROCESSOR FOLDING” in the [IBM POWER Virtualization Best Practices Guide](#).

AIX considerations

For AIX release and configuration planning you should always consult SAP Note [1780629](#) and the [SAP Product Availability Matrix \(PAM\)](#). This matrix answers the question:

- What are the AIX levels on which SAP product **<ABC>** is supported?

In addition to choosing the correct AIX level, you might also consider exploiting some of the unique capabilities of AIX like Live Update and SMC-R to further optimize the operation of your SAP environment on AIX.

AIX Updates

Just the same as with system firmware updates mentioned in the previous section, there are a number of functional enhancements, performance optimizations and fixes for some specific problems included in newer AIX Technology Levels (TLs) and Support Packages (SPs). Regularly check the [AIX support lifecycle information](#) for information about how long a specific TL is in service and update your AIX system, if needed.

The matrix of which AIX operating system level is supported on which POWER server is available at [System to AIX maps](#). Keeping your AIX level current also facilitates hardware upgrades to newer POWER technology.

Before installing an SAP system or updating SAP kernel levels on existing SAP application servers you should check SAP Note [1780629 - AIX: Minimal OS Requirements for SAP Kernel](#) and upgrade your AIX level to at least the required minimum level.

AIX Live Update

The task of keeping your AIX operating system up-to-date used to force you to stop individual SAP application servers or – if the SAP database server had to be updated – forced you to restart your complete SAP system.

Starting with AIX 7.2, the AIX operating system offers the Live Update function that eliminates such an SAP downtime. Starting with AIX 7.2 TL1, Live Update supports both Service Pack as well as Technology Level (TL) updates. For prerequisites and more details see the [Live Update](#) topic in the IBM Knowledge Center. An overview of the concept and the functions of AIX Live Update is provided by this [video](#).

SAP workloads on a system continues to run during a Live Update operation with only short impact to SAP responsiveness during the so-called blackout time of the Live Update process. For a details and best practices see the IBM White paper [SAP Applications with AIX Live Update](#) and SAP Note [2977742](#).

AIX C++ Runtime

Another important check is for the C++ runtime level (see [XL C++ Runtime Environment and C++ Utilities](#)) that must be installed on your AIX system to run a specific SAP kernel.

In many cases the level that is installed as a default with a new AIX installation is not sufficient. SAP Note [1780629 - AIX: Minimal OS Requirements for SAP Kernel](#) lists the required minimum C++ runtime levels for all SAP kernels that are supported on AIX.

You can check the installed C++ runtime using the command:

```
lslpp -L "x1C.aix*.rte"
```

With SAP kernel 781 and higher, C++ runtime version 16 is the required minimum. When installing or upgrading to version 16 of the C++ runtime, make sure you include the new *libc++.rte* files set in your installation or upgrade. For details see [What is libc++.rte and should I install it as part of the C++ Runtime installation?](#)

If you run multiple applications on your AIX system you must install at least the highest level required by any application.

An update of the C++ runtime does not require a reboot. Running applications continue to use the older version of the runtime until they are restarted, for details see the section “Is a Reboot Required after the Installation?” in [XL C++ Runtime Environment and C++ Utilities](#).

Restricted AIX Tunables and I/O Pacing

Do not change any restricted tunables without discussing the change with AIX support first. If you still have some systems running at older AIX versions, do not carry forward tunables when you migrate to AIX 7.1 or AIX 7.2. A number of tunable settings that had to be adapted in earlier AIX releases have become the default settings with AIX 7.1 and higher (see SAP Notes [1972803](#) and [973227](#)) and in general, there is no need to change those

tunables anymore. During review of the system when planning an AIX upgrade, one might find some other tunables not mentioned in the above SAP Notes. Those might have been changed based on recommendations from IBM to resolve a performance or some other system issue. In this case, please contact IBM support prior to the upgrade to verify whether those changes would still be applicable to the new release.

