Bizagi Digital Business Platform

User Guide

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Part I

Automation Server requirements

Automation Server requirements

Overview

Automation Server is the runtime platform where your designed business processes and applications operate and are made available to your corporate end users.
Automation Server (formerly referred to as Bizagi Engine), executes your processes and delivers them to the desktops and mobiles of every business user.

Throughout this complete section, you will get to know: The recommended system architecture to operate Automation Server in a production environment, its minimum system requirements, how to support high availability and scale your solution, along with sizing to define the processing hardware needed to support your demands, database growth estimation, and which guidelines to follow for best performance.

System requirements

Overview

Automation Server executes your processes and delivers them to the desktops and mobiles of every business user.
Automation Server supports setup in a .NET platform.
For introductory information about Automation Server, refer to Automation Server.

Further information

Refer to the following articles for further information about system requirements for different setups:

1. For a high availability architecture on a production environment, refer to High availability .NET system requirements.
2. For a standard architecture on a production environment, refer to Standard .NET system requirements.
3. For a standard setup on a test environment, refer to Test environment .NET system requirements.

High availability .NET system requirements

Overview

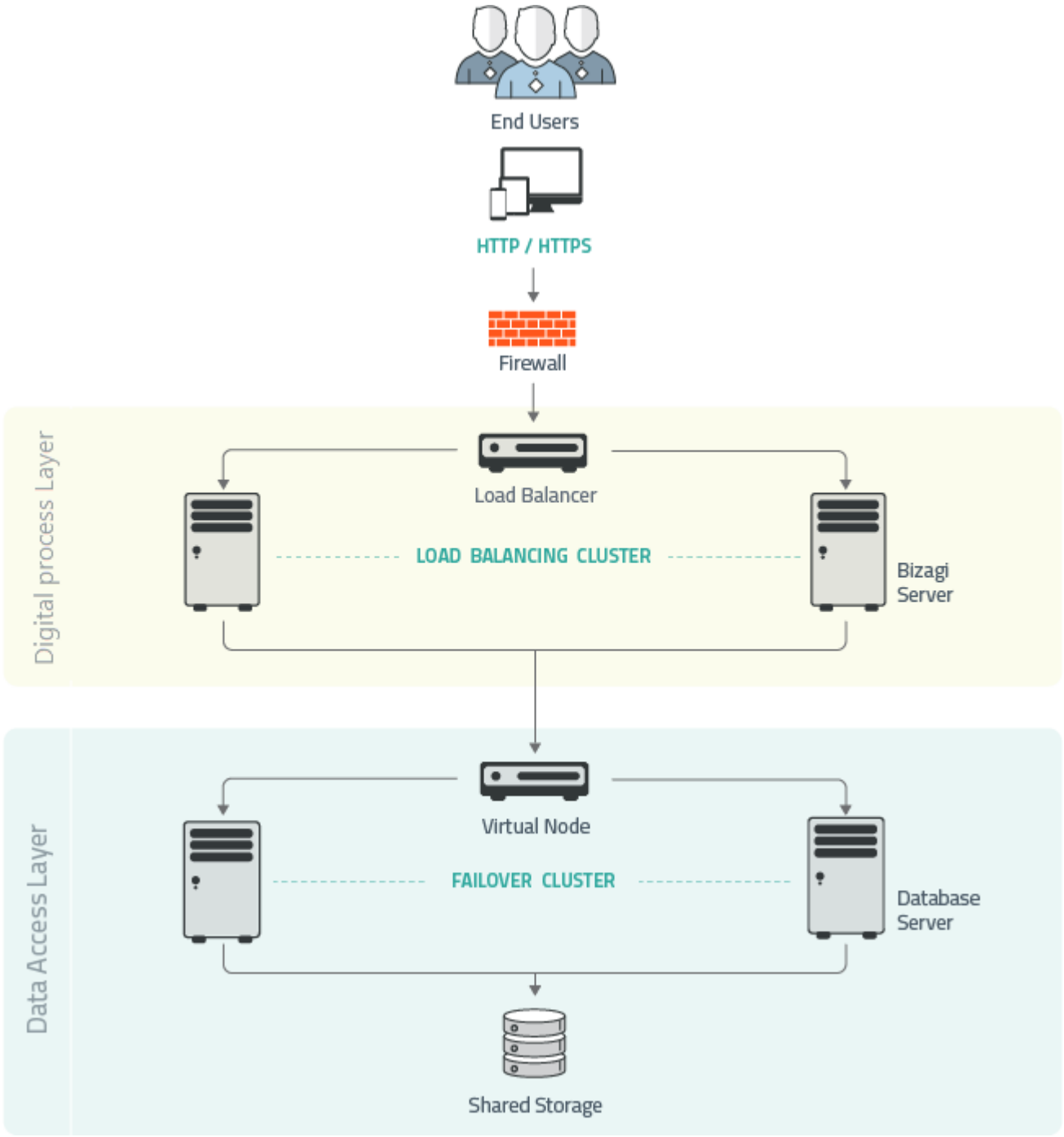
A high availability system architecture is designed for mission critical business processes which are expected to be available 24/7/365.

Such system architecture for Automation Server would be represented by having at least:

- A database cluster (for failover capabilities at the database server).
- A Bizagi cluster (to support load balancing and scalability).
- A load balancer, in order to provide load balancing for the Bizagi cluster.

System architecture

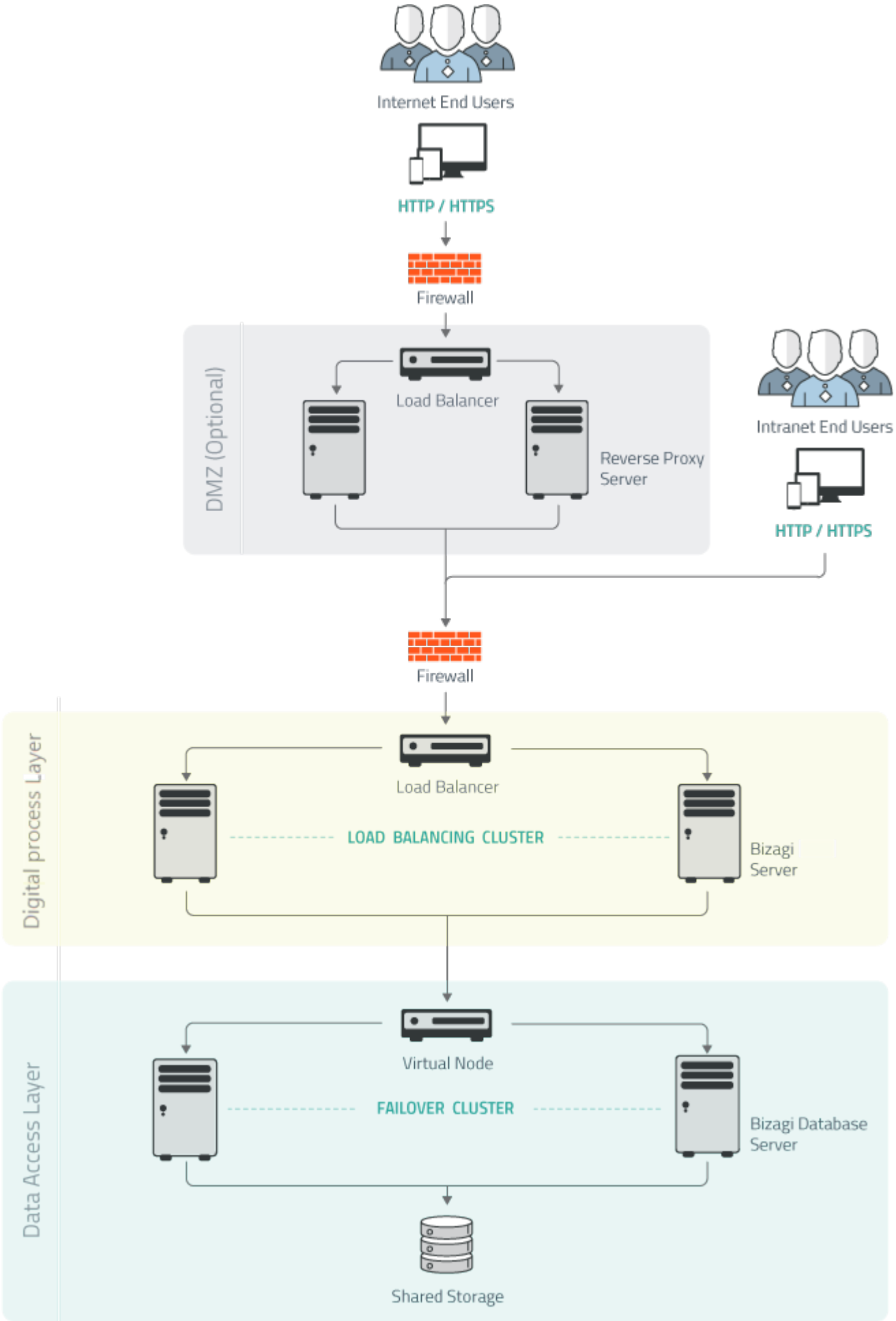
The system architecture is represented by the image below:



Optional setup for Internet access (use of a proxy server)

Whenever end users need to work on the processes via internet from any device, and Bizagi is set up on-premises strictly within the intranet, consider using a reverse proxy server.
This optional reverse proxy server, is set in the DMZ and avoids the need to publish the Bizagi server and its IP address.

For a high availability solution, this setup considers a using two nodes in a cluster hosting the reverse proxy (to avoid single points of failure in your system architecture).
The following image illustrates this system architecture:



Requirements

The following requirements are narrowed down by database server, Bizagi server, and other infrastructure assets.

Database server

For a high availability system architecture, at least two nodes for the database are recommended.
Each node should consider the following requirements:

REQUIREMENTS FOR EACH NODE FOR THE DATABASE SERVER		
HARDWARE	RAM	• 16 GB minimum. • It is strongly recommended to consider the most RAM you can use to provide the best performance.
	Hard Disk	• Two disks in RAID 1 (optional, recommended). • Each disk having 80 GB minimum. • It is strongly recommended to use high-speed disk drives.
	Processor	• 64-bit. • 4 cores minimum. • 3GHz or higher.
	Additional recommendations	• Two NIC - Dual port 1GB. • Redundant Power Supply (optional, recommended).
SOFTWARE	Database Engine	Standard or higher editions of: • Microsoft SQL Server 2017 • Microsoft SQL Server 2016 SP1 or SP2 • Microsoft SQL Server 2014 • Microsoft SQL Server 2012 • Microsoft SQL Server 2008 R2 SP1 or higher • Microsoft SQL Server 2008 SP3 or higher • Oracle Database 12c • Oracle Database 11g R2

Bizagi server

For a high availability system architecture, at least two nodes for a Bizagi cluster are recommended.
Each node should consider the following requirements:

REQUIREMENTS FOR EACH NODE FOR THE BIZAGI SERVER		
HARDWARE	RAM	16 GB minimum.
	Hard Disk	• Two disks in RAID 1 (optional, recommended). • Each disk having 10 GB minimum.
	Processor	• 64-bit. • 4 cores minimum. • 3GHz or higher.
	Additional recommendations	• Two NIC - Dual port 1GB • Redundant Power Supply
SOFTWARE	Operating System	• Windows Server 2019 • Windows Server 2016 • Windows Server 2012 R2 • Windows Server 2008 R2

REQUIREMENTS FOR EACH NODE FOR THE BIZAGI SERVER		
		These operating systems should have the latest Service Pack installed.
	Web Server	• IIS 10 • IIS 8.5 • IIS 7.5
	Additional Components	• Automation Server, which also installs Microsoft's .NET Framework version 4.6.1 (and this one includes in turn, other components such as Visual C++ 2010, 2008 Redistributable). • Oracle Data Provider for .NET component (applies to projects that connect to an Oracle database).

Other relevant infrastructure assets

Consider the following infrastructure requirements and other relevant recommendations:

1. Load balancer

For the load balancing for Bizagi servers, you may use either a software or hardware load balancer.
Bizagi does not provide the load balancer.
It is recommended the use of a hardware-appliance load balancer such as f5.

2. File server (optional)

Files and documents uploaded through your processes, are not stored in the database.
You may choose to integrate your corporate ECM/DMS system as a documents repository that store such files and documents; or alternatively, you may rely on a file server (i.e., a shared network drive). Bizagi does not provide the file server or ECM/DMS system.
It is important that all nodes of your Bizagi server cluster have access to such file server.

Such file server needs no specific requirements, save having the sufficient hard disk capacity to store your documents and files.
You will need to calculate and perform a sizing analysis based on the expected amount of files and their file size.

3. Reverse proxy server (optional)

In case you choose to set up a secure access to your processes via Internet, it is recommended to use two nodes for a reverse proxy server in a high availability system architecture (configuring a load balance cluster at this layer).
Bizagi does not provide the reverse proxy server.
Each node should consider the following requirements, involving an Apache HTTP Server:

REVERSE PROXY SERVER		
HARDWARE	Hard Disk	1 GB.
	Additional recommendations	• Two NIC - Dual port 1GB. • Redundant Power Supply.
SOFTWARE	Reverse proxy module	Apache HTTP Server. Requisites to set an Apache HTTP Server instance can be reviewed at Apache HTTP project official's documentation according to the specific version and platform.

End users

Bizagi Work portal is a web-based application and therefore, end users only need a browser or Bizagi's app installed for mobile devices.

Bizagi presents several optimization measures featured by its own product architecture, focused on mobile devices support, so that the best user experience is provided without the need of demanding requirements (for instance, Bizagi has been tested with 3G and 4G internet).
Even though Bizagi does not demand a high speed in the network for end user connectivity, consider that there are factors which are beyond Bizagi's control, and which may affect overall end user experience.
End users on mobile devices would be communicating over the internet (its communication will inherently depend upon factors such as: A higher latency in data transmission, fluctuations, interference and congestion affecting the speed of the channel, or the quality of the networks used during transmission, among others).

REQUIREMENTS FOR END USERS		
DESKTOP (PC) OR LAPTOPS	Screen resolution	1024 x 768 or higher.
	Browsers	• Internet Explorer 10 or 11. • Chrome 24 or higher. • Firefox 19 or higher. • Microsoft Edge v41.16299.492 & Microsoft EdgeHTML v16.16299 or higher.
	Others	For the optional graphical analysis feature in query forms, Adobe flash is required.
MOBILE DEVICES (tablets, smartphones)	Devices / OS	• iOS iPad, iPhone: 9 or higher. Browser: Safari (Private browsing mode not supported) • Android smartphones and tablets: Lollipop (5.0) or higher. Browser: Chrome.

Important

Consider the following notes:

1. Operating systems installed in Turkish language are not supported.
All involved servers will need to be set with regional settings different to those for Turkish language and culture (tr, tr-TR).

2. Consider recommended guidelines when installing and configuring Bizagi.
These guidelines include a sizing estimation for best performance, as well as relevant infrastructure aspects in the overall system architecture.
For instance, there are recommendations regarding the network or when setting up the above servers in virtual machines.
For more information about these recommendations, refer to the Optimizing performance chapter.

Standard .NET system requirements

Overview

A standard architecture is designed for business processes which do not necessarily need to be in a high availability scheme.

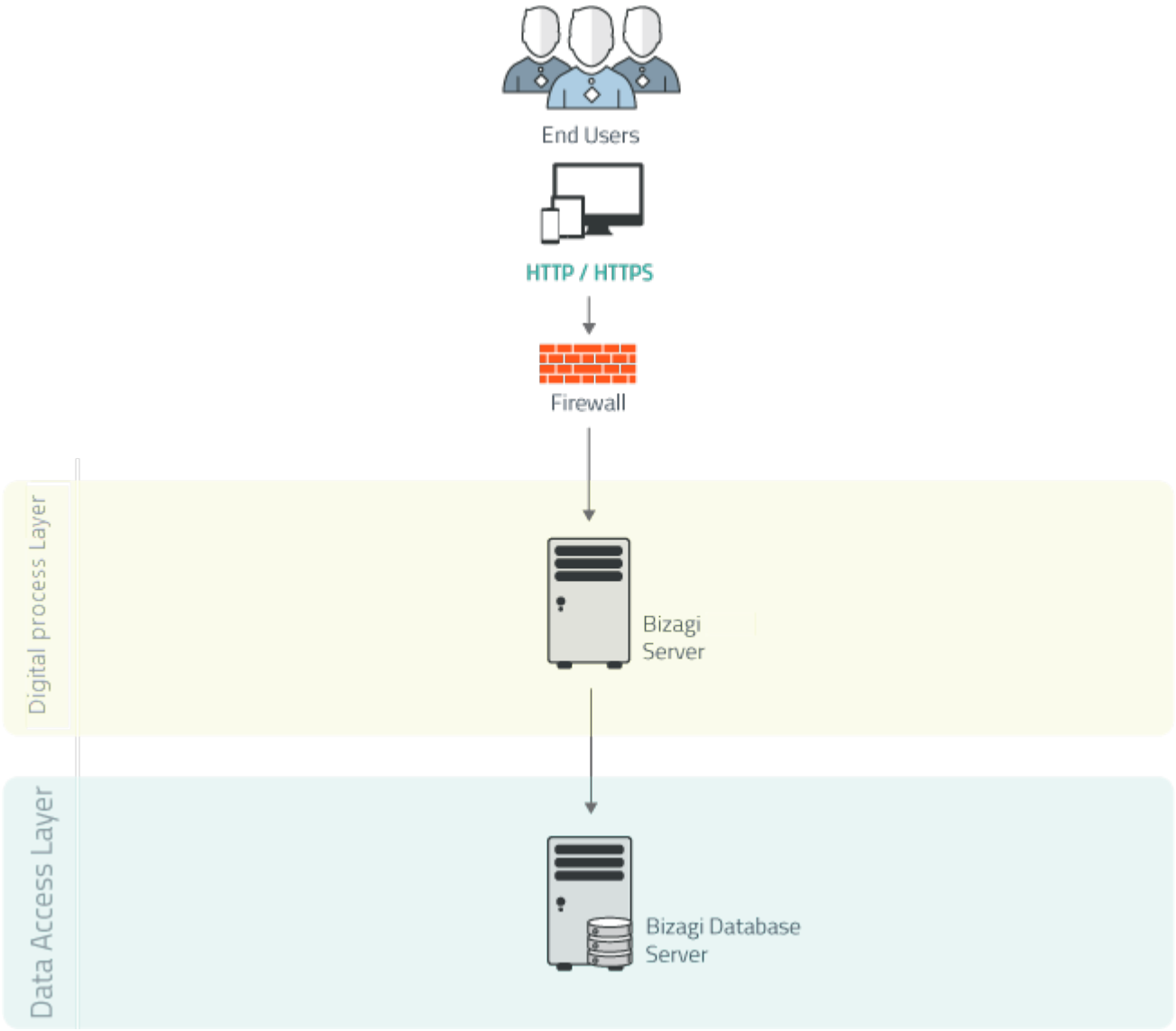
Such standard system architecture for Automation Server would be represented by having:

- A single database server.
- A single Bizagi server.

In case you consider that your corporate solution needs a high availability architecture to support failover and load balancing capabilities, refer to High availability .NET system requirements.

System architecture

The system architecture is represented by the image below:



Optional setup for Internet access (use of a proxy server)

Whenever end users need to work on the processes via internet from any device, and Bizagi is set up on-premises strictly within the intranet, consider using a reverse proxy server.

This optional reverse proxy server, is set in the DMZ and avoids the need to publish the Bizagi server and its IP address.

Requirements

The following requirements are narrowed down by database server, Bizagi server, and other infrastructure assets.

Database server

For a standard system architecture, a single server is involved considering the following requirements:

REQUIREMENTS FOR THE DATABASE SERVER		
HARDWARE	RAM	• 16 GB minimum. • It is strongly recommended to consider the most RAM you can use to provide the best performance.
	Hard Disk	• Two disks in RAID 1 (optional, recommended). • Each disk having 80 GB minimum. • It is strongly recommended to use high-speed disk drives.
	Processor	• 64-bit. • 4 cores minimum. • 3GHz or higher.
	Additional recommendations	Battery backup unit (optional, recommended).
SOFTWARE	Database Engine	Standard or higher editions of: • Microsoft SQL Server 2017 • Microsoft SQL Server 2016 SP1 or higher • Microsoft SQL Server 2014 • Microsoft SQL Server 2012 • Microsoft SQL Server 2008 R2 SP1 or higher • Microsoft SQL Server 2008 SP3 or higher • Oracle Database 12c • Oracle Database 11g R2

Bizagi server

For a standard system architecture, a single server is involved considering the following requirements:

REQUIREMENTS FOR THE BIZAGI SERVER		
HARDWARE	RAM	16 GB minimum.
	Hard Disk	• Two disks in RAID 1 (optional, recommended). • Each disk having 10 GB minimum.
	Processor	• 64-bit • 4 cores minimum. • 3GHz or higher
	Additional recommendations	Battery backup unit (optional, recommended).
SOFTWARE	Operating System	• Windows Server 2019 • Windows Server 2016 • Windows Server 2012 R2 • Windows Server 2008 R2 These operating systems must have the latest Service Pack installed.

REQUIREMENTS FOR THE BIZAGI SERVER		
	Web Server	• IIS 10 • IIS 8.5 • IIS 7.5
	Additional Components	• Automation Server, which also installs Microsoft's .NET Framework version 4.6.1 (and this one includes in turn, other components such as Visual C++ 2010, 2008 Redistributable). • Oracle Data Provider for .NET component (applies to projects that connect to an Oracle database).

Other relevant infrastructure assets

Consider the following infrastructure requirements and other relevant recommendations:

1. File server (optional)

Files and documents uploaded through your processes, are not stored in the database.
You may choose to integrate your corporate ECM/DMS system as a documents repository that store such files and documents; or alternatively, you may rely on a file server (i.e., a shared network drive). Bizagi does not provide the file server or ECM/DMS system.

