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1. Introduction

SAP® Business Process Automation by Redwood (SAP BPA) enables you to centralize and standardize process execution across the entire enterprise. You can eliminate delays caused by manual processing and improve consistency across different parts of the business. You can also dramatically increase operational efficiency – accelerating the speed at which your organization can respond to changing business demands.

Through a central point of control, it enables organizations to orchestrate automation of the task generated by modern business practices and to manage efficiently the compound processes this orchestration demands across multiple systems and landscapes.

With its comprehensive automation rules, SAP BPA manages both routine and predictable workload as well as the ad hoc tasks that can be generated at any time by applications such as e-commerce, business-to-business transfers, and do-it-yourself end-user interfaces.

1.1 Functions of SAP Business Process Automation

The main functions of SAP BPA include:

- **Central Management and Automation of the Tasks Required by Complex Business Processes**
  SAP BPA provides a single interface for definition and management of all the underlying tasks required for process completion, simplifying cross-enterprise management and automating business processes across the SAP landscape and (optionally) non-SAP environments. By automating execution of this workload, SAP BPA increases operational efficiency and improves productivity.

- **Seamless Integration with SAP Business Applications**
  SAP BPA enables unique low level integration with SAP business applications such as SAP NetWeaver BI and the SAP Closing Cockpit, allowing transparent automation of these environments.

- **Optimized Use of IT Resources**
  By controlling execution of business process related IT tasks, SAP BPA enables workload to be distributed across systems and run at appropriate times to maximize resource utilization, smoothing out processing peaks and reducing the impact of background tasks on on-line response times.

- **Event Driven Process Management**
  SAP BPA allows workload to be managed and controlled on the basis of occurrence of real-time events, such as the arrival of an order file from a customer. This event-driven approach allows more flexibility and responsiveness than basic time based approaches.
1.2 Architecture of SAP Business Process Automation

SAP BPA consists of two main components:

- **SAP BPA Central Server**
  The Central Server is the focal point of SAP BPA. It contains all the critical information relating to what processes are run, when, under what conditions and following which events. The Central Server also maintains historical run-time data, audit information and critical information for support and maintenance purposes. This configuration and run-time information relates to all processes and therefore makes the Central Server a very powerful component in the centralized management, monitoring and analysis of enterprise wide processing. The Central Server stores its data in a schema within the SAP NetWeaver database.

- **Managed Systems**
  Managed systems are the remote servers, for example SAP application servers, on which the background workload underpinning the business processes being managed by SAP BPA is executed.

1.3 Factors that Influence Performance

SAP BPA is designed to ensure that processes are automated efficiently to maximize resource utilization. It cannot have a bearing on performance once the process starts executing. This is down to the underlying hardware on which the application or process is executing. SAP BPA has no control over speed of task execution itself, other than ensuring the most appropriate system is selected for execution in the first place.

2. Sizing Fundamentals and Terminology

SAP provides general sizing information on the SAP Service Marketplace. For the purpose of this guide, we assume that you are familiar with sizing fundamentals. You can find more information at [http://service.sap.com/sizing](http://service.sap.com/sizing) → Sizing → General Sizing Procedures. This section explains the most important sizing terms as defined by SAP, as some of these are used in this document.

**Sizing**

Sizing means determining the hardware requirements of an SAP application, such as the network bandwidth, physical memory, CPU processing power, and I/O capacity. The size of the hardware and database is influenced by both business aspects and technological aspects. This means that the number of users using the various application components and the data load they put on the server must be taken into account.

Note that due to the nature of the BPA application, the number of users is generally relatively small (less than 100). This means that the number of users is unlikely to be a major consideration for sizing. In practice the primary concern is process volume, as the majority of the workload is automatically initiated by the system without user intervention.