For example, in the past it was quite common to change the I/O pacing settings for *minpout* and *maxpout*. Please verify the current settings using the command:

```
lsattr -El sys0 -a minpout,maxpout
```

The values should rarely require changes to the default values of 4096/8193. Do not change them without contacting IBM support first; the older legacy values of 24/33 can result in some severe I/O performance issues.

Optimize network communication using SMC-R

Running your SAP system requires optimal performance. There are multiple areas of an SAP landscape, like CPU, storage, and networking which have significant impact on your business performance.

With AIX 7.2 TL 2, the AIX operating system supports the new communication protocol solution Shared Memory Communications over Remote Direct Memory Access (SMC-R) which can optimize network performance. See the SMC-R overview and documentation at: https://www.ibm.com/support/knowledgecenter/en/ssw_aix_72/com.ibm.aix.rdma/smc_r.htm.

The usage of SMC-R can improve network latency, network throughput, and lead to a reduction of CPU usage. SMC-R usage is transparent to the SAP application - so you can switch it on without having to modify your SAP setup. See SAP Note [2699513](#).

The white paper [SMC-R on AIX for SAP - Experience report](#) summarizes the results of SAP test scenarios that demonstrate the benefits that SMC-R has for SAP workloads in a distributed SAP environment.

Note: SMC-R will work only on physical RoCE adapters (RDMA over Converged Ethernet) and there's no support yet for RDMA on virtual adapters.

AIX Performance tuning

As a good starting point for tuning the performance of your AIX system, check out the papers referenced on this Web page: [Service and support best practices for Power Systems](#) and in particular the white paper [AIX on Power - Performance FAQ](#).

For more in-depth analysis and configuration hints, refer to the white paper [AIX Version 7.2 Performance management](#).

SAP recommendations

SAP installation and operations documentation (see [Guide Finder for SAP NetWeaver and ABAP Platform](#)) guide you through the initial setup and installation for your SAP system and point out some AIX specific settings. SAP has also built in some operating system prerequisites checks into their installation procedure which help to avoid the most common

AIX configuration pitfalls. A comprehensive list of all current configuration recommendations for SAP on AIX can be found in SAP Note [1972803](#).

For ongoing operations and specific usage and error situations there exists a number of additional SAP Notes. The following sections give some guidance on update strategies for your SAP system and highlight some topics and important SAP Notes that are relevant for your SAP on AIX operation.

SAP kernel update strategy

It is a good practice, to keep the kernels of your SAP systems up to date and thus receive problem and security fixes from SAP. Make sure you update your kernel to a higher, downward compatible kernel level before the current kernel goes out of maintenance. See SAP Note [2083594](#) for all currently supported kernel versions and latest patch levels. For a detailed description of SAP kernels and how to find the correct kernel version see [Update Strategy for the Kernel of the Application Server ABAP in On Premise Landscapes](#).

In February 2020, SAP announced a maintenance extension for S/4 HANA and for SAP Business Suite software. For details refer to:

- <https://news.sap.com/2020/02/sap-s4hana-maintenance-2040-clarity-choice-sap-business-suite-7/>
- https://support.sap.com/content/dam/support/en_us/library/ssp/release-upgrade-maintenance/maintenance-strategy/sap-release-and-maintenance-strategy-new.pdf (requires an SAP user id)
- SAP Notes [1648480](#) and [2881788](#)

As a consequence, SAP NetWeaver kernels supporting SAP Business Suite will be supported until 2027 – with an optional maintenance extension until 2030.

Your strategy for SAP kernel updates should take multiple aspects into account:

- How long is the SAP kernel supported?
- When is the right time to move to a newer, downward compatible kernel?
- Does a newer kernel come with a requirement for a newer AIX level?
- What is the end-of-service date for my AIX operating system version?

As an example, let us here have a look at SAP kernels 72x which support SAP NetWeaver releases 7.0 to 7.3 EhP1 (see SAP Notes [1744209](#) and [1780629](#)):

- The 720 kernel and its 721 and 722 successors were initially released on AIX 5.2.
- Subsequent ‘extension’ kernels 720_EXT, 721_EXT and 722_EXT required AIX 6.1 as a minimum.
- The latest ‘second extension’ kernel 722_EX2 requires AIX 7.2.