Such file server needs no specific requirements, save having the sufficient hard disk capacity to store your documents and files.
You will need to calculate and perform a sizing analysis based on the expected amount of files and their file size.

2. Reverse proxy server (optional)

In case you choose to set up a secure access to your processes via Internet, it is recommended to use a reverse proxy server.
Bizagi does not provide the reverse proxy server.
Such server should consider the following requirements, involving an Apache HTTP Server:

REVERSE PROXY SERVER		
HARDWARE	Hard Disk	1 GB.
	Additional recommendations	Battery backup unit.
SOFTWARE	Reverse proxy module	Apache HTTP Server. Requisites to set an Apache HTTP Server instance can be reviewed at Apache HTTP project official's documentation according to the specific version and platform.

End users

Bizagi Work portal is a web-based application and therefore, end users only need a browser or Bizagi's app installed for mobile devices.
Bizagi presents several optimization measures featured by its own product architecture, focused on mobile devices support, so that the best user experience is provided without the need of demanding requirements (for instance, Bizagi has been tested with 3G and 4G internet).
Even though Bizagi does not demand a high speed in the network for end user connectivity, consider that there are factors which are beyond Bizagi's control, and which may affect overall end user experience.
End users on mobile devices would be communicating over the internet (its communication will inherently depend upon factors such as: A higher latency in data transmission, fluctuations, interference and congestion affecting the speed of the channel, or the quality of the networks used during transmission, among others).

REQUIREMENTS FOR END USERS		
DESKTOP (PC) OR LAPTOPS	Screen resolution	1024 x 768 or higher.
	Browsers	• Internet Explorer 10 or 11. • Chrome 24 or higher. • Firefox 19 or higher. • Microsoft Edge v41.16299.492 & Microsoft EdgeHTML v16.16299 or higher
	Others	For the optional graphical analysis feature in query forms, Adobe flash is required.
MOBILE DEVICES (tablets, smartphones)	Devices / OS	• iOS iPad, iPhone: 9 or higher. Browser: Safari (Private browsing mode not supported) • Android smartphones and tablets: Lollipop (5.0) or higher. Browser: Chrome.

Important

Consider the following notes:

1. Operating systems installed in Turkish language are not supported.
All involved servers will need to be set with regional settings different to those for Turkish language and culture (tr, tr-TR).

2. Consider recommended guidelines when installing and configuring Bizagi.
These guidelines include a sizing estimation for best performance, as well as relevant infrastructure aspects in the overall system architecture.
For instance, there are recommendations regarding the network or when setting up the above servers in virtual machines.
For more information about these recommendations, refer to the Optimizing performance chapter.

Test environment .NET system requirements

Overview

Automation Server is used to execute your Bizagi processes on runtime environments such as a production or a test environment.

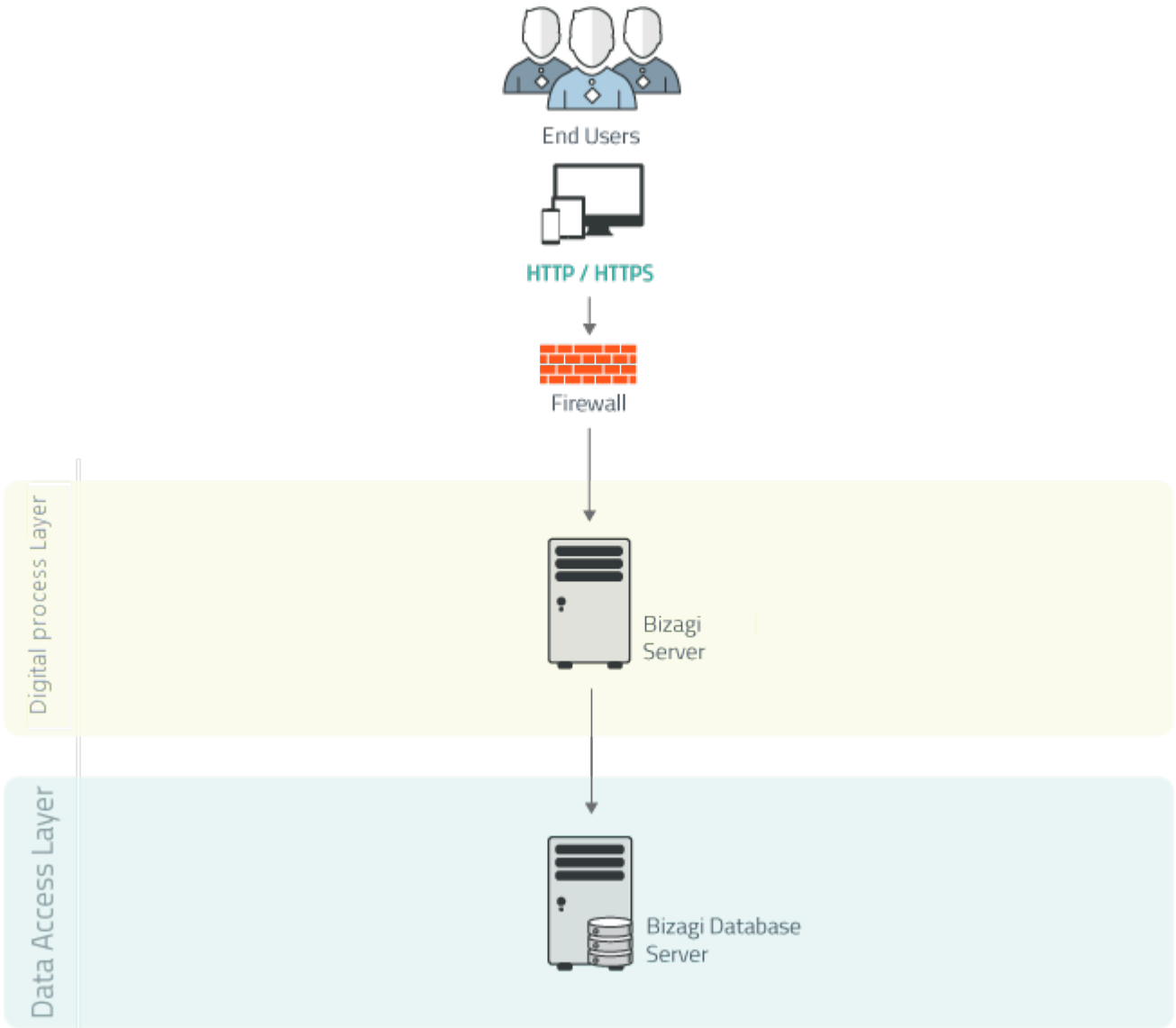
Keep in mind that, if you are going to perform stress tests, unless you are using staging or a pre-production environment, it is recommended to set a test environment which has similar characteristics to your designated production environment.

Minimum requirements for the production environment are described at the following links, according to the system architecture of your choice.

- High availability .NET setup.
- Standard .NET setup.

Simplified test environment

Minimum requirements for a simplified test environment, is represented by the image below:



Requirements

The following requirements are narrowed down by database server, Bizagi server, and other infrastructure assets.

Database server

For a test environment, a single server is involved considering the following requirements:

REQUIREMENTS FOR THE DATABASE SERVER		
HARDWARE	RAM	8 GB minimum.
	Hard Disk	40 GB minimum.
	Processor	• 64-bit. • 2 cores minimum. • 2.4GHz or higher.
SOFTWARE	Database Engine	Standard or higher editions of: • Microsoft SQL Server 2017 • Microsoft SQL Server 2016 SP1 or higher • Microsoft SQL Server 2014 • Microsoft SQL Server 2012 • Microsoft SQL Server 2008 R2 SP1 or higher • Microsoft SQL Server 2008 SP3 or higher • Oracle Database 12c • Oracle Database 11g R2

Bizagi server

For a test environment, a single server is involved considering the following requirements:

REQUIREMENTS FOR THE BIZAGI SERVER		
HARDWARE	RAM	8 GB minimum.
	Hard Disk	40 GB minimum.
	Processor	• 64-bit. • 2 cores minimum. • 2.4GHz or higher-
SOFTWARE	Operating System	• Windows Server 2019 • Windows Server 2016 • Windows Server 2012 R2 • Windows Server 2008 R2 • Windows 10 • Windows 8.1 • Windows 8 (all editions except Windows 8 SL). • Windows 7 (Supported editions are: Ultimate, Enterprise or Professional). These Windows versions must have the latest Service Pack installed.
	Web Server	• IIS 10 • IIS 8.5 • IIS 8.0 • IIS 7.5

REQUIREMENTS FOR THE BIZAGI SERVER		
	Additional Components	• Automation Server, which also installs Microsoft's .NET Framework version 4.6.1 (and this one includes in turn, other components such as Visual C++ 2010, 2008 Redistributable). • Oracle Data Provider for .NET component (applies to projects that connect to an Oracle database).

User-acceptance testers

Bizagi Work portal is a web-based application and therefore, testers (and end users) only need a browser or Bizagi's app installed for mobile devices.

Bizagi presents several optimization measures featured by its own product architecture, focused on mobile devices support, so that the best user experience is provided without the need of demanding requirements (for instance, Bizagi has been tested with 3G and 4G internet).

Even though Bizagi does not demand a high speed in the network for end user connectivity, consider that there are factors which are beyond Bizagi's control, and which may affect overall end user experience.

End users on mobile devices would be communicating over the internet (its communication will inherently depend upon factors such as: A higher latency in data transmission, fluctuations, interference and congestion affecting the speed of the channel, or the quality of the networks used during transmission, among others).

REQUIREMENTS FOR TESTERS		
DESKTOP (PC) OR LAPTOPS	Screen resolution	1024 x 768 or higher.
	Browsers	• Internet Explorer 10 or 11. • Chrome 24 or higher. • Firefox 19 or higher. • Microsoft Edge v41.16299.492 & Microsoft EdgeHTML v16.16299 or higher
	Others	For the optional graphical analysis feature in query forms, Adobe flash is required.
MOBILE DEVICES (tablets, smartphones)	Devices / OS	• iOS iPad, iPhone: 9 or higher. Browser: Safari (Private browsing mode not supported) • Android smartphones and tablets: Lollipop (5.0) or higher. Browser: Chrome.

Important

Consider the following notes:

1. Operating systems installed in Turkish language are not supported.

All involved servers will need to be set with regional settings different to those for Turkish language and culture (tr, tr-TR).

2. Consider recommended guidelines when installing and configuring Bizagi.

These guidelines include a sizing estimation for best performance, as well as relevant infrastructure aspects in the overall system architecture.

For instance, there are recommendations regarding the network or when setting up the above servers in virtual machines.

For more information about these recommendations, refer to the Optimizing performance chapter.

Ports and Protocols requirements - Dataflow

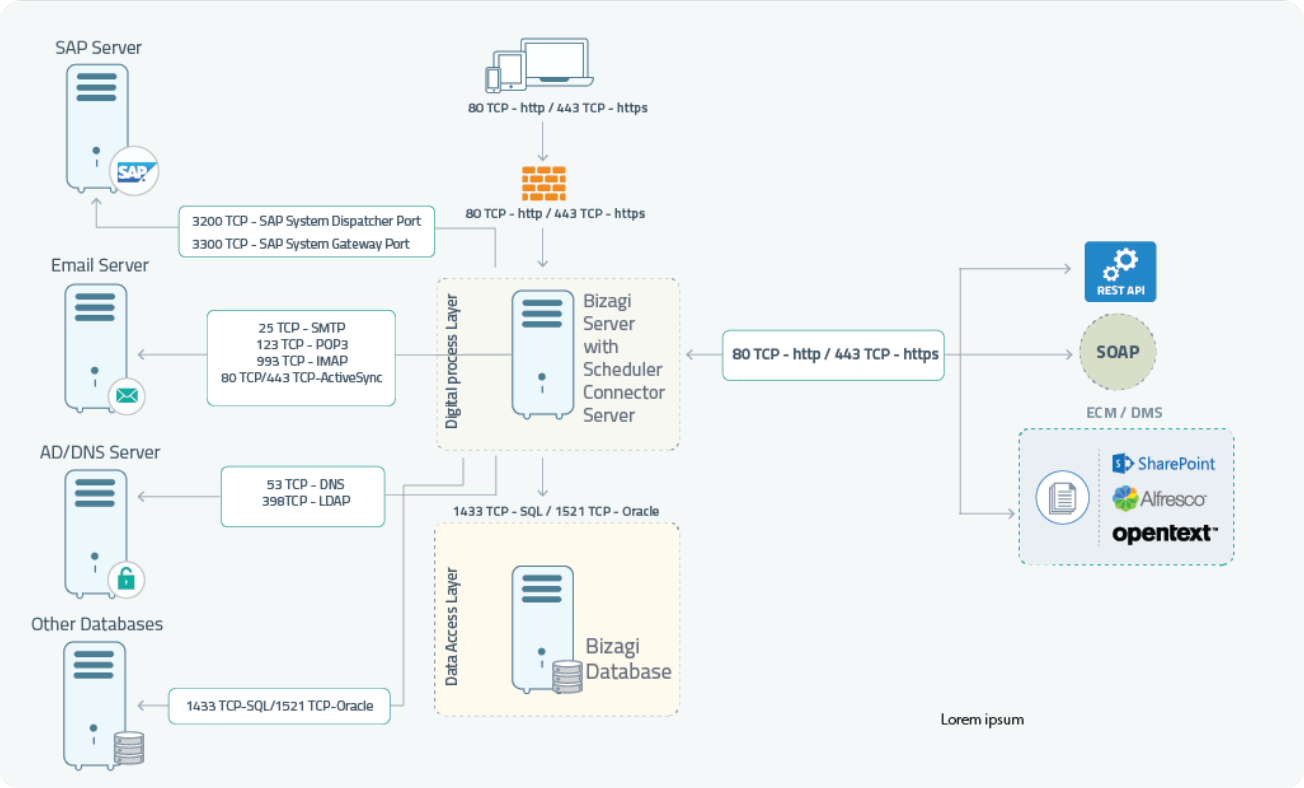
Overview

Automation Server executes your processes and delivers them to the desktops and mobiles of every business user. Refer to System requirements for Automation Server, according to your specific platform.

This section presents complementary information to understand the Dataflow of a Bizagi installation. That is, the movement of data from Bizagi to internal and external systems. Depending on the features used, the list of ports and protocols that should be enabled for a successful connection between Automation Server and your infrastructure is defined below.

Dataflow

The dataflow is represented by the image below:



Ports used by Automation Server

The following table illustrates all the ports mentioned in the dataflow. All the ports use *TCP* protocol.

PORT	SERVICE	PURPOSE	USED BY
25	SMTP	Email integration	Email Server
53	DNS	Resolution of names	Active directory Server
80	HTTP	Customers Access. Redirects to HTTPS	Bizagi Server
		Connection with systems by REST	Other environments

		Connection with systems by SOAP	Other environments
		ECM integration	ECM Server
		Redirect traffic to an endpoint	Firewall
110	POP3	Email integration	Email Server
398	LDAP	User Authentication	Active directory Server
443	HTTPS	Customers Access	Bizagi Server
		Connection with systems by REST	Other environments
		Connection with systems by SOAP	Other environments
		ECM integration	ECM Server
		Redirect traffic to an endpoint	Firewall
993	IMAP	Email integration	Email Server
1433	SQL	Communication between Bizagi and SQL Server database	Bizagi Database using SQL Server
1521	Oracle	Communication between Bizagi and Oracle database	Bizagi Database using Oracle
3200	SAP Dispatcher	Integration with SAP	SAP Server
3300	SAP Gateway	Integration with SAP	SAP Server
16541	HTTPS	Service to execute Bizagi Connectors	Connector Server

Performance and optimization

Overview

Automation Server executes your processes and delivers them to the desktops and mobiles of every business user. System requirements for Automation Server, according to your specific platform, are those presented at System requirements.

This section presents complementary information to system requirements, such as guidelines, a sizing estimator, and other recommendations for relevant infrastructure aspects in the overall system architecture, to consider when seeking best performance with Automation Server.

Further information

Consider the following chapters:

- For a reference architecture and recommended practices aimed at performance and optimization, refer to System architecture recommended practices.
- For recommendations regarding using virtual machines, refer to Guidelines for Bizagi when considering compute virtualization.
- For a paper providing a scalability (and performance) benchmark, refer to Scalability benchmark.

- For a sizing estimator, guidelines and information for your own Bizagi project's analysis in terms of processing capacity (CPU and RAM), refer to Sizing estimation.
- For a database growth estimation, based on a sample exercise, refer to Database growth estimation.

System architecture recommended practices

Overview

Automation Server executes your processes and delivers them to the desktops and mobiles of every business user. For introductory information about Automation Server, refer to Automation Server.

The information presented here points out the most critical technical aspects that you should consider in your corporate infrastructure, in order to set up a Bizagi system architecture that performs under optimal conditions and according to official Bizagi Ltd recommendations.

Before you start

This information presented here is complementary to the sizing analysis you should carry out for your specific project (hardware sizing), and detailed documentation about specific system requirements (supported software configuration and versions).
For more information about system requirements, according to your specific platform, refer to System requirements.

The information presented here will not provide a guide to install or configure Automation Server or any of its required components, but it will serve as a reference architecture instead.

Concepts

The best practices and requirements presented here, consider a corporate Bizagi system architecture based on the following concepts.

High availability

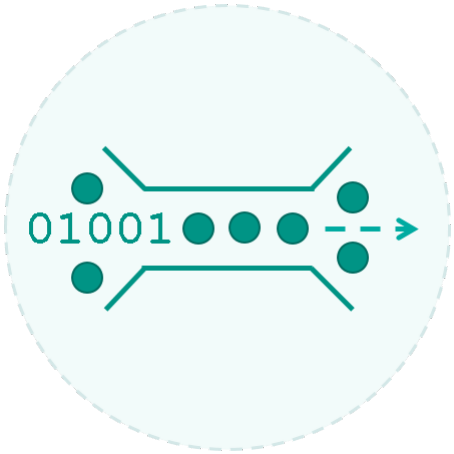
A high availability architecture is designed to support best system reliability (enhanced service uptime), while implying the use of redundant IT assets that avoid single points of failure (i.e, typically for mission critical business processes).

Therefore, common recommendations such as using redundant power supply for your servers, two NICs per node, or maintaining an identical server configuration across nodes in clusters, apply for a Bizagi system architecture (along with any other similar measures).

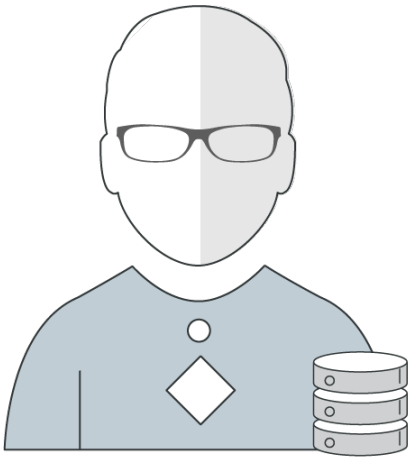
Bizagi supports high availability by supporting cluster configuration across its different tiers, while allowing you to further scale-out the Bizagi cluster at anytime.

Bizagi product architecture

Bizagi is an intensive data-access application, which runs a light-weight application server, which is model-driven.
Therefore and given that Bizagi does not generate intermediate code, the database health and accessibility is critical.
It is strongly recommended that you make sure that the underlying infrastructure for Bizagi to access data is providing an optimal performance (avoiding data-access bottlenecks in general).



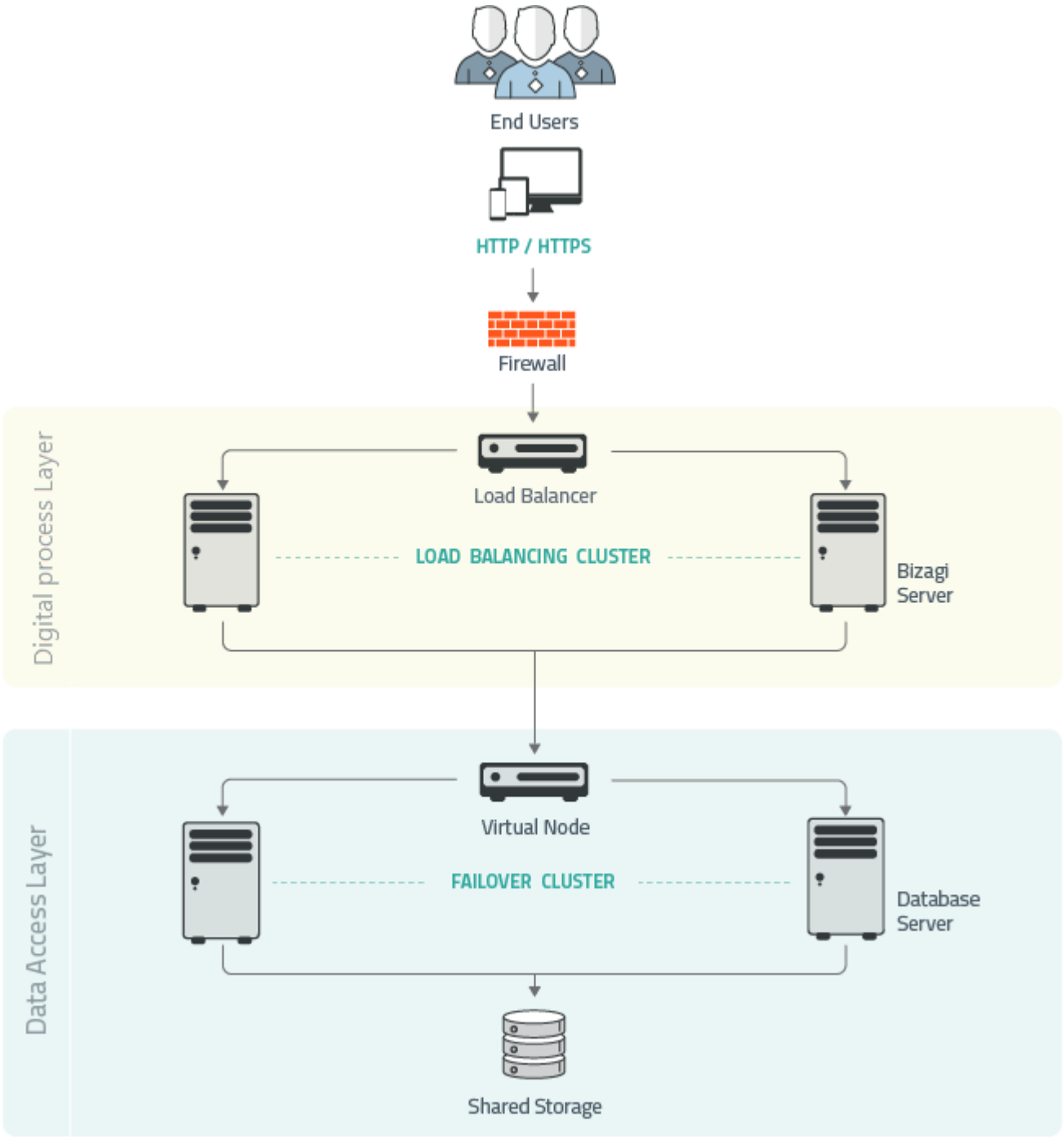
Regarding this architecture design, it becomes very important that your DBA performs continuous monitoring and tuning tasks, such as: Verifying the database integrity, updating database statistics, reorganizing and maintaining indexes, performing appropriate shrinks, or looking after the database growth behavior (i.e. filegroups, tablespaces).
Common recommendations regarding database maintenance and tuning, as issued by your database engine vendor, apply as well to your Bizagi database.