**Benchmarking**

Sizing information can be determined using SAP Standard Application Benchmarks and scalability tests ([www.sap.com/benchmark](http://www.sap.com/benchmark)). Released for technology partners, benchmarks provide basic sizing recommendations to customers by placing a substantial load upon a system during the testing of new hardware, system software components, and relational database management systems (RDBMS). All performance data relevant to the system, user, and business applications are monitored during a benchmark run and can be used to compare platforms.
SAP BPA Sizing Guidelines

SAPS
The SAP Application Performance Standard (SAPS) is a hardware-independent unit that describes the performance of a system configuration in the SAP environment. It is derived from the Sales and Distribution (SD) Benchmark, where 100 SAPS is defined as the computing power to handle 2,000 fully business processed order line items per hour. (For more information about SAPS, see http://www.sap.com/benchmark/SAPS).

Please note that the SAPS approach is designed for use in sizing requirements for SAP application environments and is not appropriate SAP BPA server sizing.

Initial Sizing
Initial sizing refers to the sizing approach that provides statements about platform-independent requirements of the hardware resources necessary for representative, standard delivery SAP applications. The initial sizing guidelines assume optimal system parameter settings, standard business scenarios, and so on.

Expert Sizing
This term refers to a sizing exercise where customer-specific data is being analyzed and used to put more detail on the sizing result. The main objective is to determine the resource consumption of customized content and applications (not SAP standard delivery) by comprehensive measurements. For more information, see http://service.sap.com/sizing → Sizing Guidelines → General Sizing Procedures → Expert Sizing.

Configuration and System Landscaping
Hardware resource and optimal system configuration greatly depend on the requirements of the customer-specific project. This includes the implementation of distribution, security, and high availability solutions by different approaches using various third-party tools. In the case of high availability through redundant resources, for example, the final resource requirements must be adjusted accordingly.

There are some "best practices" which may be valid for a specific combination of operating system and database. To provide guidance, SAP created the NetWeaver configuration guides (http://service.sap.com/instguides → SAP NetWeaver).

Hardware Minimum Requirements
Unless otherwise indicated, the sizing guidelines specify the net requirements of the business application. The minimum requirements for installing an “empty” system are specified in the respective implementation guides (http://service.sap.com/instguides, in the section for hardware and software requirements). The same applies for front-end PC minimum and optimal requirements.

3. Initial Sizing for SAP BPA

3.1 Assumptions
1) The centralized control provided by SAP BPA means that, typically, only a single Central Server is required for a production environment. Furthermore, processing effort itself is carried out by remote systems running the SAP BPA agent software or by the servers that host the business applications for which workload is being managed. The server on which the Central Server resides does not run the actual tasks required of by the business processes; therefore it is not necessary to deploy multiple Central Servers to achieve high levels of throughput and scalability. It is rare for a customer to run multiple production SAP BPA Central Servers.

2) Although the SAP BPA Central Server does not have to run on a stand-alone server,
most customers do provide a separate machine. It is strongly recommended that SAP BPA be installed into a dedicated SAP NetWeaver instance in order to minimize downtime imposed by other components in the environment. \textit{As BPA orchestrates a wide range of applications it is important that its downtime is not coupled with other related or unrelated applications.}

3) These guidelines are based on the use of a single Central Server running on a standalone server in a dedicated SAP NetWeaver instance managing all SAP systems. \textit{Note that sizing and tuning of the underlying SAP NetWeaver environment is not covered by this document. Please refer to the appropriate SAP information for these aspects.}

\section*{3.2 Sizing Guidelines}

\textbf{Base Line Used for Guidelines}  
These guidelines use the following base line workload:  
1) Up to 25 simultaneous SAP BPA users.  
2) Up to 100k SAP BPA processes running per day.  
3) Retention of history data for up to 10 million processes.  
4) Each concurrent (logged on) SAP BPA user will use about 20MB of RAM.  
5) Processes have an average log file size of 16kb.

\textbf{Basic Guidelines for SAP BPA Central Server Memory Requirements}  
The memory requirements for the SAP BPA Central Server will be influenced by many factors including the number of SAP systems managed, the number of processes that are to be submitted and the frequency of access to historic data.

In 64 bit operating system environments a minimum of 8GB of RAM is required for the SAP BPA Central Server and the SAP NetWeaver Java stack. \textit{No other applications should run in this environment.}

\textbf{Basic Guidelines for SAP BPA Central Server CPU Requirements}  
It is extremely difficult to be specific about CPU requirements for the Central Server. Factors such as performance requirements, nature of the workload (how many parallel processes will run), the number of SAP systems and the number of expected active users will all have an effect. What can be stated is:

1) Multiple CPUs can be exploited where there are multiple remote agents as they can execute in parallel.