With kernels 721 and 721_EXT being out of service since the end of 2020, you need to switch at least to the 722 kernel which is supported until the end of 2022. The EXT or EX2 variants of this kernel are supported at least until 2025.

On the AIX operating system side, AIX 5.2 and AIX 6.1 have reached their end-of-service date and AIX 7.1 no longer receives any TL (Technology Level) updates (see [AIX support lifecycle information](#)).

In summary, a good strategy for an SAP system running SAP NetWeaver releases 7.0 to 7.3 EhP1 would be to upgrade your operating system level to AIX 7.2 and your kernel to a 722_EXT or even to the latest 722_EX2 level. This approach ensures that you:

- are running at all times with a fully supported environment
- benefit from new features and enhancements
- might see performance improvements since EXT and EX2 kernels are built with newer C++ runtimes and newer compiler versions

Similar recommendations apply to the SAP NetWeaver releases 7.4 and 7.5 or SAP NetWeaver Application Server for ABAP 7.51 and 7.52 which are supported by the kernels 74x and 75x. See SAP Note [2556153](#) and SAP's kernel release roadmap in SAP Note [1969546](#).

For the SAP kernels 77x and 78x that provide SAP application server support for SAP S/4HANA 1809, SAP S/4HANA 1909 or SAP S/4HANA 2020 see SAP Note [2870484](#) and the SAP kernel release roadmap in SAP Note [2907361](#).

Whenever possible, consider using SAP's Rolling Kernel Switch procedure which is described in SAP Note [953653](#). This procedure allows you to avoid or minimize any SAP downtime that is usually involved when updating the SAP kernel.

Avoiding out-of-memory situations

Operating system memory is a critical resource for an SAP system and any application that runs on AIX. If AIX starts running out of virtual memory (physical memory + paging space) the operating system sends a Signal 33 (SIGDANGER) to all running processes. SAP work processes that receive this signal are restarted. If the low memory situation is not relieved, AIX starts killing active processes, causing the entire SAP system to stop.

To avoid this situation, it is therefore extremely important that you familiarize yourself with memory requirements of your SAP system, also consider the requirements of AIX and other applications and configure the virtual memory of your LPAR accordingly.

To avoid a signal 33 situation, it is important that you get alerted before the system is running out of paging space. There is an SAP host agent metric available, which should be used to set up an alert. Upon receiving this alert, you can react early enough and avoid running into an out-of-memory situation.

For detailed information on the metric and instructions how to set up alerts via SAP transaction RZ20 or in SAP Solution Manager or SAP Focused Run, consult SAP Note [2630086 - Avoid signal 33, out of memory on AIX](#).

SAP licensing

SAP licenses are based on a HARDWARE KEY value which you can retrieve via SAP transaction SLICENSE or from the command line using SAP's *saplicense* or *saplikey* program:

```
# saplicense -get
saplicense: HARDWARE KEY = V1234567890
```

In the past, this HARDWARE KEY was only based on the physical hardware characteristics of the POWER server where the SAP message server is running (see SAP Note [174911](#)). This could cause a problem when a virtualized server (LPAR) was moved from one physical server to another, for example when using Live Partition Mobility. Such a workload relocation might be required for planned hardware maintenance, as reaction to a server failure, or for load balancing in a private cloud environment.

After the relocation of the LPAR to a different physical server, the HARDWARE KEY changes and therefore the installed SAP license is no longer valid. For a limited time, the SAP system continues to run with a temporary license until an expiration date. If you do not install a new SAP license before this date, the SAP system will no longer accept any user logins.

To avoid this problem, use the new SAP license mechanism (see SAP Note [2879336](#)) which effectively ties the HARDWARE KEY – and therefore the SAP license - to the partition universally unique ID (UUID) of the LPAR where the message servers is running. The partition UUID does not change when the LPAR is moved to a different physical server – so there is no need to request and install a new SAP license.