Reference system architecture

The following diagram illustrates a general Bizagi system architecture for a corporate setup.

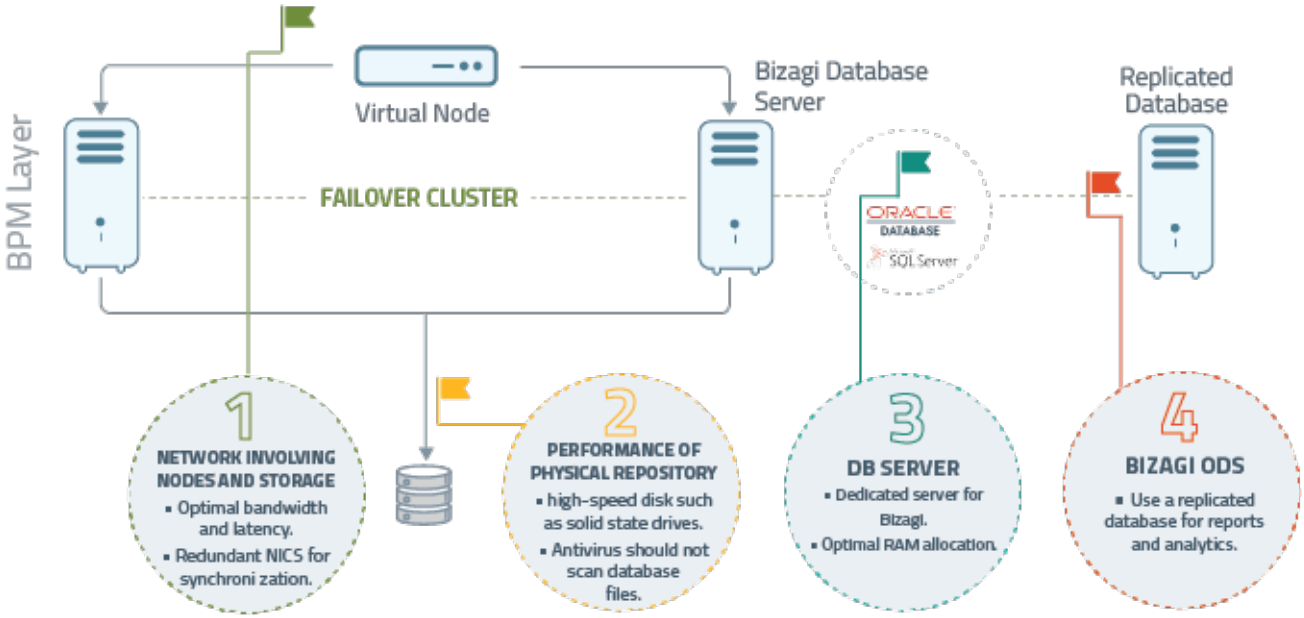
The sub-sections below will elaborate on best practices and requirements to consider for the different assets in each tier.



Database tier

The database tier (data access layer) is where the database engine is installed (i.e, SQL Server, Oracle).
For high availability, use 2 or more nodes in a database cluster configuration (mainly for fail-over capabilities, or to use an active-active distribution when using Oracle RAC).

The following diagram highlights the database tier configuration, and which aspects are critical for best performance:



As pin-pointed above, consider:

1. DB SERVER.

- It is strongly recommended to use a dedicated database server to host exclusively Bizagi database.

This is so, in order to avoid having other databases take up the host resources and end up affecting Bizagi (or vice versa).

- Assign the most RAM possible to database servers, and according to your project's sizing estimation and keep in mind that you may scale-up the database server in terms of RAM allocation.
- If you are using Oracle, then you may choose to use an active-active scheme (Oracle RAC).
- It is especially important for the database servers to use high-speed disks (these will constantly perform I/O operations).

In case that you are virtualizing your servers (i.e on VMWare products such as vSphere, Hyper-V, or cloud compute services such as Azure or Amazon WS), then it is really important that the host machine provides high-speed disks as well and that the VM at the host is configured to use a reserved/dedicated amount of resources accordingly. For further detail on such VM set up recommendations, refer to Guidelines for Bizagi using compute virtualization.

2. NETWORK INVOLVING NODES AND STORAGE.

- Make sure an optimal network configuration for your cluster setup.

Optimal network characteristics must consider especially a low latency (e.g, usually accomplished by having the nodes of a database cluster in a same network segment or connected directly).

- Rely on your database engine vendor's official guidelines and recommendations when setting up the cluster.

Common recommendations such as using redundant NICs for cluster synchronization will apply.

3. PERFORMANCE OF THE PHYSICAL DATA REPOSITORY.

- Optimal performance of the physical data repository includes following best practices when setting up a SAN, and also providing a low latency between the database nodes and the shared storage, as well as ensuring you use high-speed disks for the underlying storage (e.g, using solid state drives), so that the I/O processes do not become a bottleneck.
- Regarding database files, it is very important that anti-virus software do not scan or interfere with them.

4. BIZAGI ODS.

- The use of Bizagi ODS configuration allows you to use BI features without affecting assigned resources for transactional operations.

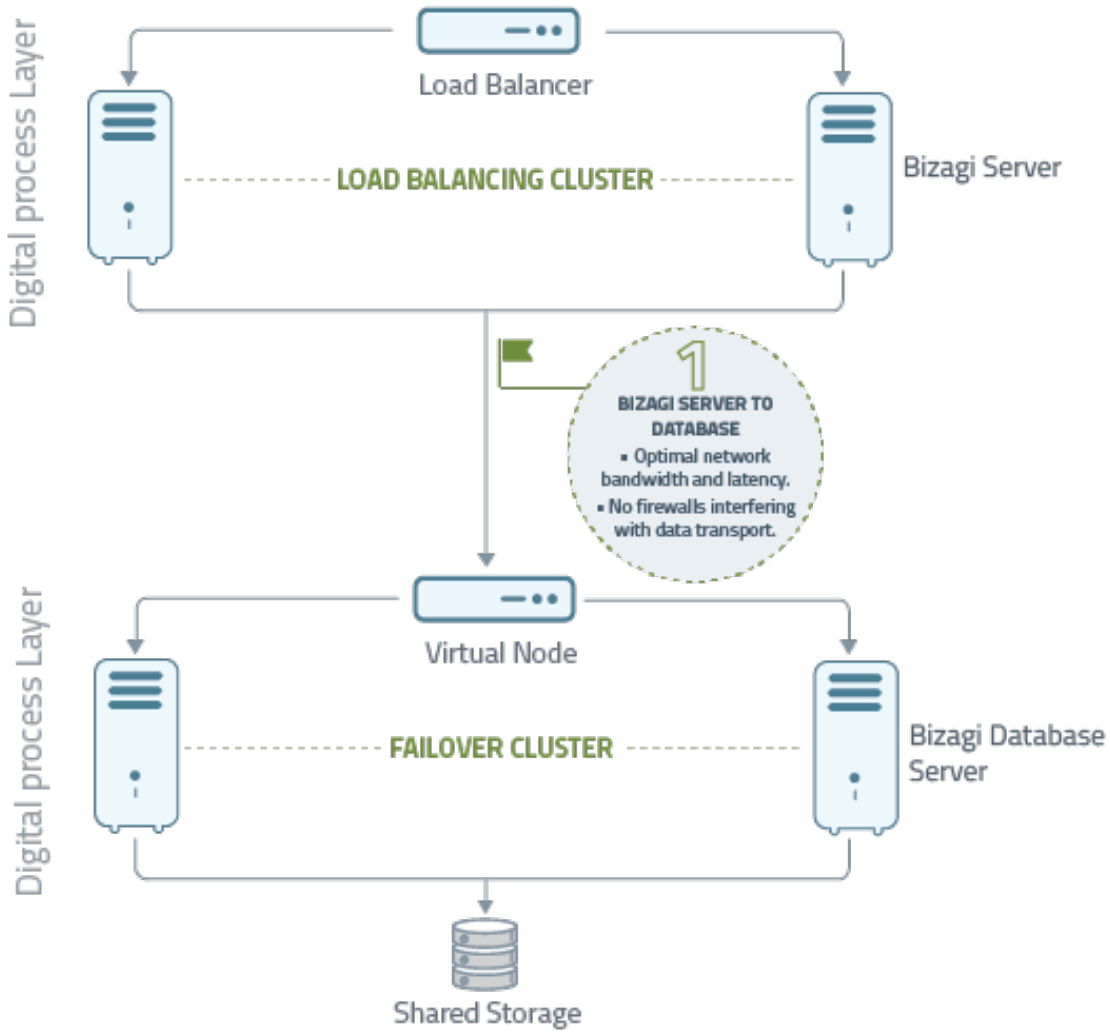
Through this option, BI features (those which are not usually part of critical daily work, such as process analytics or reports) are run in separate database which is set up by means of replication technologies of the database engine per se.

This way, executing queries that typically involve large volumes of information will not impact your processes operations, especially if your system is highly concurrent.

Network between database and Bizagi

The network between the database and Bizagi servers (connectivity to the database), plays an important role in Bizagi system architecture.

The following diagram highlights this part and the aspect which is critical for best performance:



As pin-pointed above, consider:

1. BIZAGI SERVERS TO DATABASE

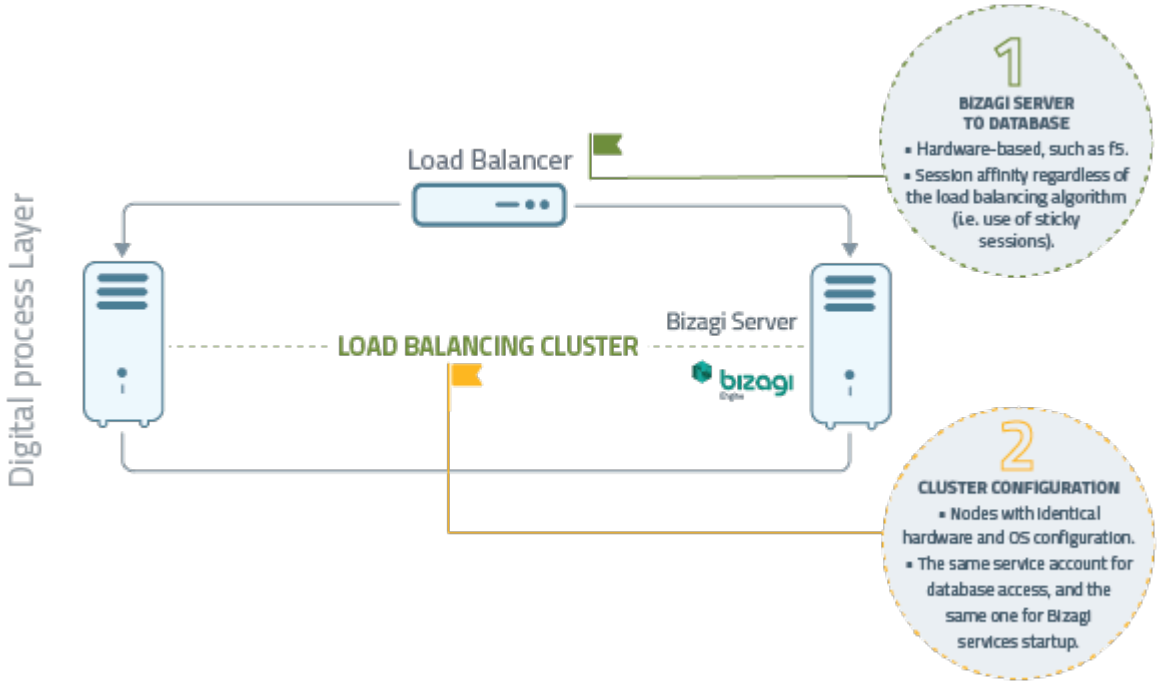
- Optimal network characteristics between the database and Bizagi servers, must consider especially a low latency (e.g, usually accomplished by having these servers in a same network segment, usually with a switch in between).
- It is important that an average latency of 0,15 ms is met.

A suggested bandwidth (e.g, for instance using optical fiber technology). considers at least 10,000 kb in 64ms.

Digital process tier

The Digital process tier is where Automation Server runs.
For high availability, use 2 or more nodes in a Bizagi cluster configuration with load balancing capabilities.

The following diagram highlights this tier's configuration, and which aspects are critical for best performance:



As pin-pointed above, consider:

1. LOAD BALANCER

- Use a hardware-based load balancer, such as f5.

Hardware appliances providing load balancing capabilities are known to support higher concurrency and overall perform better than software-based load balancers.

- While using a load balancer, make sure that you configure session affinity regardless of the employed algorithm (e.g, in a .NET-based environment, this concept is known as sticky sessions).
- Apart from session affinity, you may employ a dynamic algorithm that considers important factors of your nodes, such as: the response time or the number of connections in each one. For instance with f5, and provided that all your nodes have a homologous or very similar specification or configuration (hardware, network configuration), then you may use the ***Least response time*** algorithm.

2. CLUSTER CONFIGURATION

- Follow best practices for a cluster setup, and as issued by your database engine vendor.

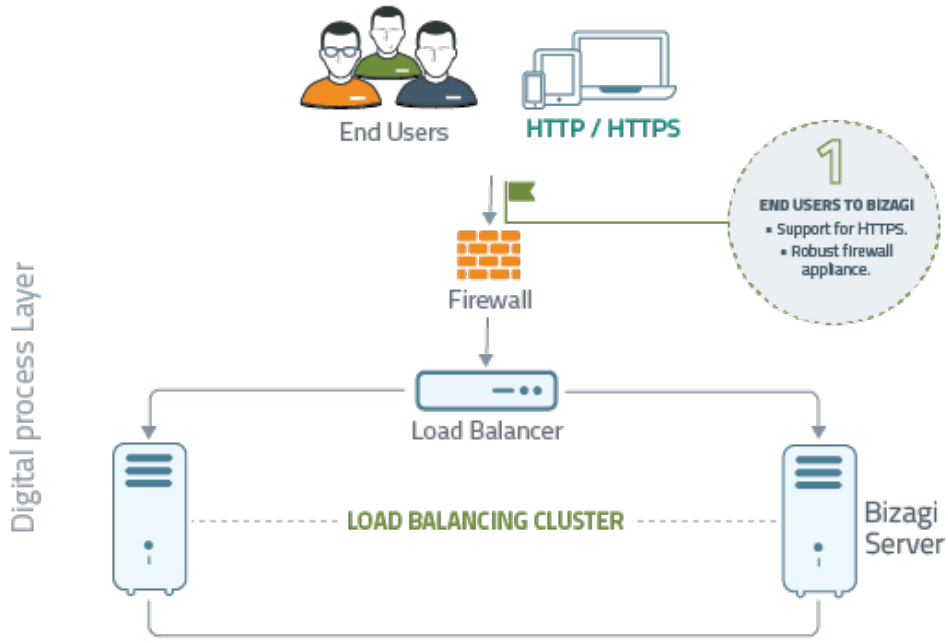
Common recommendations such as using an identical server configuration for all nodes in a cluster, or disabling the operating system's automatic upgrades, will apply to Bizagi servers.

- While maintaining an identical server configuration for all nodes, make sure that these use the same service account to access the database engine, the same service account for application start-up (and further access to attachment's file server), and the same configuration to connect to the SMTP service.

For a best reliability on your hardware sizing analysis and the load balancing algorithms, use a dedicated server to host Automation Server.

Network for end users

The network used by end users to access Bizagi is not demanding in terms of bandwidth, though it should implement significant security measures.
The following diagram highlights this part and the aspect which is critical for a secure access to Bizagi:



As pin-pointed above, consider:

1. END USERS TO BIZAGI

- Security access to Bizagi is promoted by setting HTTPS support.

No special or further considerations are required in terms of the network connectivity offered for end users access (Automation Server is optimized and designed to support end users connecting from the internet or working on overall slow networks).
Bandwidth specification is mainly bound to the expected file size of documents attached to your business processes.

- Rely on a robust firewall appliance as well for hardened security measures (e.g, a WAF such as Barracuda).

Other aspects

Regarding integration with your corporate systems, rely on your ESB when applicable (for business continuity support) while ensuring that network connectivity to the ESB or other systems is optimal as well.
An optimal network connectivity should consider adequate bandwidth according to the expected volume of information to be transmitted (i.e, consider the size of documents attached to the process when sending them over to another system, or the total amount of information exchanged when invoking external web services or in B2B integration scenarios in general).

Guidelines for Bizagi when considering compute virtualization

Overview

Automation Server executes your processes and delivers them to the desktops and mobiles of every business user.
For introductory information about Automation Server, refer to Automation Server - system requirement.

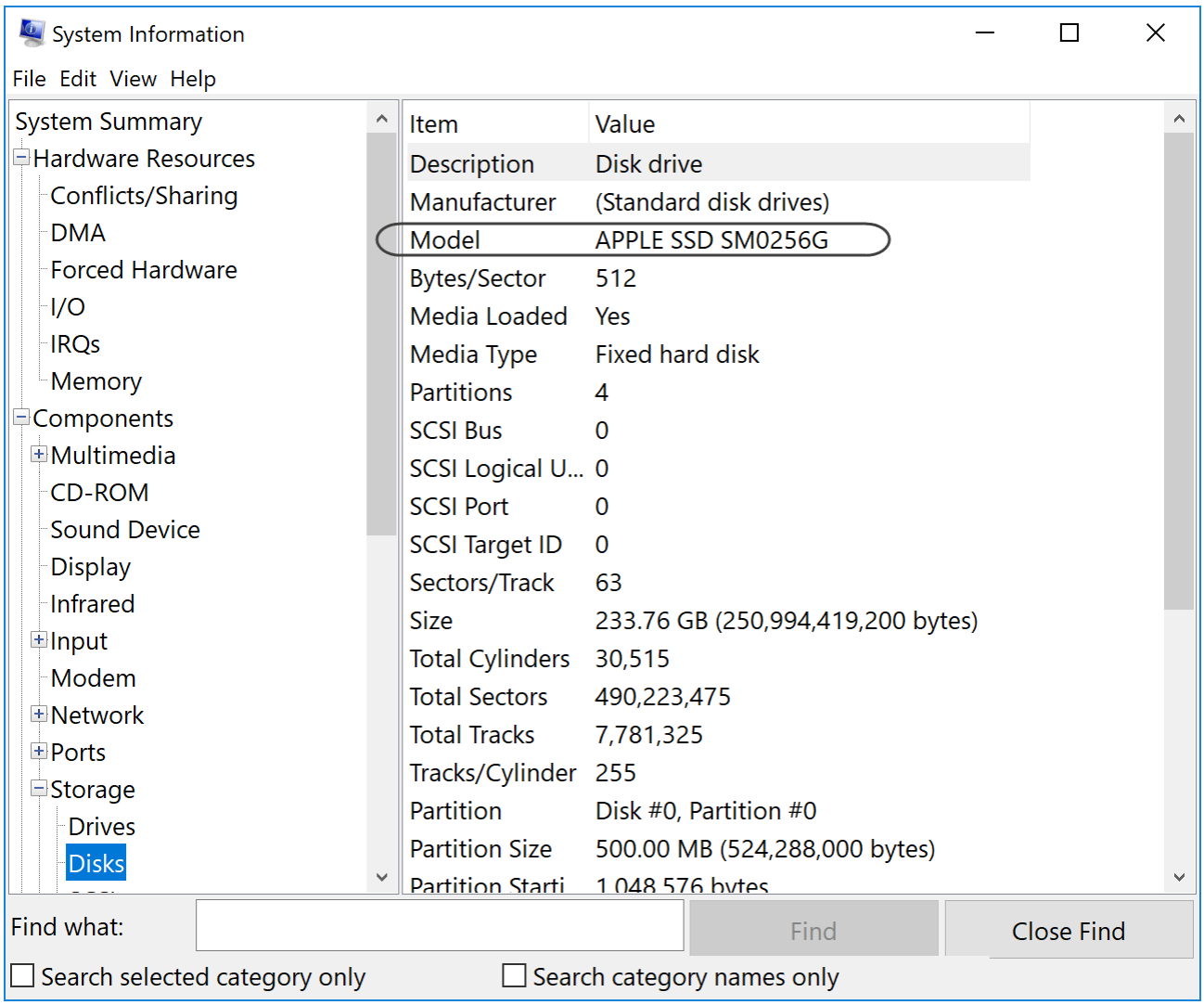
When setting up Automation Server, you will need to make sure that your hardware meets with minimum requirements and that these are aligned to the sizing estimation of your project.
You may set up Automation Server either directly on physical servers or on virtual machines.