2) It is, however, more effective to have fewer faster CPUs than a larger number of older, slower ones.

3) Experience shows that a 2 or 4 CPU server will be able to manage the loads required by most customers.

4) Central Server process submission rates have been benchmarked at between 40 - 50 processes per second on standard server platforms.

5) Typically a modern dual or quad core Intel system (or equivalent) with a clock speed of 2.0GHz or faster will be sufficient to meet SAP BPA processing demands based on the baseline described above.
Basic Guidelines for SAP BPA Central Server Disk Space

As with all aspects of SAP BPA sizing, the amount of disk storage space required for the Central Server will vary depending on many factors. The numbers presented here are averages across database vendors, versions and operating systems:

1) The number of objects defined in the Central Server (i.e. the number process definitions, process chains, calendars, users, applications and so on).

2) The number and length of retention of process log files held in the Central Server.

3) The amount of disk space required for process output files on the central server. This depends on the number and length of retention of process output files that are transferred to the Central Server from remote managed systems. Operating system process output is held on the remote systems where the processes actually run. For processes run as SAP jobs in SAP CCMS or BI, SAP BPA will copy the output (spool data) to the SAP BPA Central Server.

4) The number of generations or versions of a process’s historical runtime data retained in the Central Server.

Note: These guidelines do not allow for the space required by the SAP NetWeaver Web Application Server Java stack used for the installation or the database software itself. These will vary dependent on database and Java stack used. Approximately 200Mb of disk space is required for the SAP .sca file used to deploy SAP BPA.

The following can be applied to arrive at an approximate disk space requirement figure for the Central Server:

1) Assume base database size of 32MB.

2) Allow 4k per process in held in history data.

3) Allow 1MB for every 5,000 process definitions in the Central Server.

4) Average log file size of 16k is used for these examples – this will vary from customer to customer and process to process.

The following can be used to help calculate disk space requirements for the SAP BPA Central Server and the systems on which the processes are to run (the Managed Systems):

1) 200Mb for the Redwood software on the SAP BPA Central Server.

2) 16Mb for the agent software on any Managed Systems where it is deployed.

3) 16Mb for the SAP BPA SAP transports on any SAP system where they are applied.

4) 32k per process for process log and spool files (16k for process log and 16k for spool).

5) Allow for the size of the SAP NetWeaver Java stack and large ABAP spool files (application dependent).
3.2 Sizing Summary

To manage a base line workload of 100k processes per day, with 10 million processes retained in the history data, more than 95% of processes producing average log file size of 16k and no large output files:

1) CPU: 2 x 2.0Ghz Intel processors (or equivalent)

2) Memory: 4GB

3) Disk storage:
   
i) Database Storage: 32Mb + (4k * history size).
   = 32Mb + (4k * 10,000,000)
   = 32Mb + 40Gb
   45 – 50 Gb will suffice for SAP BPA but need to allow for Java Stack and database software.

   ii) File system Storage: 100Mb + (20k * history size).
    = 100Mb + (20k * 10,000,000)
    = 100Mb + 200Gb
    250 Gb will suffice for SAP BPA and history but need to allow for Java Stack and any large ABAP spool files.

   iii) Managed systems: 32k * history size for log and spool files
    = 32k * 10,000,000
    = 320Gb

Total disk storage = approximately 600 - 800 Gb for SAP BPA and history data for 10 million processes, including logs and spool data from the managed systems. This calculation assumes that the managed system is not using the same server as the SAP BPA Central Server and therefore SAP output data is copied from the managed to the Central Server System.

Notes:

i) In most implementations the Central Server database (item i) and the SAP BPA server storage (item ii) will be on the same server, in which case the figures for these two components can be added together.

ii) Most installations will have more than one managed system.