The new mechanism for generating the HARDWARE KEY is enabled by setting the SAP profile parameter *slic/hwkey_mode* to 1. After setting the profile parameter, for example in DEFAULT.PFL, retrieve the new HARDWARE KEY:

```
# saplicense -get pf=<profile>
saplicense: HARDWARE KEY = D0987654321
```

Request a new SAP license for this HARDWARE KEY and install it in your system using transaction SLICENSE. After the license is active, any relocation of the LPAR is possible without the need to install a new license.

To be able to use this mechanism, you need a minimum SAP kernel level as well as a certain minimum firmware and Reliable Scalable Cluster Technology (RSCT) levels. All these requirements are listed in SAP Note [2879336](#).

On an LPAR where the required firmware and RSCT levels are installed, you can check that the partition UUID can be retrieved by issuing the `/opt/rsct/bin/ctgethscid` command:

```
# /opt/rsct/bin/ctgethscid
PartitionUUID="12f345f6-b789-12a3-ae45-6db78901234e"
HscHostName[6]="sample1.myserver.com"
HscHostName[7]="sample2.myserver.com "
```

POWER Processor Utilization Metrics

There are lots of POWER specific Processor Utilization metrics which can help in monitoring your SAP system. To analyze your system please use SAP transaction ST06. For long-term analysis the history data are very helpful. For getting more metrics please switch ST06 to expert view. The history data in ST06 is taken from the Central Performance History (CPH). CPH can be set up in RZ23N and in ST06 as described in SAP Knowledge Base Article [1915341](#).

The relevant metrics for the different LPAR types are:

Dedicated LPAR

In a dedicated LPAR, physical CPUs are exclusively assigned to the LPAR. This type of LPAR can be treated and analyzed like a single physical machine. Therefore, for performance analysis you should look on the number of physical CPUs and the CPU utilization. For a dedicated LPAR the "Virtual System" section of transaction ST06 only shows the Partition Type, the SMT Mode and the number of threads. All relevant CPU data can be retrieved from the section "CPU".

Capped Shared Pool LPAR

In a capped shared pool LPAR the entitlement is the guaranteed and maximum computing power. A CPU bottleneck might be indicated by a consumed entitlement nearing 100%.

Uncapped Shared Pool LPAR

In an uncapped shared pool LPAR the entitlement is the guaranteed computing power. The maximum computing power is the number of shared pool CPUs (which requires to define at least so many virtual CPUs).

For detecting a CPU bottleneck switch to the History view to see CPU consumption metrics over time. A CPU bottleneck might exist when both of the following situations occur at the same time:

- Physical CPUs consumed nearing number of virtual CPUs
- Available capacity consumed nearing 100%

Details about these processor utilization metrics can be found in SAP Note [1379340](#).

Db2 Database Server

See the [SAP on IBM Db2 for Linux, UNIX, and Windows](#) community for documentation, news and blogs focusing on Db2 as an SAP database server. For further documentation consult the [Db2 Product Hub](#) which hosts a collection of [Db2 best practices](#).

Join the [Db2 Topic Group](#) in the IBM Hybrid Data Management Community to start discussions on Db2 topics and - under the Library tab - access a large number of additional resources.

With Db2 for z/OS as a database server, an SAP application server on AIX you must have the IBM Data Server Driver for ODBC and CLI installed. Do not download these drivers from IBM support web sites but consult SAP Note [1927404](#) for the supported driver levels and download the drivers directly from SAP Software Downloads. The drivers are located in the category DATABASES -> Database and Database Patches -> IBM Db2 for z/OS.

For the configuration for these drivers see the [Database Administration Guide for SAP on IBM Db2 for z/OS](#) and for details on how to configure failover for database connections refer to latest version of the CLI_Failover_v<nn>.pdf document under the Library tab in the IBM [SAP on IBM Z](#) user group.

For more content related to DB2 for z/OS visit the [SAP on Db2 for z/OS](#) community.