The information presented here considers guidelines for you to set up Automation Server, along with its other fundamental assets of the system architecture (such as the database engine or network aspects) on virtual machines (e.g., using VMWare products such as vSphere, Hyper-V, or cloud compute services such as Azure or Amazon WS).

VM Host characteristics

It is especially important for the host (physical servers) of VMs with databases, to have high-speed disks (e.g., SSD, high RPM).
The database in Bizagi will be constantly performing I/O operations.

You may check if your disk is SSD, or choose to look up the disk's exact manufacturer and model to get to know its RPM specification.

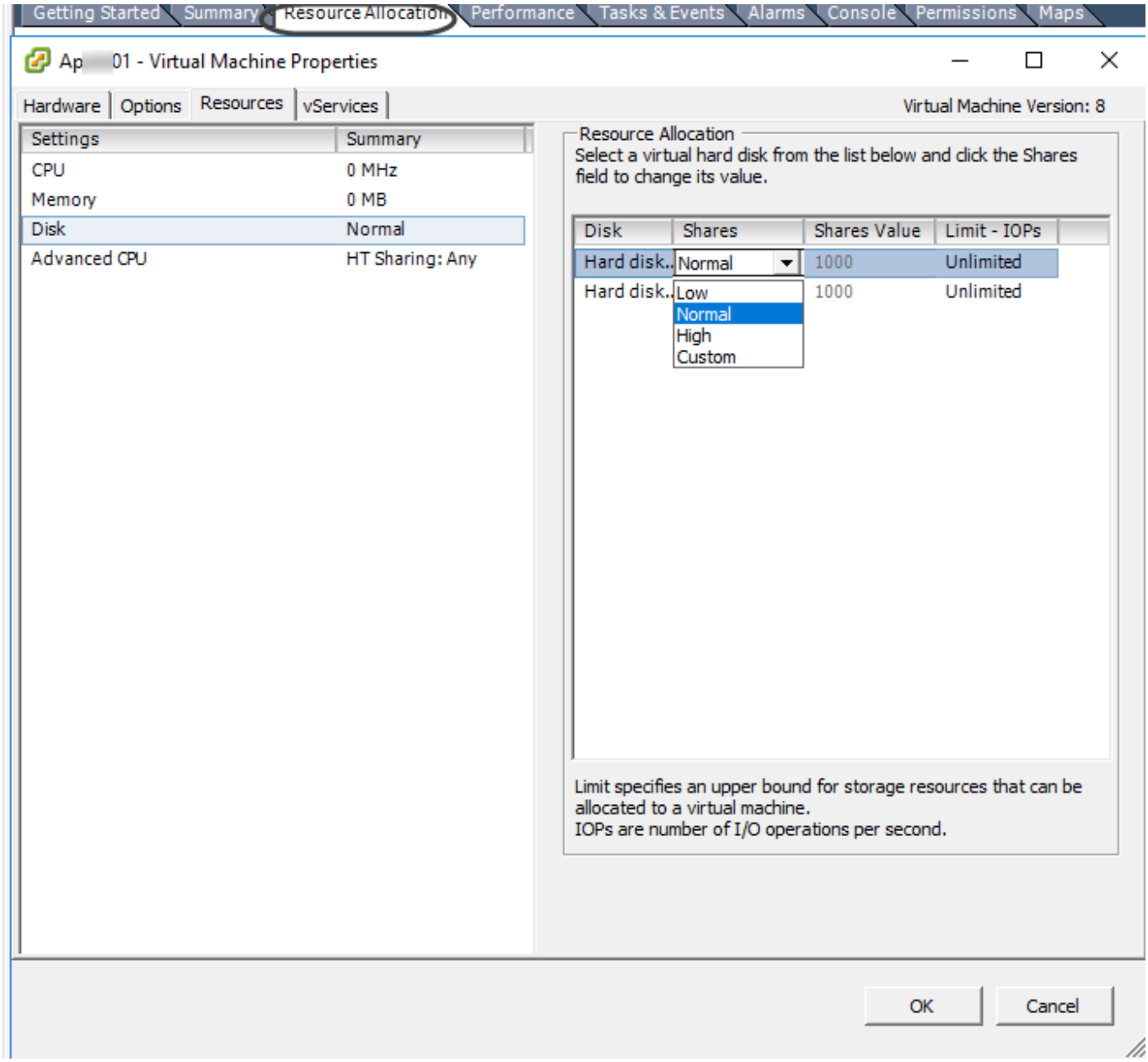


VM allocated resources (limits and reserved resources)

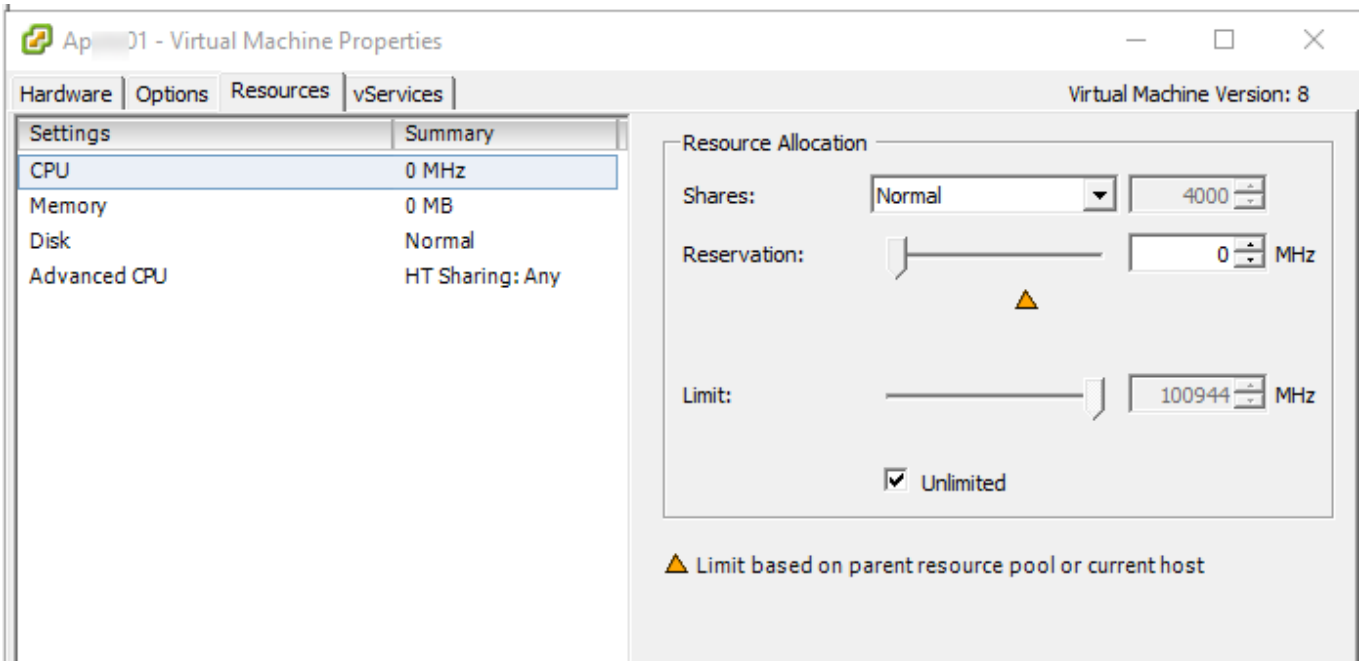
Whenever multiple VMs are configured on a shared host, it is strongly recommended that you tune how the resources are allocated and optimized for each VM.
Consider that each VM would still need to comply to minimum requirements and be aligned with recommended practices according to the type of service they support (e.g., either a Bizagi server or a database server), as described at System architecture recommended practices.

Thoroughly analyzing capacity and sizing, is specially useful to make sure that certain VMs use settings on explicit limits on the resources they can use, and similarly have a reserved amount of resources allocated for their continuous operation (regardless of how other VMs on the same host are performing).
This comes to be relevant especially if there is "contention" (CPU contention, RAM contention, etc).

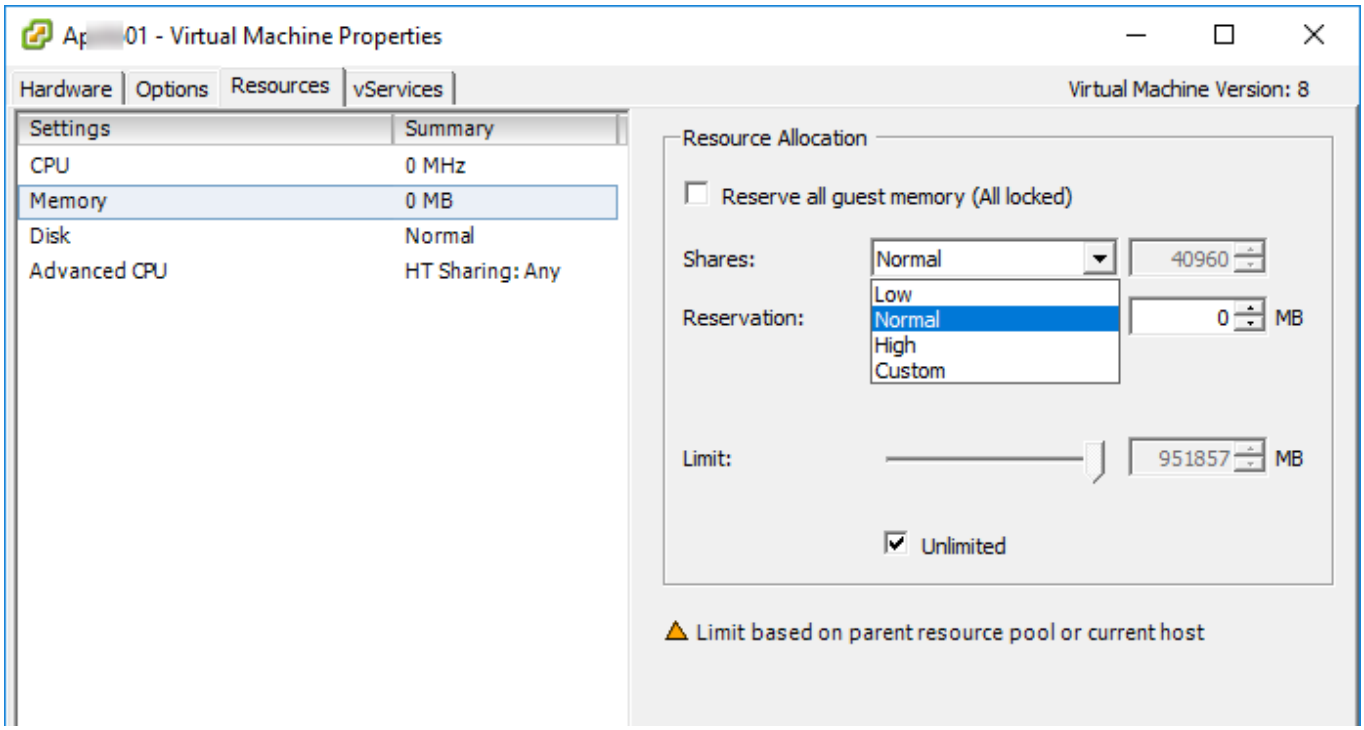
The image below shows an example of how with vSphere, you can configure specific resource allocation for a VM regarding Disk usage (or CPU and memory):



For CPU, you may increase the default ***Shares*** and choose to explicitly assign processing (in MHz) for that VM exclusively (i.e, ***Reservation***) or set a maximum usage limit:



A similar configuration is presented to configure memory (RAM):



The bottom line when using compute virtualization, is to make sure you are fully aware of the following:

- Virtual machines share a host, and some of that host's specifications are common and applicable to all of the virtual machines on top of it (such as disk speed).
- Others resources of the host are made available to virtual machines as a "pool of resources" (such as RAM and CPU), in a way that, virtual machines may end up competing over these type of resources. You may tune this behavior by conducting a thorough analysis so that you can optimize resource allocation separately for each different virtual machine (by setting limits or reservations accordingly).
- According to the above statements, the more virtual machines you set up on a same host, the more critical it becomes for you to tune and watch after how resources are handled by each virtual machine. Increasing the number of virtual machines on a same host may impact performance of common hardware resources which can't be reserved separately (such as disk speed).

Performance and scalability benchmark

Overview

For Bizagi, it is of critical importance that its projects deliver business processes which meet customers expectations.
Among these expectations and while supporting powerful functional aspects as well, Bizagi is committed to comply with non-functional aspects such as robustness and adequate performance, especially for volumes which are representative to the customer requirements.
In order to set up such business processes in a platform that offers adequate performance, it is important that customers follow the recommendations as issued by Bizagi, which includes official online documentation or any additional documents as provided by authorized Bizagi personnel.

This document presents a load test report which may be used as a benchmark analysis, in order to guide and support decisions oriented towards choosing an adequate system architecture in terms of hardware requirements and an appropriate configuration while provisioning the infrastructure for Automation Server.

Software version

The load tests apply to Automation Server version ***10.7***, running on a JEE platform.

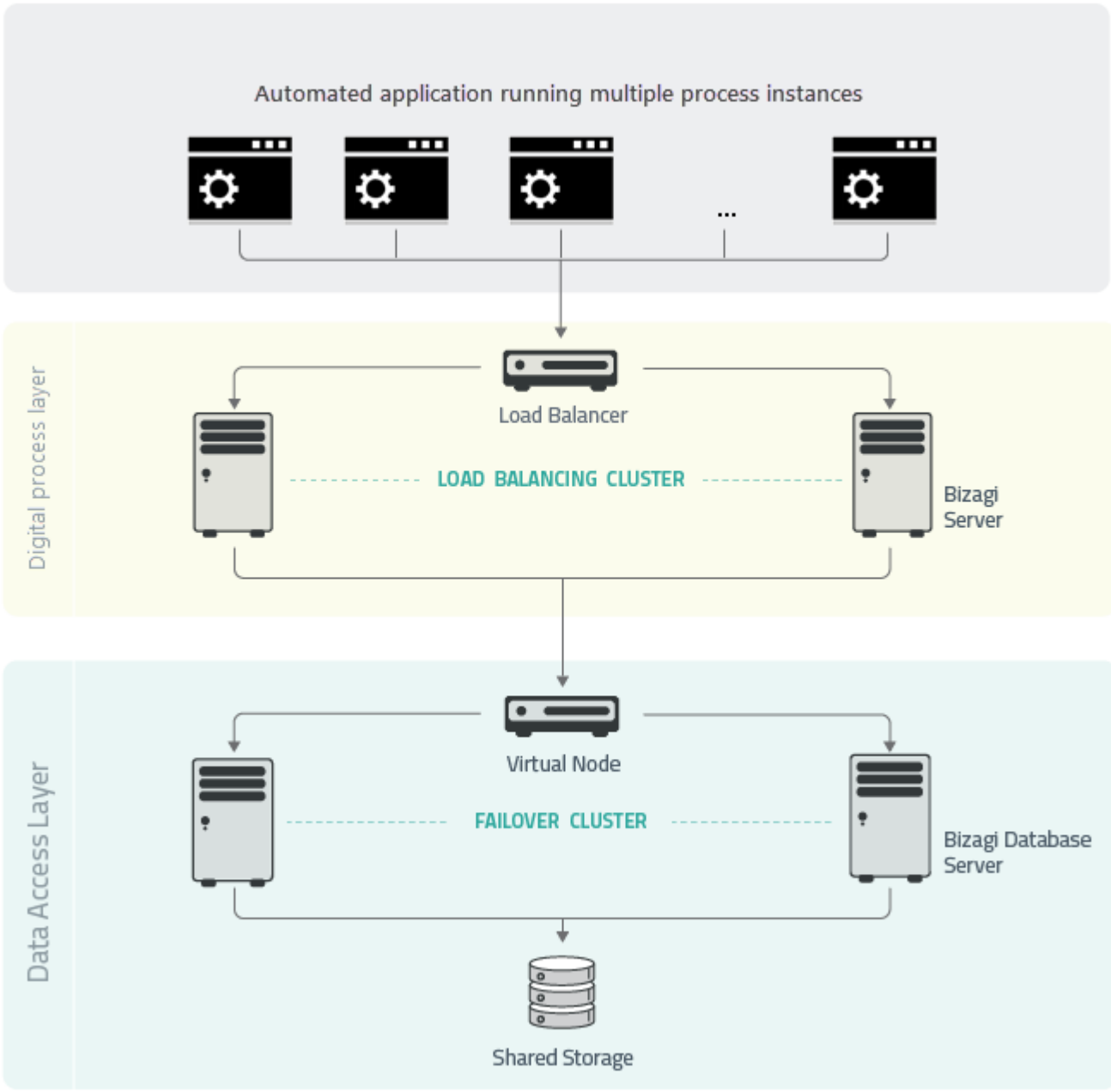
Methodology

The load tests carried out in this document were worked by using an automated application that runs multiple instances of a sample business process.
These load tests were run under 3 different benchmark scenarios: A ***Small load***, ***Medium load*** and a ***High load***.

The objective is to provide results from these load tests in terms of utilization of: CPU, memory, and IO.
Results from the load tests are focused on the processing and overall resources as demanded by back-end operations in the Bizagi server (where Automation Server runs).
Note that the processing carried out inside user interfaces is not considered, since user interfaces run on each client device and not on the server.

Benchmark profile and environment configuration

The following image illustrates the system architecture and setup used for the load tests:



All servers employed for load tests were dedicated to these tests solely.
No other business-oriented applications that would interfere with the availability of resources at the servers were running simultaneously (a controlled environment).

If you are planning to run other applications where Automation Server or its database is running, then you will need to make sure that your hardware sizing and configuration is appropriate in a way in which such additional applications do not affect the performance of Bizagi processes.

Hardware configuration

Refer to the following characteristics describing the hardware configuration in each layer and relevant element of the image shown above.

Digital process layer
The digital process layer hosts Automation Server.
For the load tests, Automation Server was set in a clustered configuration using 2 nodes using Weblogic version 12.1 in a CentOS Linux release 7.2.1511 (Core).

Each node having the following characteristics:

EACH NODE OF THE BIZAGI CLUSTER		
HARDWARE	RAM	16 GB
	Hard Disk	Two disks of 80 GB - RAID 1, disk speed of 10,000 rpm.
	Processor	Intel(R) Xeon(R) CPU E5-2665 0, using a quad-core of 2.40 GHz (64-bit)

Database layer
The database layer hosts the database used by Bizagi processes.
For the load tests, Oracle 11g database (version 11.2.0.1) in a CentOS Linux release 7.2.1511 (Core).

DATABASE SERVER		
HARDWARE	RAM	16 GB
	Hard Disk	Two disks of 80 GB - RAID 1, using solid state drives
	Processor	Intel(R) Xeon(R) CPU E5-2665 0, using a quad-core of 2.40 GHz (64-bit)

Network characteristics
The database was setup in the same network segment of the Bizagi cluster, with a speed of 10 Gbps (full duplex).

Benchmark business process

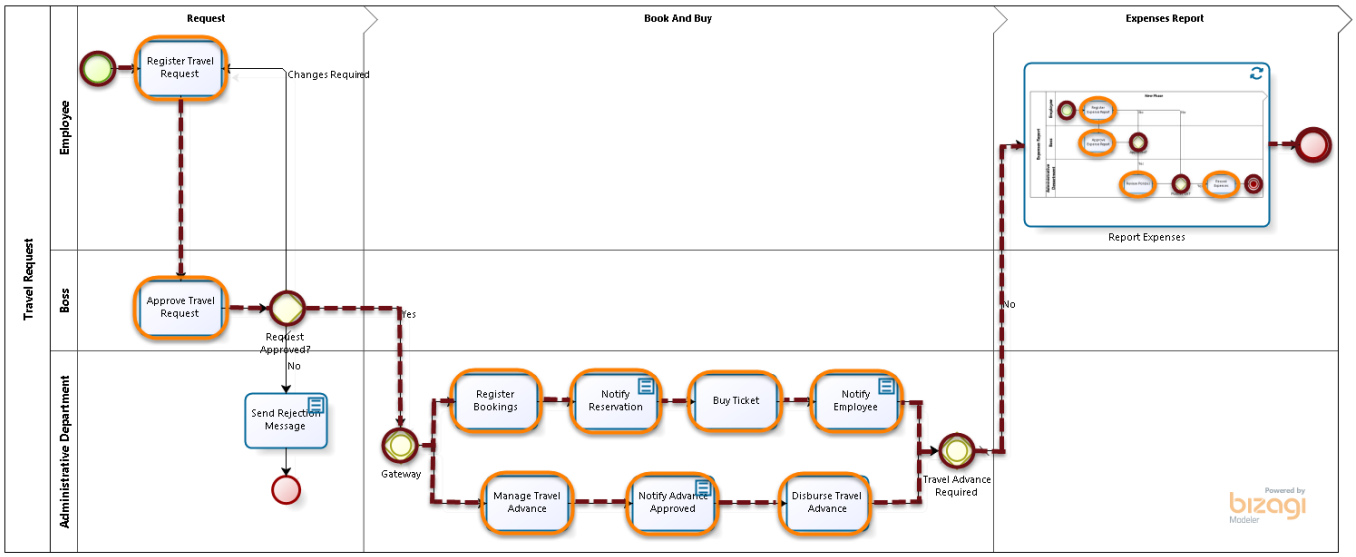
As noted in the Methodology, the load tests consider a sample business process which is presented as a baseline. Therefore, it is important to acknowledge that this sample process has its own characteristics which may not be the same ones of your own project's implementation.
This means that the test results presented in this document use linear extrapolations and should be interpreted as minimum requirements (your results may differ).