4. General Comments for Deploying SAP BPA

4.1 Minimum SAP system software requirements for SAP BPA

1) SAP NetWeaver AS Java 7.3. Note that this defines the SAP NetWeaver environment into which the SAP BPA central server component is installed. This does not mean that the systems whose workload is to be managed must be at the same level. The managed workload can be on earlier or later releases of SAP.

2) Any database supported by SAP AS Java (where SAP BPA is SAP NetWeaver deployed). Also see section 4.3 below.
4.2 Dedicated SAP NetWeaver Instance

It is strongly recommended that SAP BPA be installed into a dedicated SAP NetWeaver instance in order to minimize downtime imposed by other components in the environment.

As BPA orchestrates a wide range of applications it is important that its downtime is not coupled with other related or unrelated applications.

If a dedicated SAP NetWeaver instance is not possible, SAP BPA should be installed into an environment that is least likely to be impacted by heavy demands on resources or by infrastructure failures. It is not recommended that SAP BPA be co-hosted on the same systems as production SAP applications such as SAP ERP.

Note also that development and test instances of SAP BPA should not be installed on the same system as the production environment for similar reasons.

4.3 Single or Dual Java Server Node

The general SAP recommendation is to use two Java server nodes, however for SAP BPA the recommendation is to deploy on a single Java server node in most situations as a single server node can access more memory. Since SAP BPA makes extensive use of memory caching, this usually results in increased performance on the same hardware.

Additional (i.e. redundant) server nodes on the same hardware do not have a significant influence on reliability. If increased reliability is a concern, high availability can be implemented by adding multiple server nodes on different hosts, or by using an external HA solution (for example one based on virtualization).

The SAP NetWeaver Java Stack has a multi-process architecture. In SAP NetWeaver 7.3 each application server has multiple nodes:

- A single dispatcher node
- One or more server nodes

The dispatcher node is responsible for distributing work to the server nodes. The dispatcher node handles network connections and load balancing and uses an internal queuing mechanism to assign work to server nodes.

SAP Business Process Automation makes extensive use of memory caching in order to reduce database load and increase performance. Hence its performance improves as the cache size is increased. If there are multiple server nodes then:

a) Each node has its own cache, so there will be two or more copies of frequently accessed data in memory (one for each server node).

b) Extra communication is required to keep the caches synchronized across the different server nodes.

c) Each server node of a Java Virtual Machine has an SAP NetWeaver Application Server and the SAP BPA application loaded.

With a single server node, there is less duplication of objects in memory and the available memory can be used more efficiently.
SAP BPA Sizing Guidelines

Running with two or more server nodes has some advantages:

- Faster failover in the case of a server node failure, as the second node is already online.
- Users will be load balanced across the multiple server nodes.

The point at which adding a second server node effects performance depends on both the foreground workload (users) and the background workload (processes). In general, customers running less than 100,000 processes per day, with less than 10 concurrent users, or those running on less powerful hardware will get maximum performance out of a single server node (due to increased memory efficiency). Customers with larger workloads and more memory should consider adding a second server node.

4.4 SAP NetWeaver Web Application Server HTTP Worker Threads

As with all aspects of SAP BPA sizing, the number of HTTP worker threads required in the underlying web application server is impacted by variable factors, such as the number of users. The recommended number of Java threads can be calculated as follows:

Minimum number of HTTP worker threads should be set to 50, or $20 + (2 \times \text{the number of planned SAP BPA users})$, for example if the number of SAP BPA users is 20 the number of HTTP worker threads will be 60.

*Please also see SAP notes 1169442 and 1469844.*

4.5 Database Licensing Considerations

SAP BPA will utilize the underlying database that the SAP NetWeaver environment uses. The recommendation is that SAP BPA is deployed into a completely separate, dedicated SAP NetWeaver stack. In this case the necessary database license to support the environment will be required. SAP BPA licensing does not include either the database or SAP NetWeaver itself.

If SAP BPA is to co-exist on an existing SAP NetWeaver stack, for example with SAP Solution Manager, the existing database runtime license can be used. *Note that this is not a recommended configuration.*

5. Comments and Feedback

We are interested to receive comments and feedback on how useful these sizing guidelines have been. If you have any such feedback, please send it to: SAPBPA@sap.com.
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