Oracle Database Server

See the [SAP on Oracle](#) community for documentation, news and blogs focusing on Oracle as an SAP database server. Depending on the Oracle release, consult one of the following documents before deploying Oracle databases on AIX:

[IBM Power Systems, AIX and Oracle Database 10g & 11.2.0.3 Performance Considerations](#)

[Managing the Stability and Performance of current Oracle Database versions running AIX on Power Systems including POWER9](#)

For more on Oracle see these presentations in the [Power Systems Virtual User Group](#):

- “Oracle Best Practices Part 1 (CPU & Memory)”
- “Oracle Best Practices Part 2 (I/O & Miscellaneous)”.

Brief Summary of Important Rules

- Adjust LPAR definitions to reflect the actual demand (correct settings for entitlement and virtual processors)
- Business critical and response time sensitive production partitions should have an entitlement that covers the average utilization during the peak hour, add a few more virtual CPUs to cover additional peaks
- Regularly check partition placement using DPO reporting, in particular following LPAR configuration changes
- Include Virtual I/O Server partitions in sizing and capacity planning process and preferably run them in dedicated or dedicated donating processor configurations
- For maximum flexibility, exploit virtualization features where possible and use non-virtualized I/O only when absolutely needed
- Boot partitions in POWER8 or POWER9 mode and use SMT8
- When planning an upgrade to a newer POWER hardware, consider both capacity and single thread performance
- Evaluate available technologies like Live Update or SMC-R that can help you to overcome business continuity or performance issues.
- Check for typical operational problems like not having enough virtual memory resources and get familiar with SAP monitoring and alerting.
- Check and implement the recommendations in the "IBM POWER Virtualization Best Practices Guide" available at: <https://www.ibm.com/downloads/cas/JVGZA8RW>
- Keep your AIX operating system and your SAP kernel at current and supported levels

Resources

IBM Whitepapers

- IBM POWER Virtualization Best Practices Guide
<https://www.ibm.com/downloads/cas/JVGZA8RW>
- AIX on Power - Performance FAQ
http://www14.software.ibm.com/webapp/set2/sas/f/best/aix_perf_FAQ.pdf
- AIX Version 7.2 Performance management
https://www.ibm.com/support/knowledgecenter/ssw_aix_72/performance/performance_pdf.pdf
- IBM AIX Operating System Service Strategy and Best Practices
<https://www.ibm.com/support/pages/node/3464613>
- Hints and Tips for Migrating Workload to IBM POWER9 Processor-Based Systems
<https://www.ibm.com/downloads/cas/39XWR7YM>
- SAP Applications with AIX Live Update
<https://www.ibm.com/support/pages/node/6355823>
- SMC-R on AIX for SAP - Experience report
<https://www.ibm.com/support/pages/node/6355733>
- IBM Power Systems Performance Report
<https://www.ibm.com/downloads/cas/K90RQOW8>
- IBM POWER9 and SMT performance for IBM Db2
<https://developer.ibm.com/articles/power9-and-smt-perf-for-db2/>
- IBM Power Systems, AIX and Oracle Database 10g & 11.2.0.3 Performance Considerations
<https://www.ibm.com/support/pages/node/6355341>
- Managing the Stability and Performance of current Oracle Database versions running AIX on Power Systems including POWER9
<https://www.ibm.com/support/pages/node/6355543>
- Oracle Database 11g and 12c on IBM Power Systems S924, S922 and S914 with POWER9 processors
<https://www.ibm.com/support/pages/node/6355685>