Results are expected to be complemented with detailed sizing analysis to be conducted for your implementation, i.e while considering any other factors that directly influence the execution of processes in Bizagi.
Such factors include: any additional significant processing being executed in your processes' business rules and integration points (whether Bizagi executes third party APIs, external web services or others that involve heavy resource-consuming logic), the estimated size and amount of business documents handled as attachments in Bizagi, and any other aspects of the customer premises and infrastructure, especially while integrating with your corporate systems, among others.

Characteristics of the sample process

The test results reported in this document consider a Travel request template (as available in Bizagi Process Xchange) as the sample business process.
Since this Travel request template has more than one possible path, the path taken for testing purposes was the one in which a full process cycle is completed while having no business exceptions.
Such path presents the most possible quantity of processed BPMN shapes (e.g activities, Sub-Processes, events, gateways).

The following image presents the BPMN shapes defining the Travel request process and the path used for these tests:



A total of 24 BPMN shapes are processed for each instance of the Travel request process.

Benchmark scenarios and concepts

Since the objective is to provide results from these load tests in terms of utilization of: CPU, memory, and IO, and overall throughput for the 3 different benchmark scenarios (***Small load***, ***Medium load*** and ***High load)***, the following section describes the load used by each scenario and the definition for throughput in Bizagi projects.

Throughput definition

Throughput for Bizagi projects is primarily defined as number of BPMN shapes processed per unit of time.
In Bizagi's terminology, this is referred to as the number of processed ***workitems*** (per second).
Workitems can usually be seen mainly as activities of the modeled process, though it considers others such as Sub-Process, events and gateways since these involve processing and additional logic behind.

Small load scenario

This scenario consists of an automated application generating 250 new workitems per minute.

Medium load scenario

This scenario consists of an automated application generating 500 new workitems per minute.
This load is two times the one presented in the small load scenario (2x).

High load scenario

This scenario consists of an automated application generating 1000 new workitems per minute.
This load is four times the one presented in the small load scenario (4x).

Results

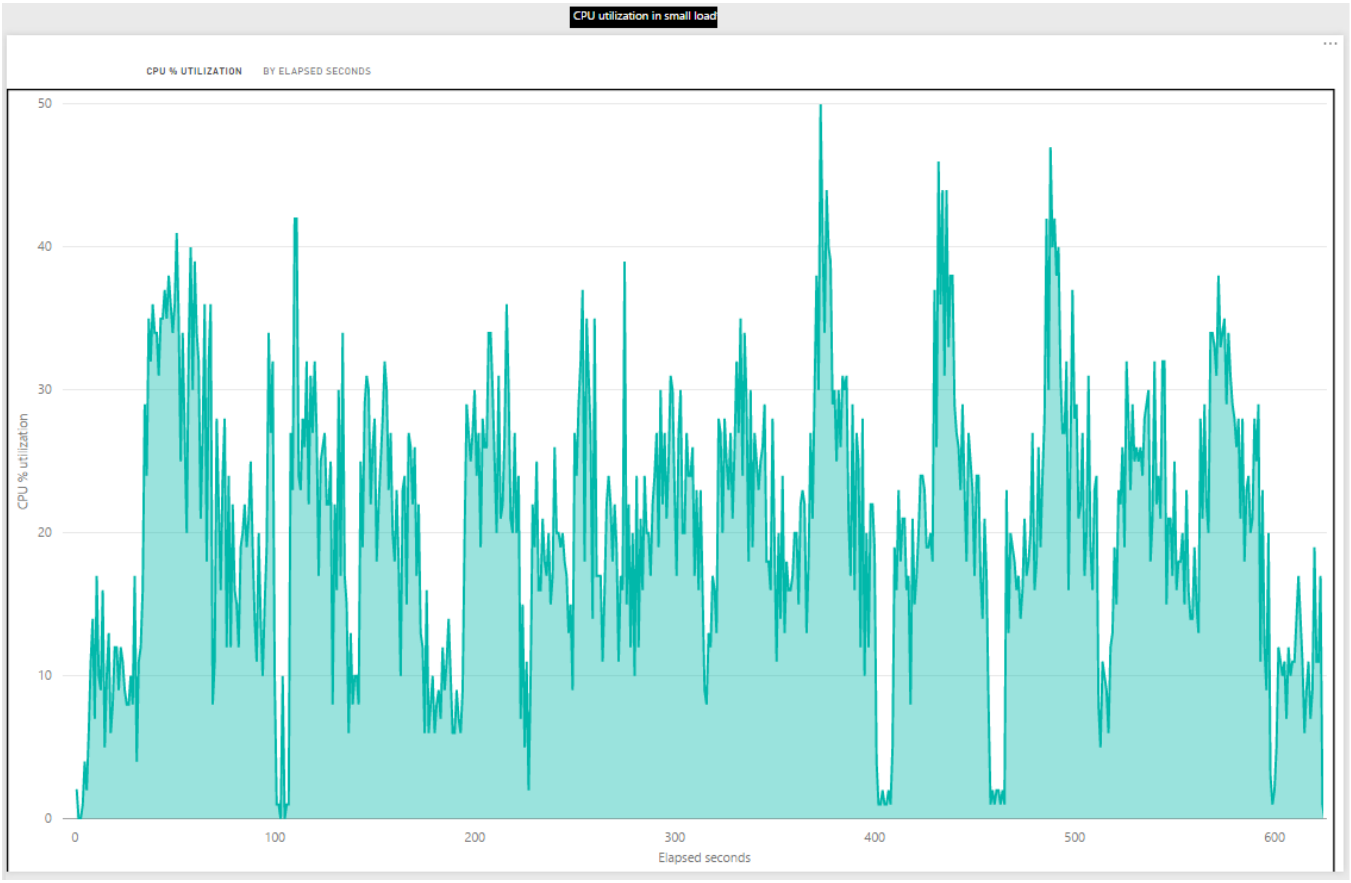
The load tests results presented in this document are classified in terms of utilization and performance of: CPU, memory, and IO.
The following results are displayed for a 600-seconds time frame sample.

CPU utilization

CPU % utilization given for the 3 different scenarios, as recorded throughout elapsed seconds for the given time frame sample.

- **Small load results**

The following image illustrates CPU % utilization:



The following facts summarize CPU % utilization:

- ***Maximum***: 50%
- ***Average***: 20.6180%

- **Medium load results**

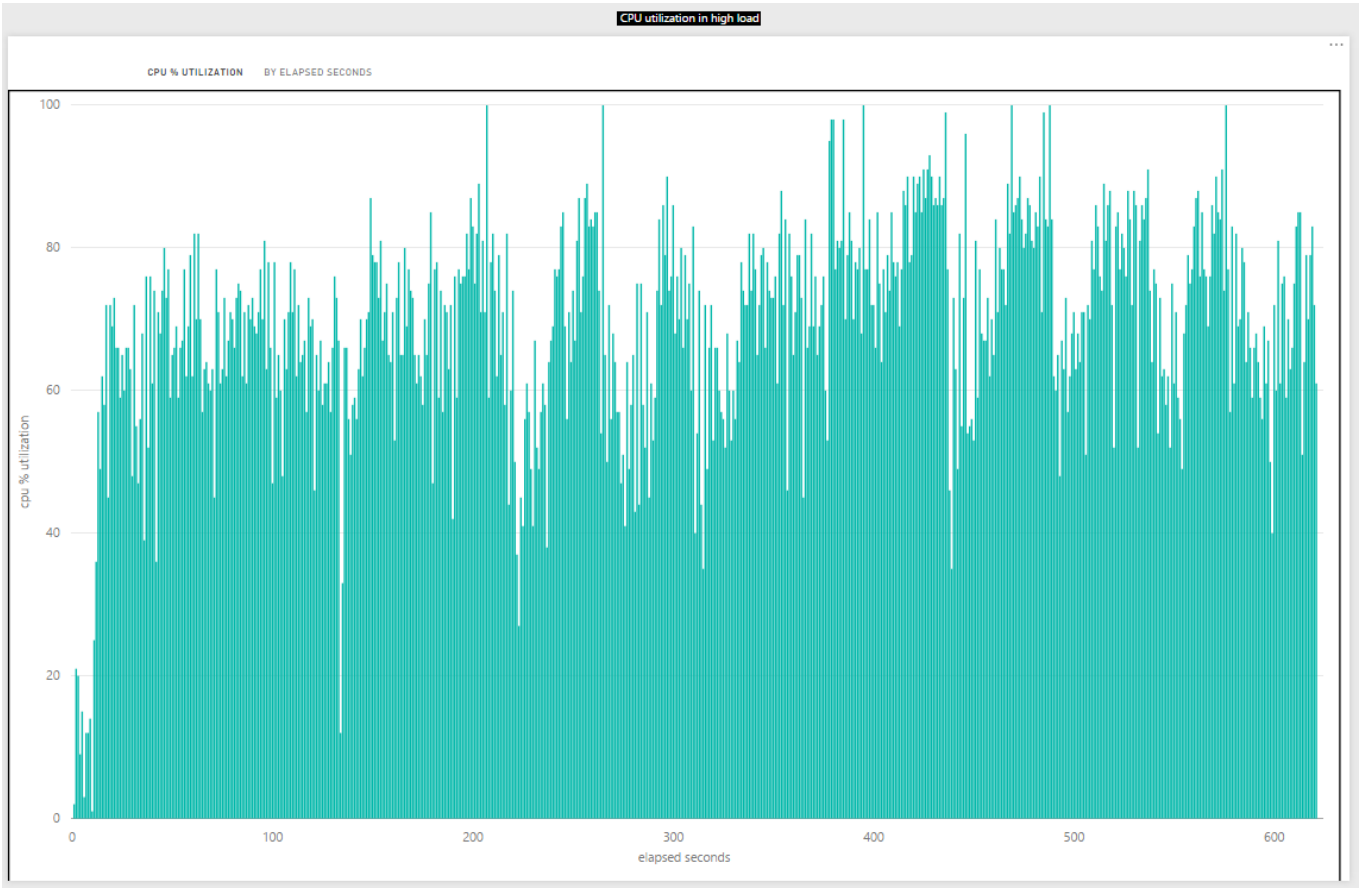
The following image illustrates CPU % utilization:

The following facts summarize CPU % utilization:

- ***Maximum***: 61%
- ***Average***: 38.87013%

- **High load results**

The following image illustrates CPU % utilization:

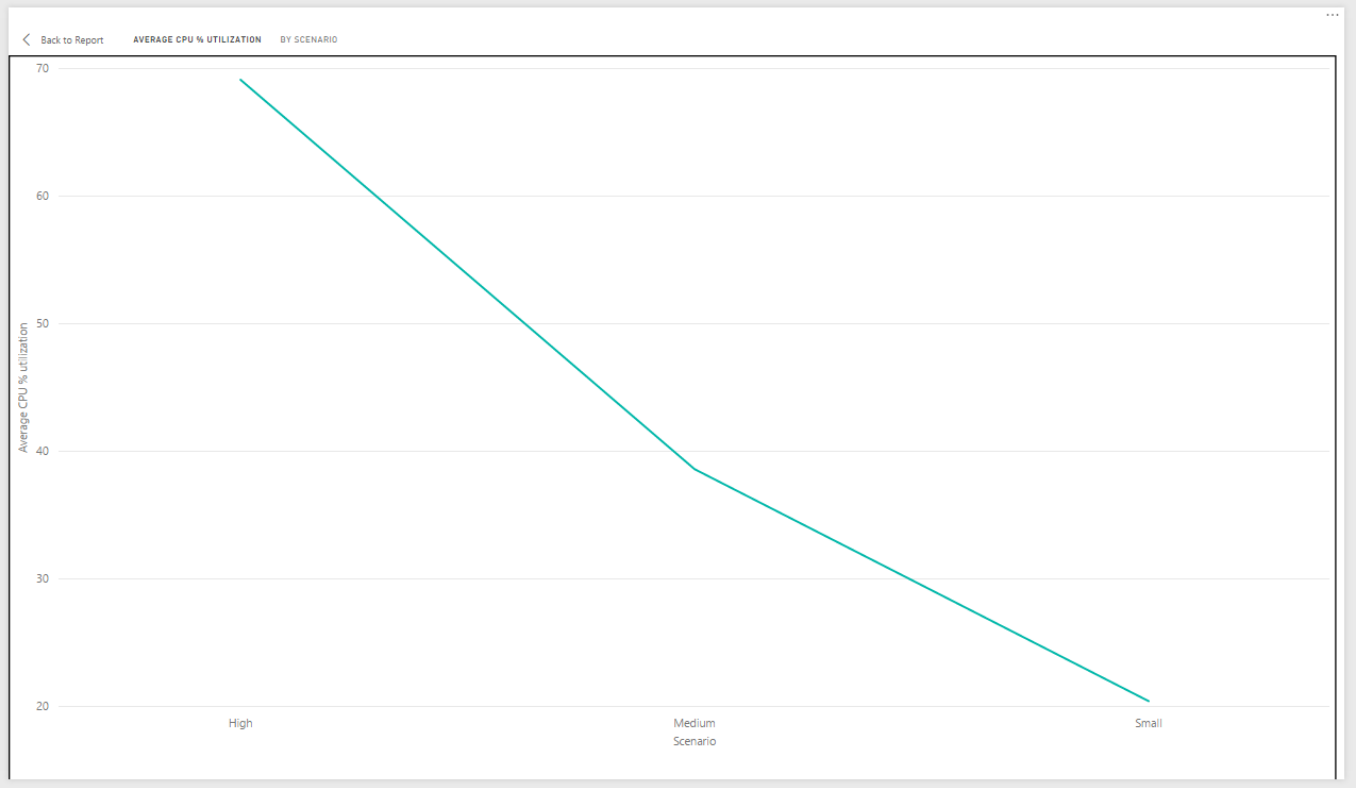


The following facts summarize CPU % utilization:

- ***Maximum***: 100 %
- ***Average***: 69.16264 %

- **Average CPU % utilization comparison**

The following image presents the 3 scenarios:

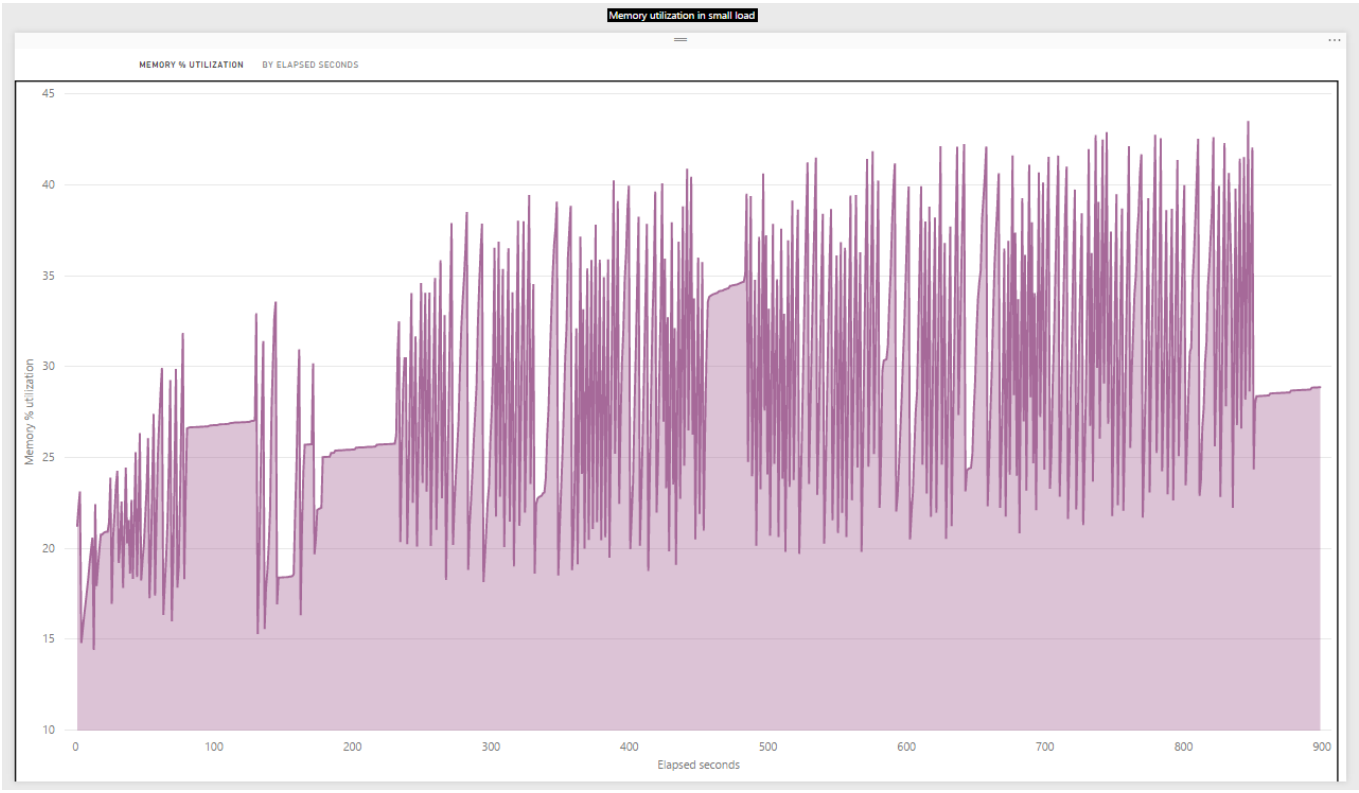


Memory utilization

Memory % utilization given for the 3 different scenarios, as recorded throughout elapsed seconds for the given time frame sample.

- **Small load results**

The following image illustrates memory % utilization:

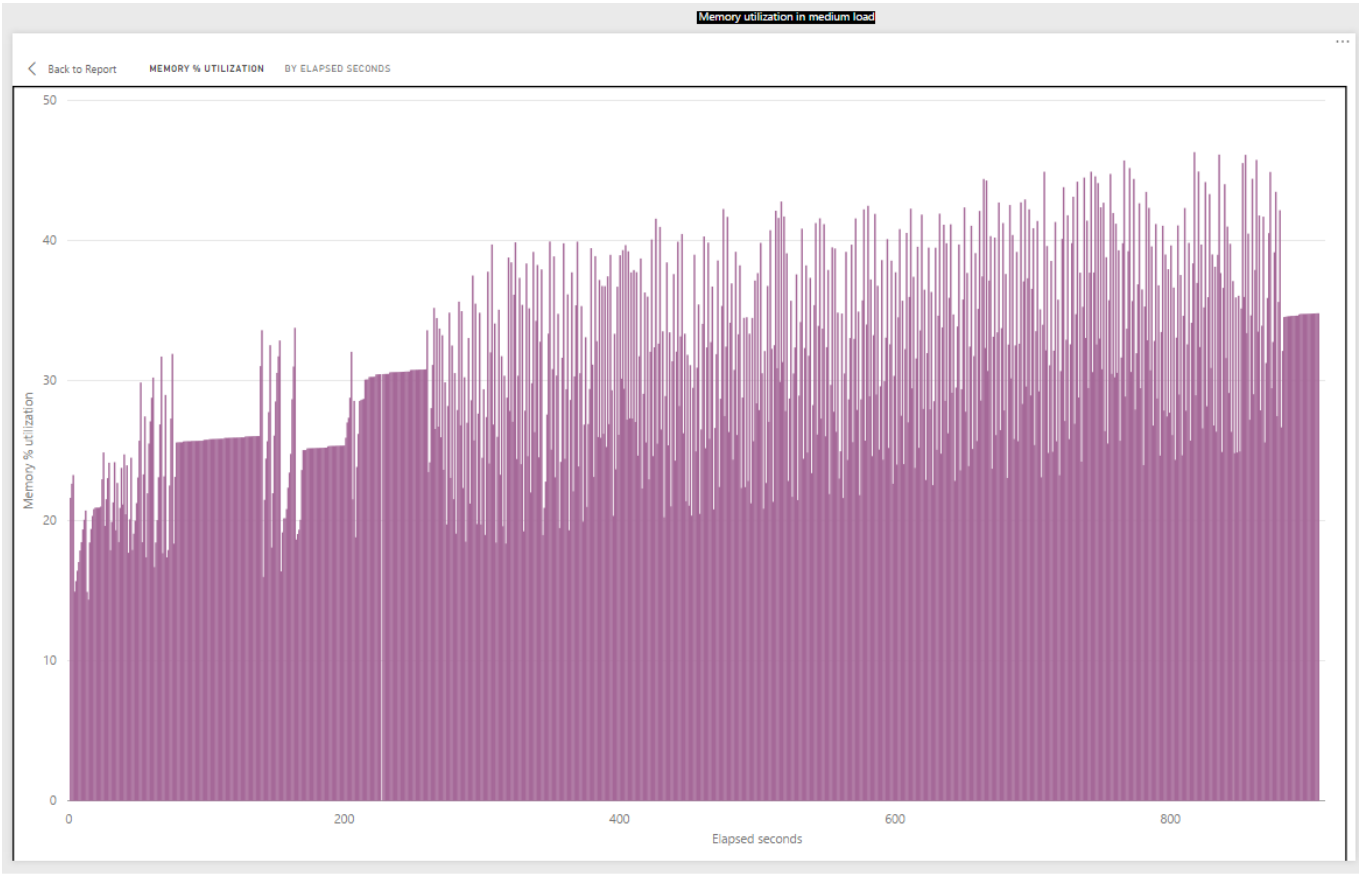


The following facts summarize memory % utilization:

- ***Maximum***: 43.5311 %
- ***Average***: 28.7644 %

- **Medium load results**

The following image illustrates memory % utilization:

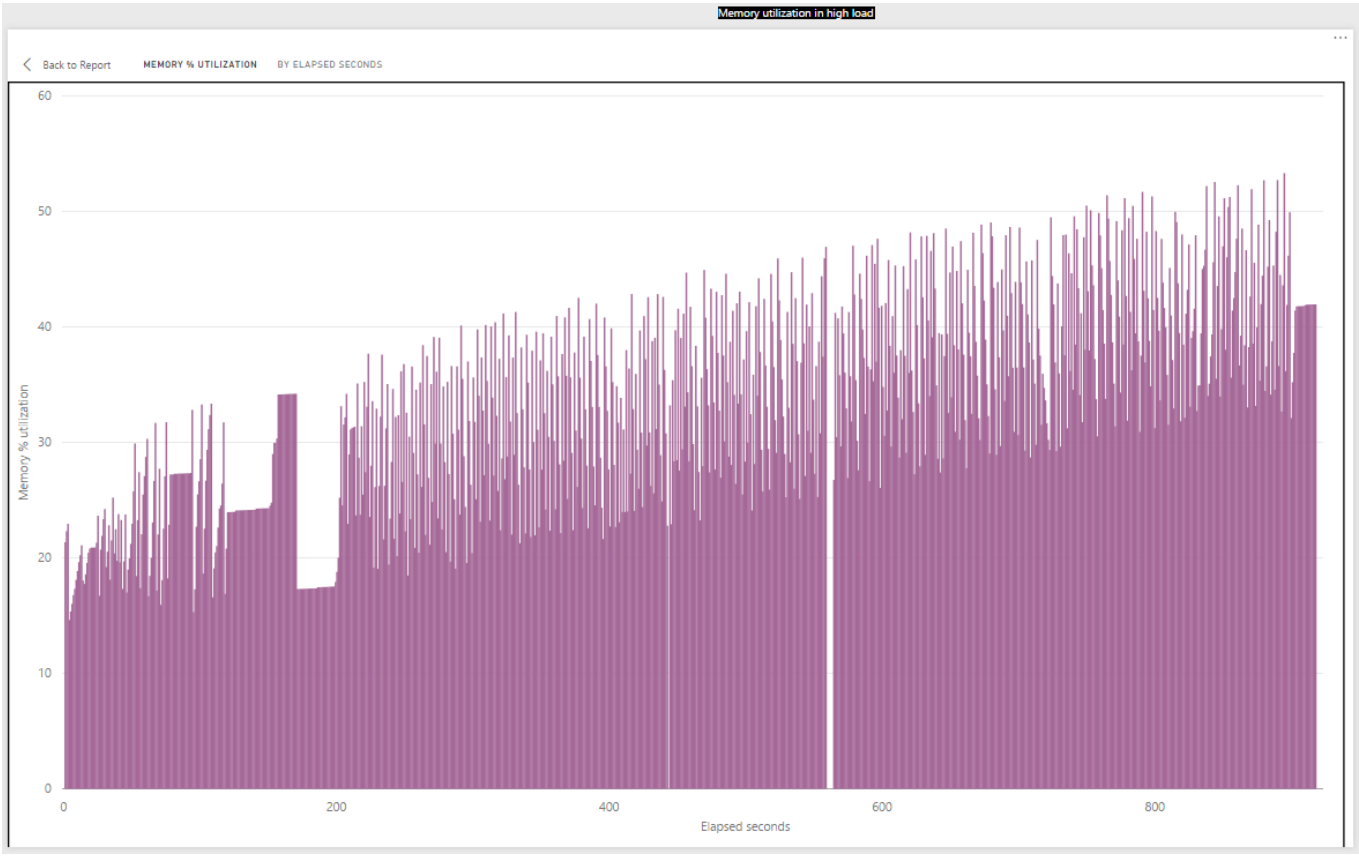


The following facts summarize memory % utilization:

- ***Maximum***: 46.3461 %
- ***Average***: 30.3962 %

- **High load results**

The following image illustrates memory % utilization:

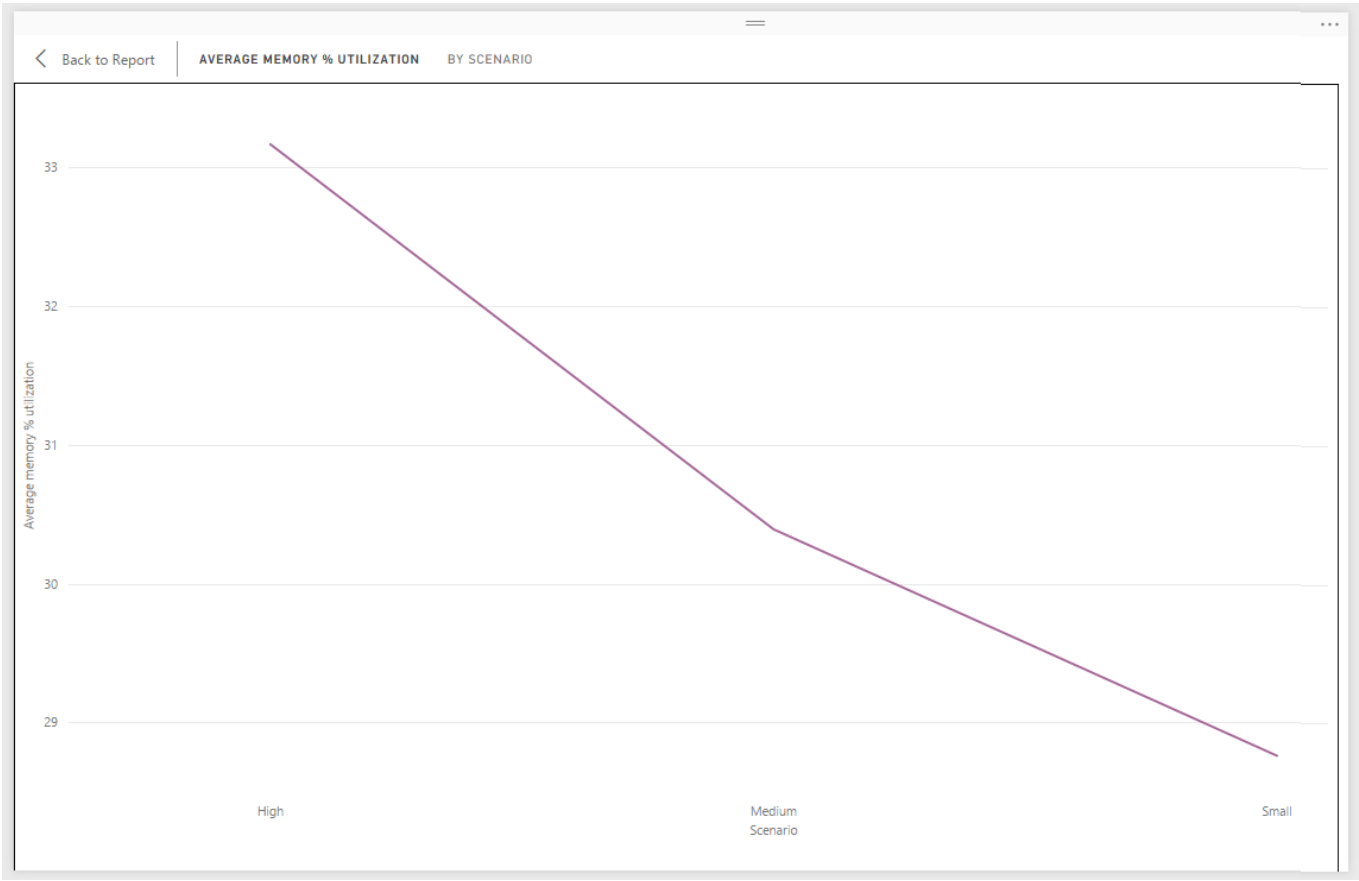


The following facts summarize memory % utilization:

- ***Maximum***: 53.3583 %
- ***Average***: 33.1713 %

- **Average memory % utilization comparison**

The following image presents the 3 scenarios:

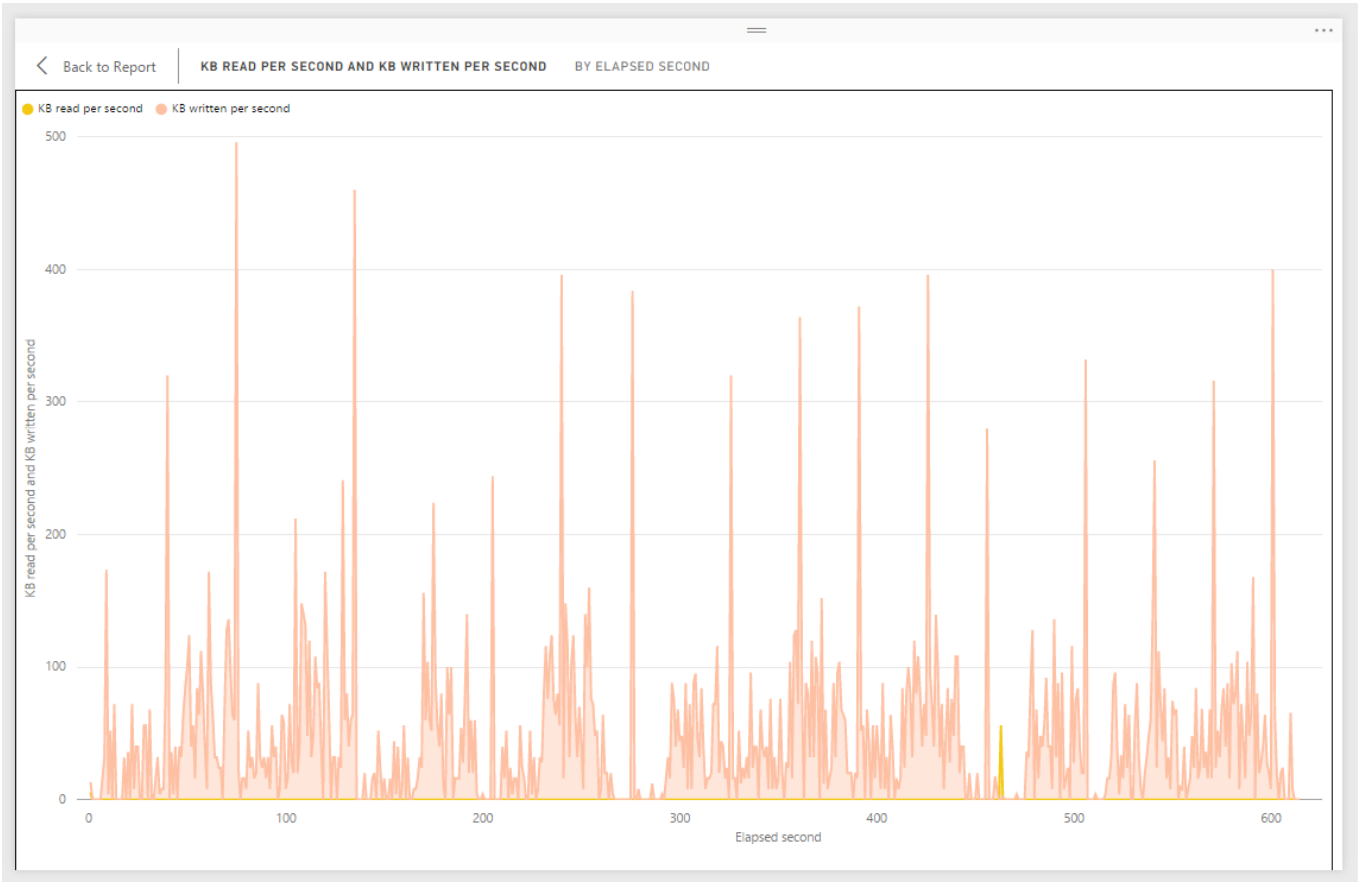


IO utilization

IO % utilization given for the 3 different scenarios, as recorded throughout elapsed seconds for the given time frame sample.

- **Small load results**

The following image illustrates IO % utilization:



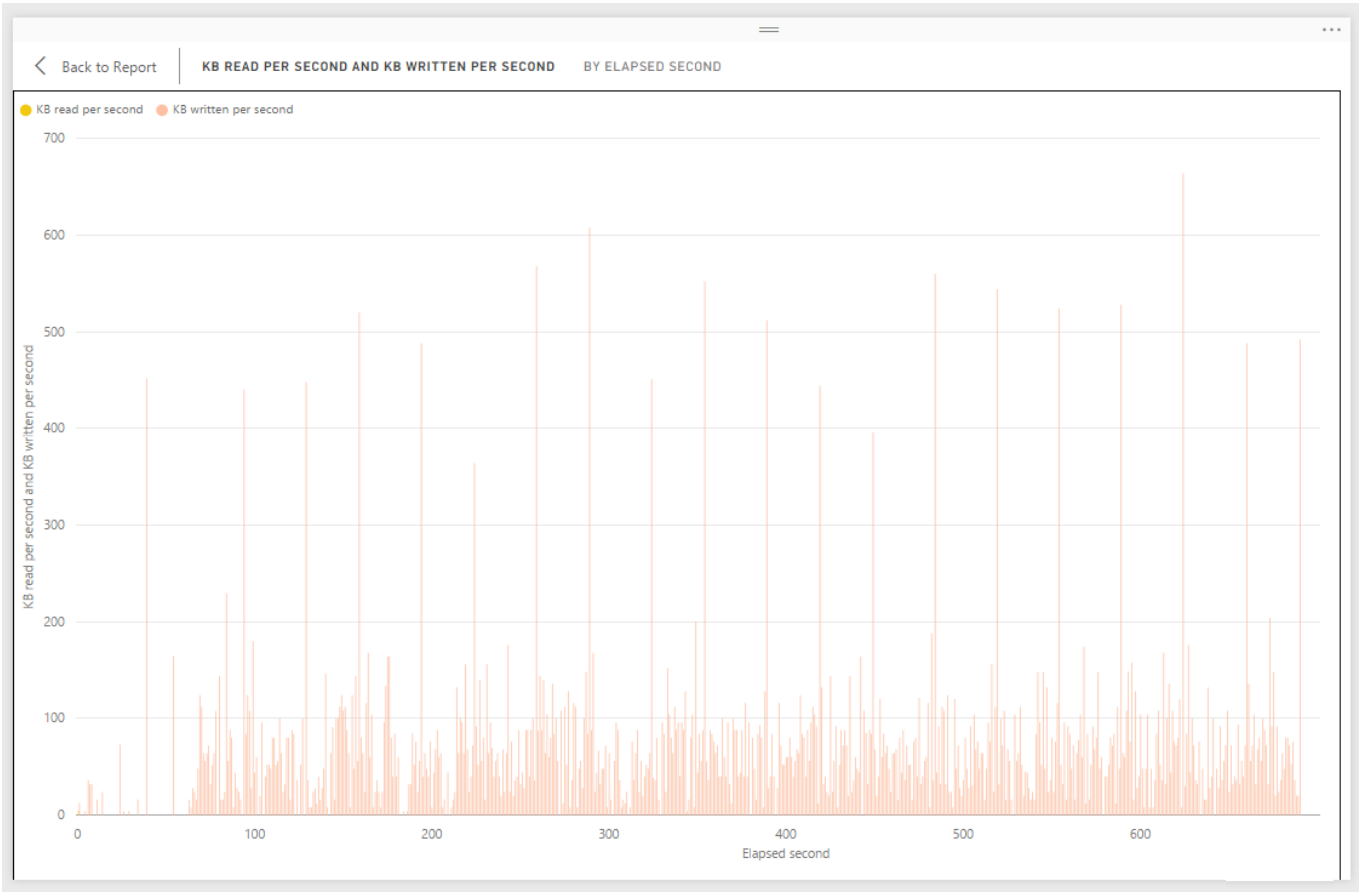
The following facts summarize IO % utilization:

- ***Maximum KB read per second***: 56
- ***Average KB read per second***: 0.0881

- ***Maximum KB written per second***: 496
- ***Average KB written per second***: 42.0994

- **Medium load results**

The following image illustrates the IO % utilization:



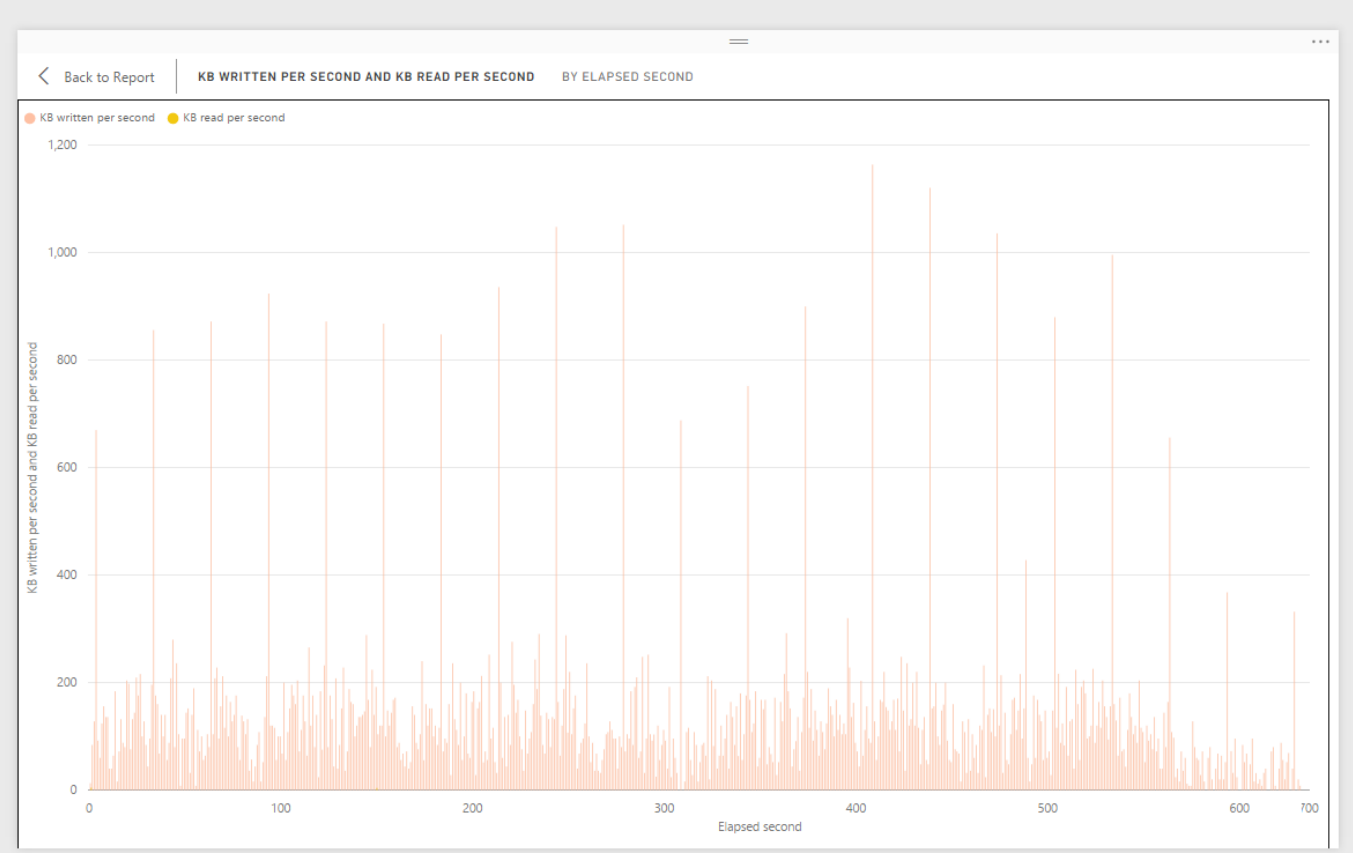
The following facts summarize IO % utilization:

- ***Maximum KB read per second***: 4.6
- ***Average KB read per second***: 0.0062

- ***Maximum KB written per second***: 664
- ***Average KB written per second***: 65.6982

- **High load results**

The following image illustrates the above CPU % utilization:



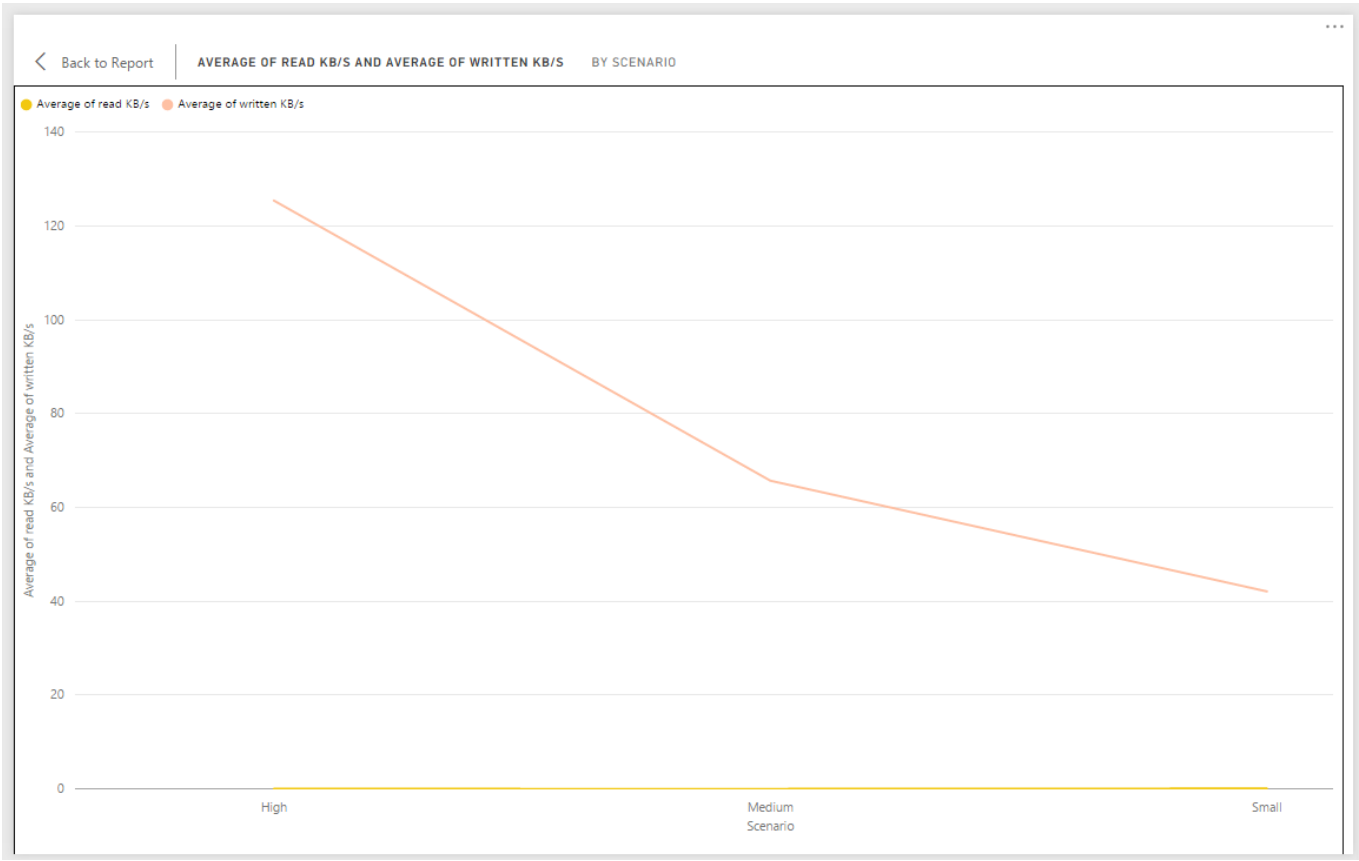
The following facts summarize IO % utilization:

- ***Maximum KB read per second***: 4.58
- ***Average KB read per second***: 0.0122

- ***Maximum KB written per second***: 1164
- ***Average KB written per second***: 125.4052

- **Average IO % utilization comparison**

The following image presents the 3 scenarios:



Important

The information presented here is provided for information purposes only, and the contents hereof are subject to change without notice.