IBM Web Sites/Blogs/Tools

- IBM Power Systems Community: SAP Topic Group
<https://ibm.biz/saponibmpower>
- IBM SAP on IBM Z user group
<https://ibm.biz/saponibmz>
- Power Systems Virtual User Group
<https://www.ibm.com/support/pages/node/1120377>
- AIX support lifecycle information
<https://www.ibm.com/support/pages/node/670775>
- Service and support best practices for Power Systems
<https://www.ibm.com/support/pages/service-and-support-best-practices-power-systems>
- Virtual IO Server Performance Advisor
<https://community.ibm.com/community/user/power/blogs/shajith-chandran1/2020/10/13/virtual-io-server-performance-advisor>
- How does Shared Processor Performance Compare to Dedicated Processors
<https://community.ibm.com/community/user/power/blogs/pete-heyrman1/2020/06/16/how-does-shared-processor-performance-compare-to-d>
- “CPU and Memory Affinity and CPU Scheduling” blog series parts 1-11 on the AIXpert blog:
<https://www.ibm.com/support/pages/node/1116387>
- Assigning the appropriate processor entitled capacity
<https://www.ibm.com/support/pages/node/720643>
- Fix Level Recommendation Tool
<http://www.ibm.com/support/customercare/flrt/>
- Supported code combinations for HMC and server firmware
<https://www14.software.ibm.com/support/customercare/flrt/mtm>
- Announcement of AIX 7.2 TL 3
<https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?infotype=AN&subtype=CA&htmlfid=897/ENUS218-381&appname=USN>
- SR-IOV FAQs
<https://community.ibm.com/community/user/power/viewdocument/sr-io-v-faqs-test?CommunityKey=71e6bb8a-5b34-44da-be8b-277834a183b0&tab=librarydocuments>
- vNIC and vNIC Failover FAQs
<https://community.ibm.com/community/user/power/viewdocument/vnic-and-vnic-failover-faqs?CommunityKey=71e6bb8a-5b34-44da-be8b-277834a183b0&tab=librarydocuments>
- The native AIX largesend segmentation offload feature in virtual Ethernet environment

<https://www.ibm.com/support/pages/native-aix-largesend-segmentation-offload-feature-virtual-ethernet-environment>

- Db2 product hub: Db2 best practices
https://www.ibm.com/support/producthub/db2/docs/content/SSEPGG_11.5.0/com.ibm.db2.luw.common.doc/doc/c0060073.html
- IBM Hybrid Data Management Community: Db2 topic group
<https://community.ibm.com/community/user/hybriddatamanagement/communities/community-home?CommunityKey=ea909850-39ea-4ac4-9512-8e2eb37ea09a>

IBM Redbooks

- SAP Applications on IBM PowerVM
<https://www.redbooks.ibm.com/abstracts/sg247564.html?Open>
- IBM PowerVM Virtualization Introduction and Configuration
<https://www.redbooks.ibm.com/abstracts/sg247940.html?Open>
- IBM PowerVM Getting Started Guide
<https://www.redbooks.ibm.com/abstracts/redp4815.html?Open>
- IBM PowerVM Best Practices
<https://www.redbooks.ibm.com/abstracts/sg248062.html?Open>
- IBM PowerVM Virtualization Managing and Monitoring
<https://www.redbooks.ibm.com/abstracts/sg247590.html?Open>
- POWER7 Optimization and Tuning Guide
<https://www.redbooks.ibm.com/redpieces/abstracts/sg248079.html?Open>
- IBM Power Systems Infrastructure I/O for SAP Applications
<http://www.redbooks.ibm.com/abstracts/redp5581.html?Open>

IBM Product Documentation

- IBM AIX V7.1 documentation
https://www.ibm.com/support/knowledgecenter/ssw_aix_71/navigation/welcome.html
- IBM AIX V7.2 documentation
https://www.ibm.com/support/knowledgecenter/ssw_aix_72/navigation/welcome.html
- AIX support lifecycle information
<https://www.ibm.com/support/pages/node/670775>
- System to AIX maps
<https://www.ibm.com/support/pages/node/6020074>
- XL C++ Runtime Environment and C++ Utilities
<https://www.ibm.com/support/pages/xl-c-runtime-environment-and-c-utilities>
- Fix Level Recommendation Tool
<http://www.ibm.com/support/customer/flrt/>
- Microcode Discovery Service
<http://www14.software.ibm.com/webapp/set2/mds/fetch?page=home.html>
- Processor compatibility mode definitions
https://www.ibm.com/support/knowledgecenter/9009-22A/p9hc3/p9hc3_pcmdefs.htm
- Virtual I/O Server Performance Advisor
https://www.ibm.com/support/knowledgecenter/9080-M9S/p9hb1/p9hb1_vios_perf_adv.htm
- IBM AIX Dynamic System Optimizer
https://www.ibm.com/support/knowledgecenter/ssw_aix_72/systemoptimizer/optimize_kickoff.html