This document is not warranted to be error-free, nor subject to any other warranties or conditions, whether expressed orally or implied in law, including implied warranties and conditions of merchantability of fitness for a particular purpose.

Bizagi specifically disclaims any liability with respect to this document and no contractual obligations are formed either directly or indirectly by this document.

Further documentation and resources

Recall that at anytime, you may scale-out your Bizagi project.

Bizagi provides an Excel spreadsheet for your project to carry out a sizing analysis for your specific requirements in terms of concurrent users and amount of activities to be processed per unit of time.

This way, you can determine if additional nodes should be added to your cluster setup. The Excel spreadsheet is referred to as the ***Sizing estimator,*** further details and its download link is specified at Sizing estimation.

Sizing estimation (capacity calculator)

Overview

Automation Server executes your processes and delivers them to the desktops and mobiles of every business user. For introductory information about Automation Server, refer to Automation Server.

The information presented here provides a quick reference for you to estimate hardware sizing (especially in terms of processing and memory) for the specific requirements of your project.

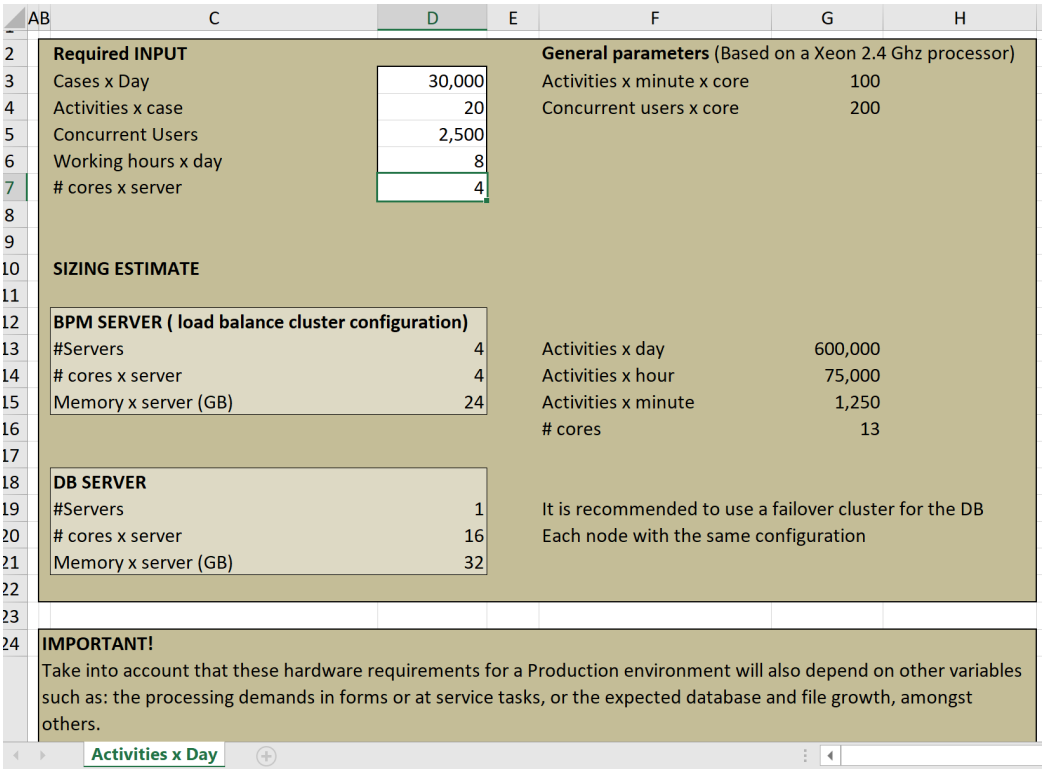
Scalability

Bizagi is highly scalable, allowing you to scale out or scale up your system architecture at any time.
Include additional nodes having Automation Server (scale-out) by ensuring these are considered within your load balancing cluster.
Regarding the database server, scaling out is available as supported by the database engine technology (e.g., Oracle RAC supports an active-active scheme). Otherwise and for instance for SQL Server, scale up your servers.

Sizing spreadsheet

It is critical for your production environment to rely on an estimate of the necessary resources to have Bizagi perform optimally while supporting your business' demands.
Minimum system requirements for Automation Server, according to your specific platform, are those presented at System requirements.

Conduct a sizing analysis for your project (i.e, to determine if you need additional nodes for the cluster, and the RAM memory or CPU processing needed), by using our Bizagi Sizing Estimator.



	C	D	F	G
2	**Required INPUT**		**General parameters** (Based on a Xeon 2.4 Ghz processor)	
3	Cases x Day	30,000	Activities x minute x core	100
4	Activities x case	20	Concurrent users x core	200
5	Concurrent Users	2,500		
6	Working hours x day	8		
7	# cores x server	4		
10	**SIZING ESTIMATE**			
12	**BPM SERVER (load balance cluster configuration)**			
13	#Servers	4	Activities x day	600,000
14	# cores x server	4	Activities x hour	75,000
15	Memory x server (GB)	24	Activities x minute	1,250
16			# cores	13
18	**DB SERVER**			
19	#Servers	1	It is recommended to use a failover cluster for the DB	
20	# cores x server	16	Each node with the same configuration	
21	Memory x server (GB)	32		
24	**IMPORTANT!** Take into account that these hardware requirements for a Production environment will also depend on other variables such as: the processing demands in forms or at service tasks, or the expected database and file growth, amongst others.			

Activities x Day

Estimation considered by this spreadsheet's formula is based on the following premise:
Automation Server while in a server employing a single core of a 2.4 GHz processor, and using 4GB of RAM, typically processes approximately 100 activities per minute (i.e workitems).

Achieving scalability in a Bizagi project is easily done by involving additional resources as per the measure provided above, while choosing horizontal scalability at best.
Variables affecting your environment's performance include: the number of concurrent users, the demanded processing behind, the estimated size and amounts of documents (file attachments), aspects regarding integration with other corporate systems, and the amount of daily cases or activities, amongst others.

Case studies

You may download here a PDF document containing case studies of Bizagi system architecture, in which operating environment setups are illustrated for large scale corporate projects having high processing volumes.

Database growth estimation

Overview

Automation Server executes your processes and delivers them to the desktops and mobiles of every business user. For introductory information about Automation Server, refer to Automation Server.

The information presented here provides a quick reference, regarding database growth estimation according to a Bizagi project's specifics.
The following case study presents results based on a specific scenario; such exercise applies for on-premises Bizagi projects.

System characteristics

The specifications of the system used for this reference are:

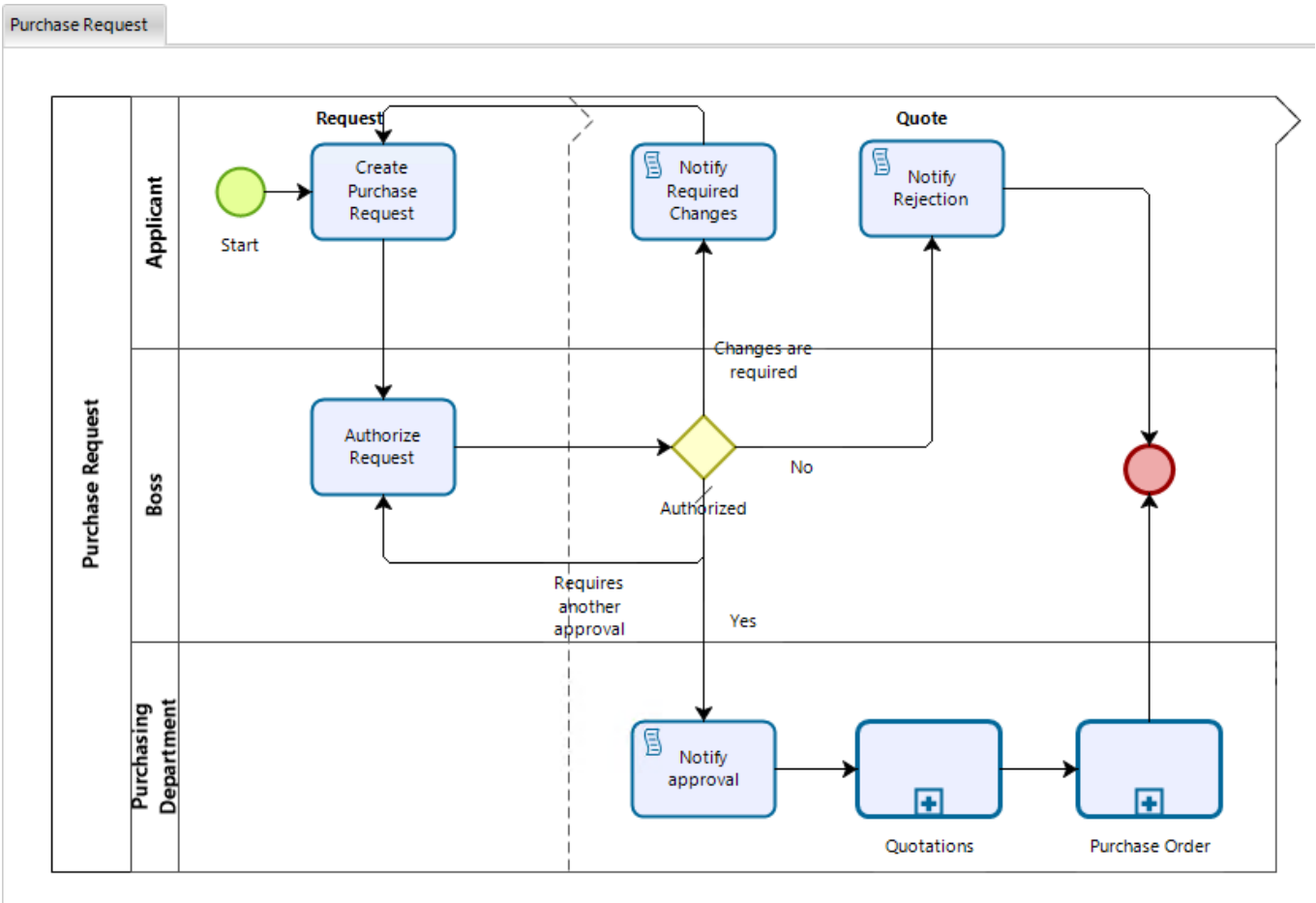
- Bizagi version: 11.1.X or higher.
- SQL Server 2008 SP3 (10.0.5500.0).

Scenario specification

The process used the test is the ***Purchase Process*** as available and downloadable from Bizagi's ***Process Xchange***.

Process and case scenario

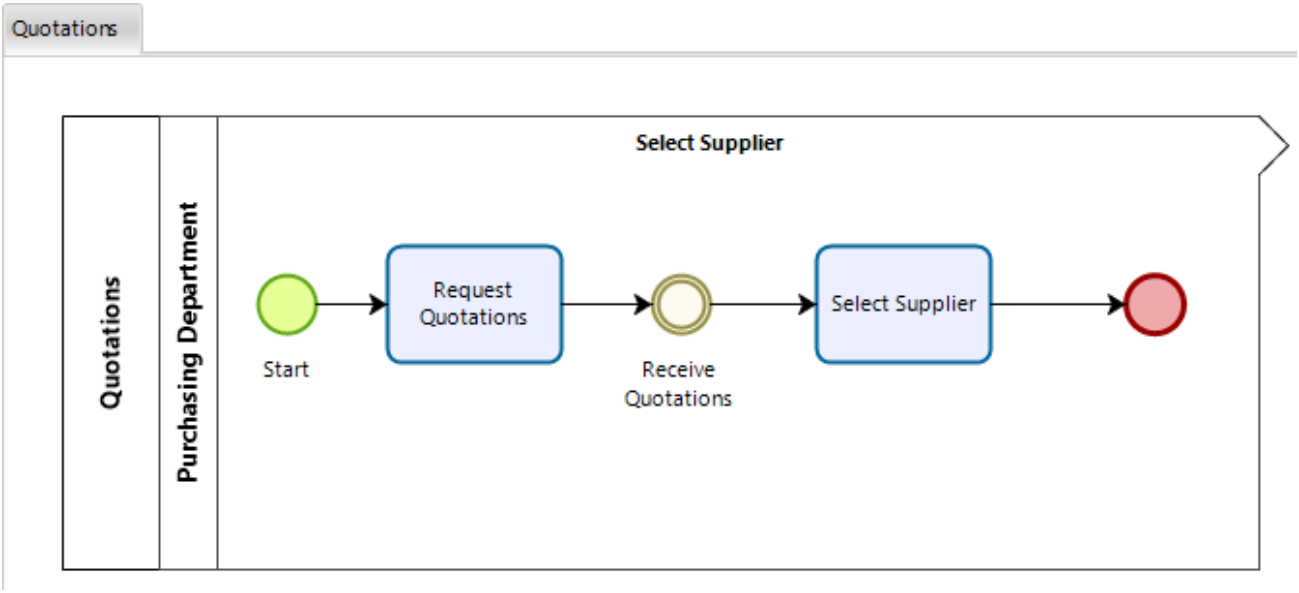
The diagram of this process is shown in the following image.



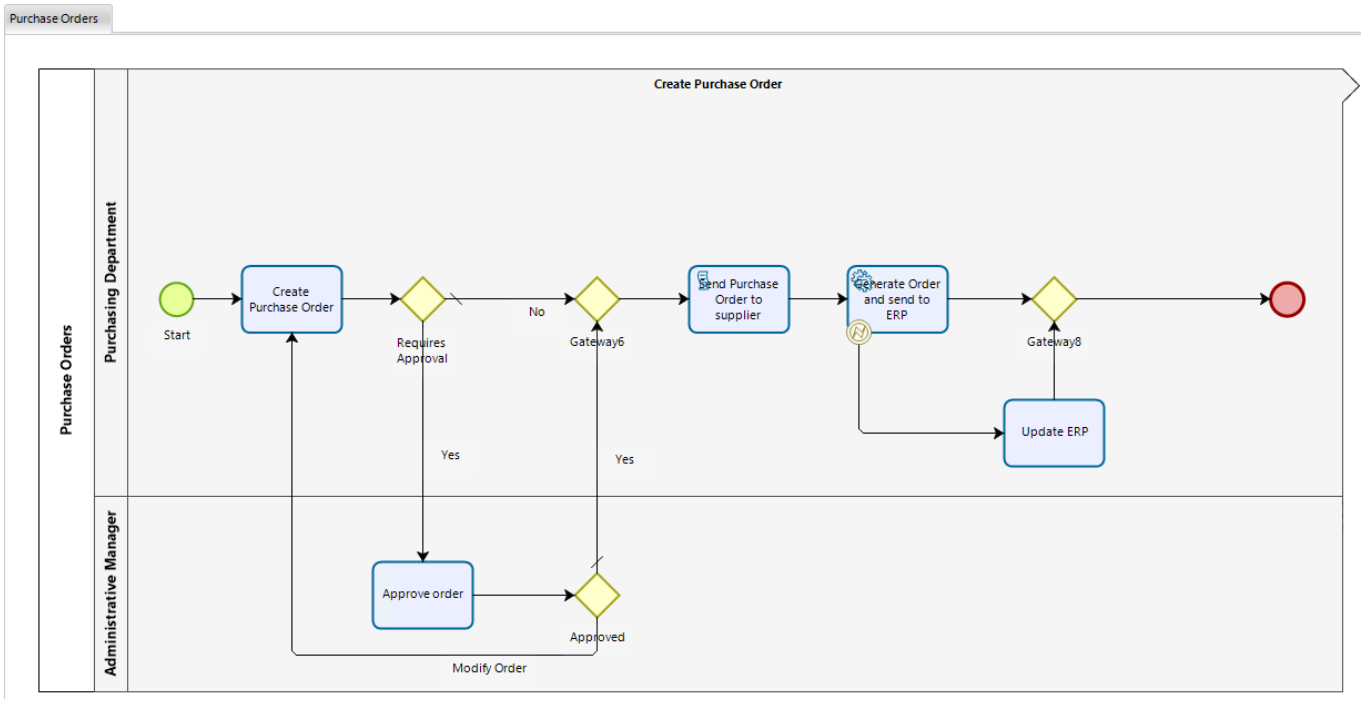
As it can be evidenced in the image, the ***Purchase Request*** process contains two sub-processes: ***Quotations*** and ***Purchase Order***.

For a complete picture of the process from start to end, it is necessary to take a look at the following sub-processes diagrams.

The ***Quotations*** sub-process:



The ***Purchase Order*** sub-process:

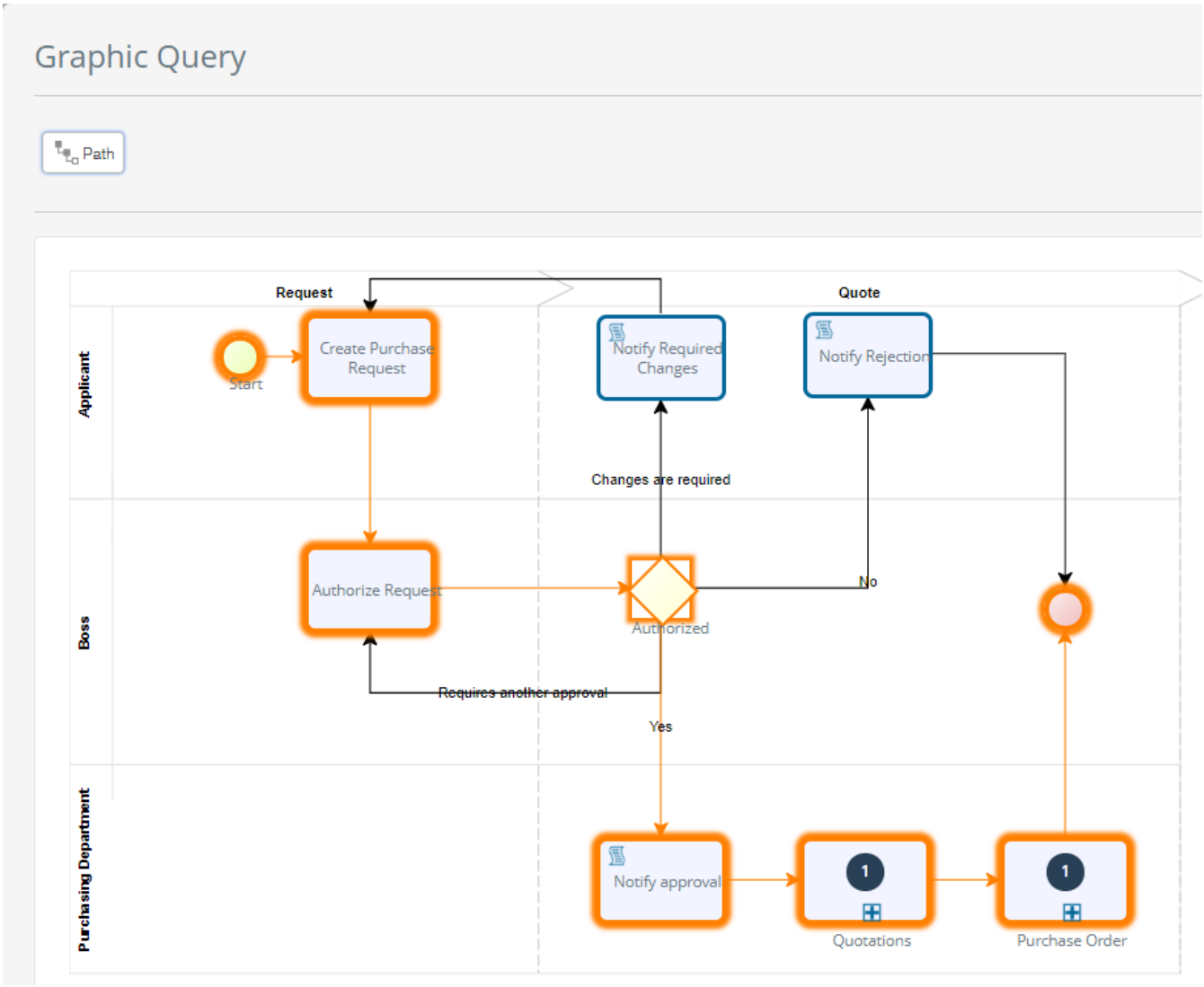


The path taken as sample for this process, goes from the ***Start event*** to the ***End event*** without passing through loops or alternative sequence flows.
The same path is executed over and over by each of the multiple cases.
Such path consists of the execution of the following 8 tasks in this particular order:

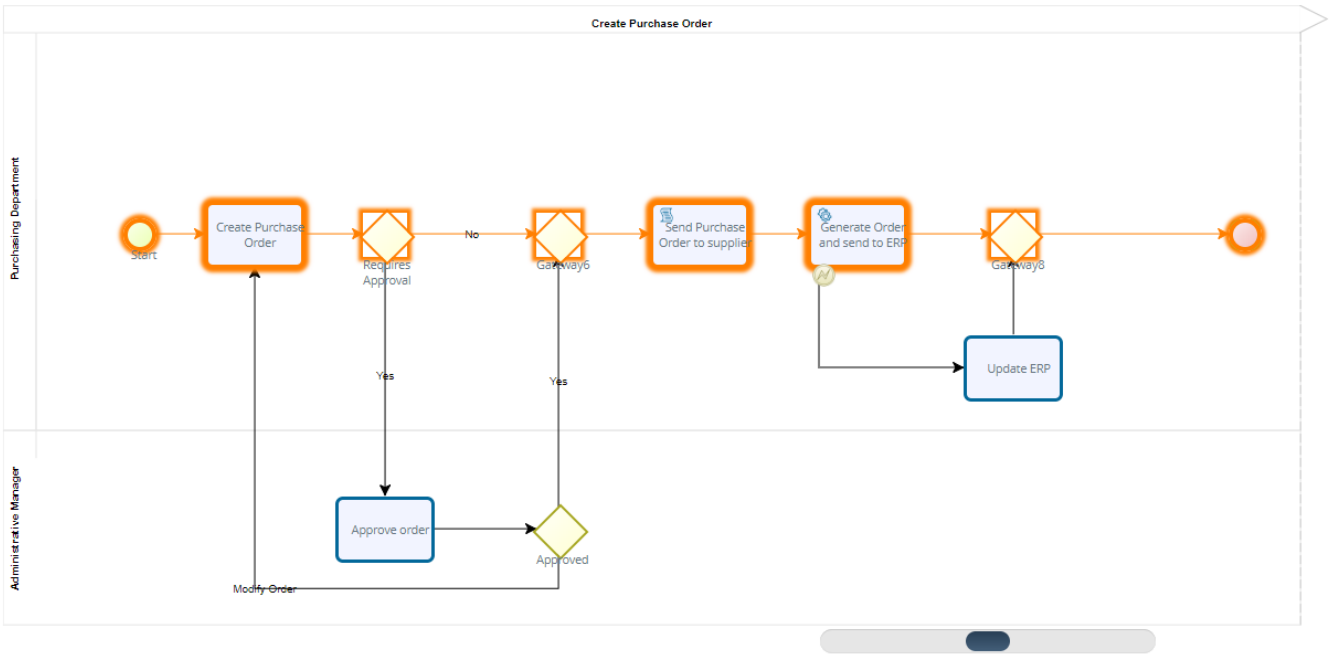
- ***Create Purchase Request.***
- ***Authorize Request.***
- ***Notify approval.***
- ***Quotations > Request Quotations.***
- ***Quotations > Select Supplier.***
- ***Purchase Orders > Create Purchase Order.***

- *Purchase Orders > Send Purchase Order to Supplier.*
- *Purchase Orders > Generate Order and sent to ERP.*

The following image illustrates the path taken for this example, as viewed from the process level (***Purchase Request***):

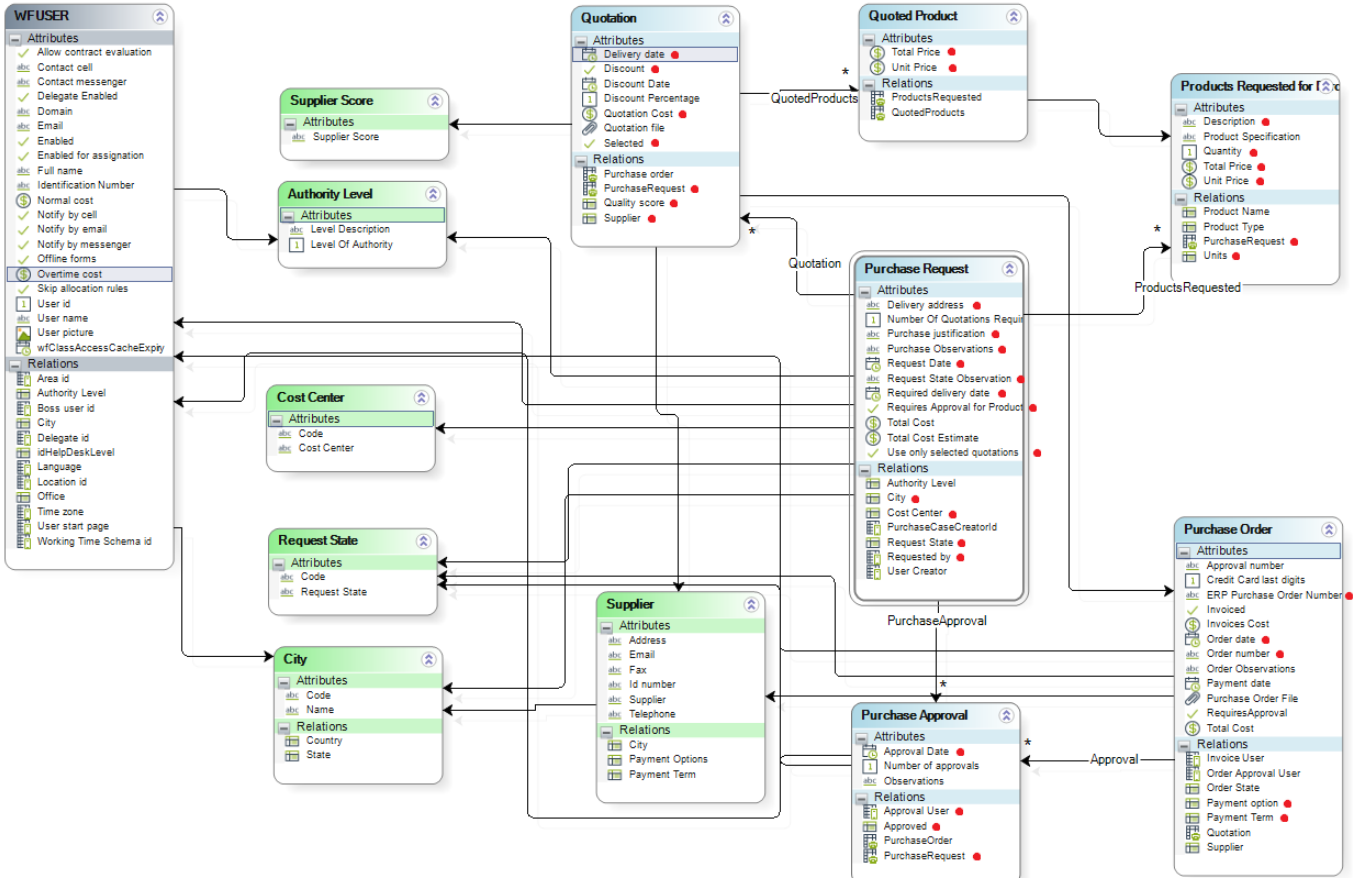


The execution flow of the Purchase Order sub-process can be evidenced in the following image:



Data model specification

The data model of ***Purchase Request*** is depicted in the image below.
Information is written into attributes of Master entities only (those 4 shown in a blue color in its header).



As mentioned above, not all attributes shown are assigned with new values (either through an insert or an update). Those marked with a red dot are used in this case scenario.
The following table indicates the list of attributes that are considered by the cases' path, and to which entity they belong:

Entity (Master type)	Attribute	Attribute type
Products Requested for Purchase	Description	String
	Quantity	Integer
	Units	Integer
	Unit Price	Currency
	Total Price	Currency
	Purchase Request	Reference to another entity (Integer)
Purchase Approval	Approval date	Date
	Approved	Boolean
	Approval user	Reference to another entity (Integer)
	Purchase Request	Reference to another entity (Integer)

Purchase Order	Order date	Date
	Order number	Integer
	Payment term	Reference to another entity (Integer)
	Payment option	Reference to another entity (Integer)
	ERP Purchase Order Number	Integer
Purchase Request	Requested by	Reference to another entity (Integer)
	Request date	Date
	Purchase Justification	String
	Requires approval for Products/Services	Boolean
	Delivery Address	String
	Required delivery date	String
	Request state	Reference to another entity (Integer)
	Request state observation	String
	Purchase Observations	String
	City	Reference to another entity (Integer)
	Cost center	Reference to another entity (Integer)
Quotation	Quotation Cost	Currency
	Delivery date	Date
	Discount	Currency
	Unit Price	Currency
	Total Price	Currency
	Use only selected quotations	Boolean
	Quality Score	Integer
	Selected	Boolean
	Supplier	Reference to another entity (Integer)
	Purchase Request	Reference to another entity (Integer)

For all business attributes above, information was recorded only once, except for those in the Quotation entity. For the Quotation entity, given that it was designed as a collection for this data model, two records were added. This means that the total number of writes into business attributes can be calculated as:
6 attributes from Products Requested for Purchase + 4 attributes from Purchase Approval + 5 attributes from Purchase Order + 11 attributes from Purchase Request + 10 attributes from Quotation twice (one per row of the table).
These adds up to a total of 41 writes into business attributes.

File attachments are not considered by the exercise presented here.

By default, Bizagi stores file attachments in a file server of yours.

Results

The following table displays database growth results after executing the case certain amount of times.

Number of executed cases	Data .mdf file size (KB)	Log .ldf file size (KB)	Total database storage size (KB)
0	32000	22144	54144
10000	474368	164672	639040
100000	4193536	199296	4392832

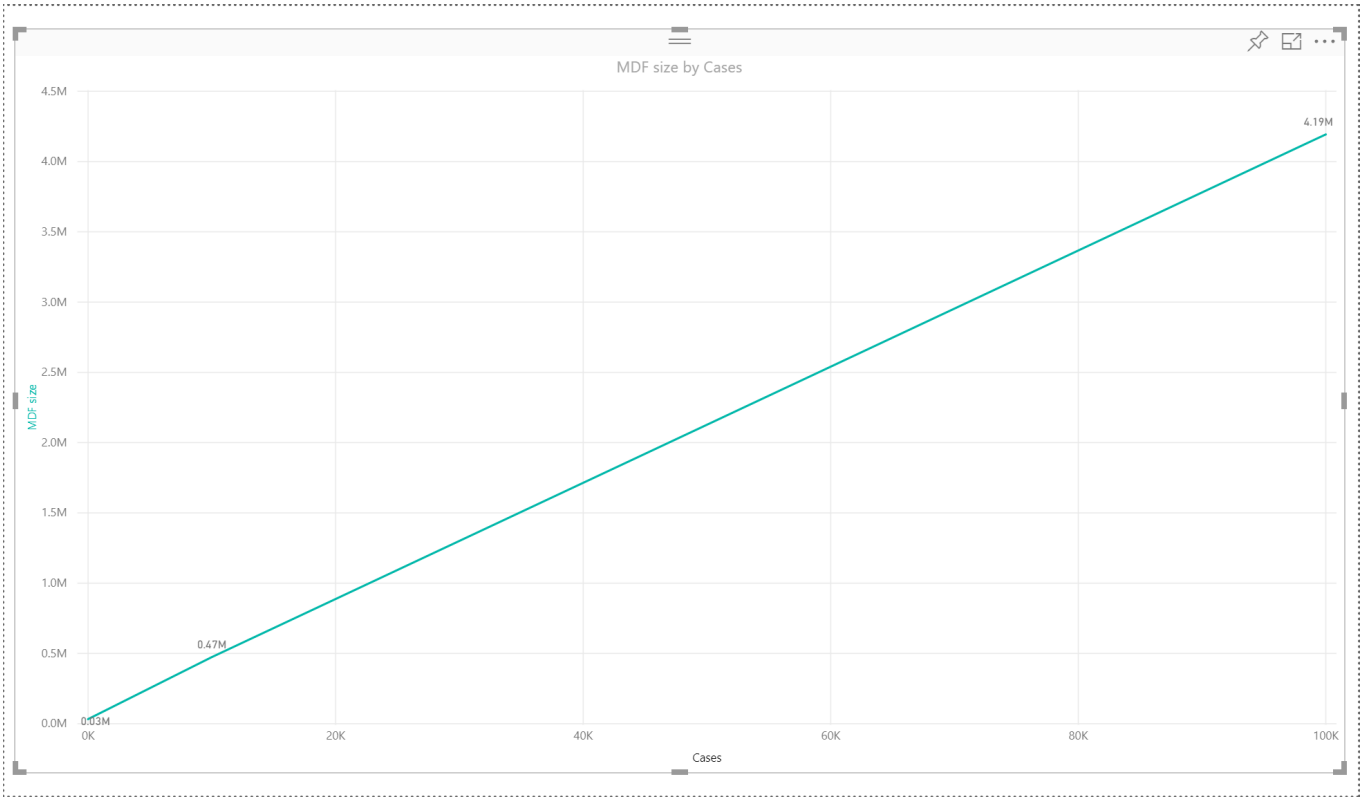
For additional reference, note that a completely blank Bizagi project, has:

- Total database storage size: 19648 KB.
- Data file size: 9472 KB.
- Log file size: 10176 KB.

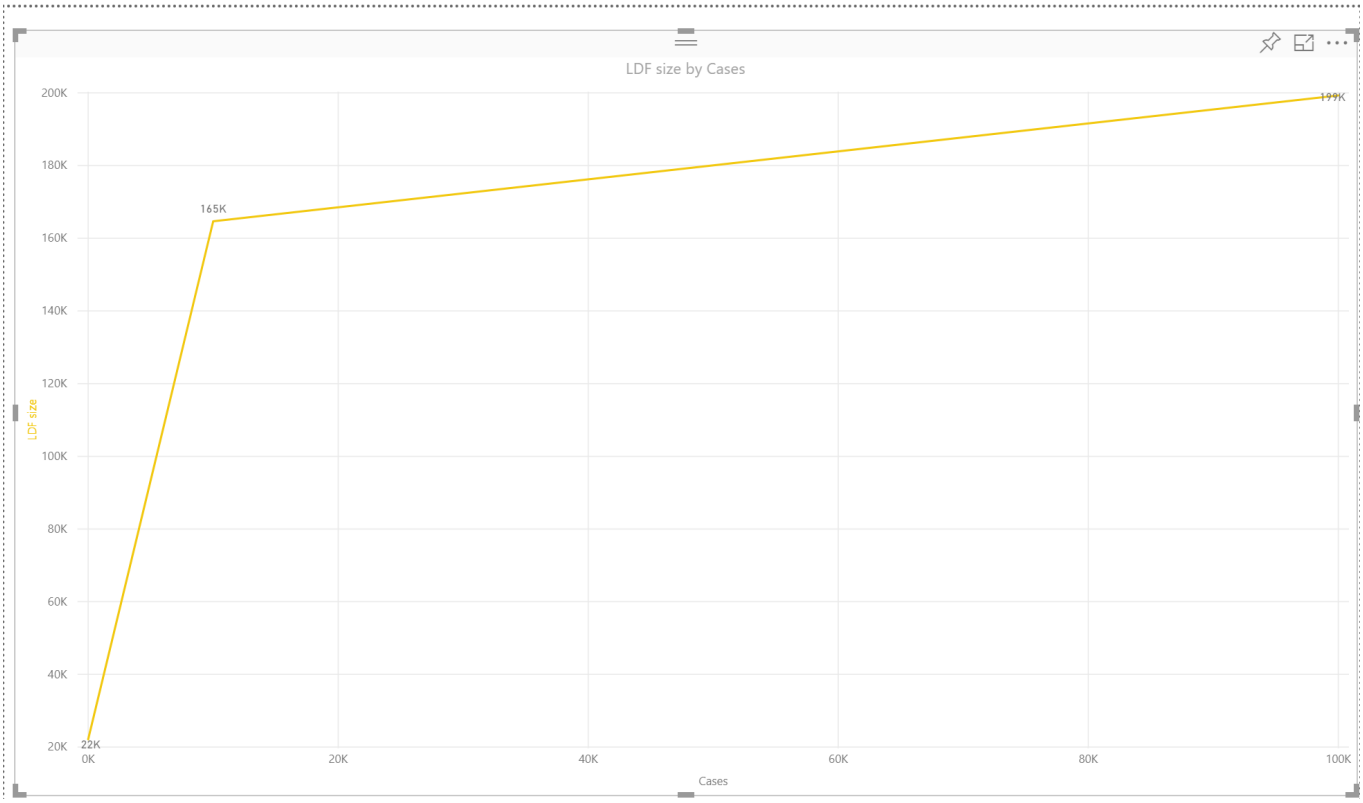
In other words, an empty project (with no data model, no processes and no information on its database) occupies 19648 KB or 19.2 MB.

Consider that you may choose to partition the Bizagi database in a way that different tables are stored in different files (.mdf, .ldf). This choice is left up to the DBA's consideration and it will not affect this analysis, given that what is suggested in these cases, is to simply separate parameter entities from master entities.

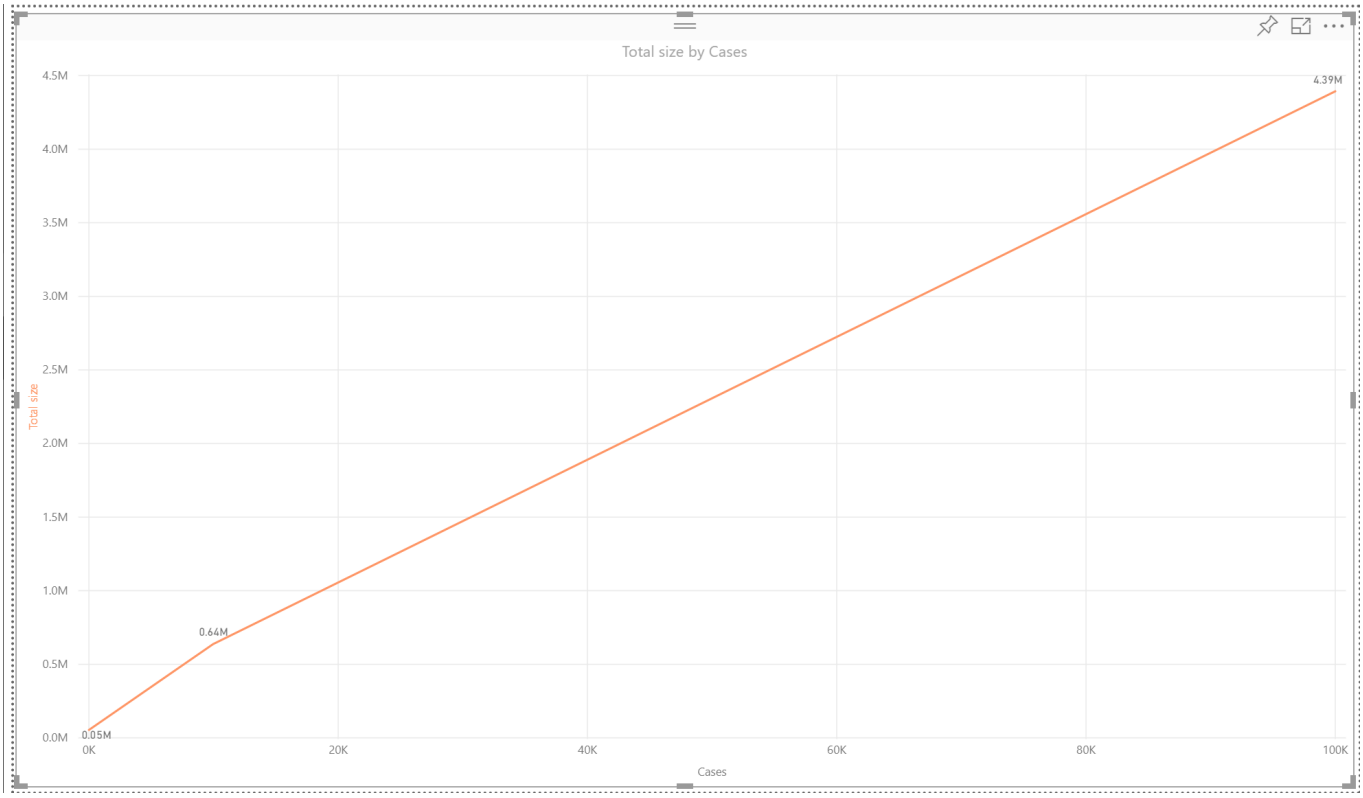
The following chart represents the data .mdf file size according to the amount of cases:



The following chart represents the data .ldf file size according to the amount of cases:



The following chart represents the total database storage size according to the amount of cases:



Average file size per case

Based on the results presented above, in average, each case having the characteristics of this particular exercise, occupies:

- Total database storage size: 52.3 KB.
- Data file size: 42.92 KB.
- Log file size: 8.01 KB.

Calculations were made by: first gathering the size occupied for each amount of cases, while first subtracting that initial size of the process model (when there were zero cases); and then dividing that resulting size between the amount of cases.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Suite