SAP Documentation and Web pages

- SAP Help Portal
<https://help.sap.com/>
- SAP Product Availability Matrix (PAM)
<https://apps.support.sap.com/sap/support/pam>
- SAP Guide Finder for SAP NetWeaver and ABAP Platform
<https://help.sap.com/viewer/nwguidefinder>
- SAP on AIX Community
<https://community.sap.com/topics/aix>
- SAP on Db2 for z/OS Community
<https://community.sap.com/topics/db2-for-zos>
- SAP on IBM Db2 for Linux, UNIX, and Windows Community
<https://community.sap.com/topics/db2-for-linux-unix-windows>
- SAP on Oracle Community
<https://community.sap.com/topics/oracle>
- SAP Service and Support announcement
<https://news.sap.com/2020/02/sap-s4hana-maintenance-2040-clarity-choice-sap-business-suite-7/>
- Update Strategy for the Kernel of the Application Server ABAP in On Premise Landscapes
<https://support.sap.com/deployment-strategies-kernel-abap.pdf>
- Database Administration Guide for SAP on IBM Db2 for z/OS
https://help.sap.com/viewer/db2_administration_guide

Important SAP Notes and Knowledge Base Articles

SAP Note	Title / Description
SAP Applications on AIX	
174911	Determining the hardware key (customer key)
953653	Rolling Kernel Switch
973227	AIX Virtual Memory Management: Tuning Recommendations
1121904	SAP on AIX: Recommendations for paging space
1458918	Support for AIX 7.1
1541935	Using SAP systems with AIX 7.1
1648480	Maintenance for SAP Business Suite 7 Software including SAP NetWeaver
1744209	SAP Kernel 720, 721 and 722: Versions and Kernel Patch Levels
1780629	AIX: Minimal OS Requirements for SAP Kernel
1915341	No History Data in ST06
1927404	DB2-z/OS: IBM Data Server Driver for CLI/ODBC/JDBC/SQLJ - Special Builds
1969546	Release Roadmap for Kernel 74x and 75x
1972803	SAP on AIX: Recommendations
2083594	SAP Kernel Versions and SAP Kernel Patch Levels
2224372	Remove the limit on maximum segment size on AIX
2267287	Using SAP systems with AIX 7.2
2699513	Recommendation of new AIX Feature SMC-R for SAP on AIX
2535891	Run your SAP workload best on AIX and POWER8 or POWER9 in SMT8 mode
2556153	Using Kernel 7.53 instead of Kernel 7.40, 7.41, 7.42, 7.45, or 7.49
2630086	Avoid signal 33, out of memory on AIX
2870484	Using kernel 7.77 instead of kernel 7.73
2879336	Hardware key based on unique ID
2907361	Release Roadmap for Kernel 77x and 78x
PowerVM Virtualization	
1002461	Support of IBM Dynamic LPAR and Micropartitioning
1102760	PowerVM Live Partition Mobility
1105456	SAP Installations in AIX WPARs
1464605	Active Memory Expansion (AME)
2977742	SAP Applications with AIX Live Update
Monitoring	
994025	Virtualized OS environments in the operating system monitor
1131691	CPU utilization metrics of IBM System p
1379340	Extended set of virtualization metrics for AIX Power Systems
1379855	Installation of saposcol and sapccmsr on IBM VIOS
2932766	Key Monitoring Metrics for SAP on IBM Power Systems Virtual Servers
SAP on IBM Power Virtual Servers	
1380654	SAP support in IaaS environments
2855850	SAP Applications on IBM Power Systems Virtual Servers
2923984	SAP on IBM Power Systems Virtual Servers: Support prerequisites
2947579	SAP HANA on IBM Power Systems Virtual Servers

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