

System and Hardware Requirements

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Merit ERP (version 24.14)
MacroBASE (version 24.14)

macrologic ERP
by asseco

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TABLE OF CONTENTS

THE PURPOSE OF THIS DOCUMENT.....	3
1. SYSTEM REQUIREMENTS.....	4
1.1. BASIC SERVER MODULES	4
1.2. BASIC APPLICATION SERVER CLIENT MODULES	5
1.3. ADDITIONAL MODULES.....	7
1.4. CORE SOLUTION ARCHITECTURE	8
2. HARDWARE REQUIREMENTS AND SPECIFIC REQUIREMENTS FOR MODULES.....	9
2.1. DATABASE SERVER AND THE APPLICATION SERVER (RUNNING ON THE SAME MACHINE).....	9
2.2. HTML TERMINAL SERVER MACROINTERMSERVER	10
2.3. HTML CLIENT INTERM (USER'S MACHINE).....	10
2.4. JAVA CLIENT JTERM (USER'S MACHINE).....	11
2.5. INTEGRATION PLATFORM SERVER – MACROWEBAPISERVER.....	11
2.6. SERVER FOR WEBTERM WEB CLIENT – MACROWEBSERVER	11
2.7. DATA SEARCH ENGINE – ELASTICSEARCH.....	12
2.8. MOBILE WAREHOUSE MANAGEMENT	12
2.9. REMARKS TO HARDWARE PARAMETERS.....	12
2.10. NETWORK ENVIRONMENT PARAMETERS.....	14
3. REQUIREMENTS FOR INDIVIDUAL DOMAINS OF MERIT ERP SOLUTION	17
3.1. EXAMPLE OF CALCULATING REQUIREMENTS FOR RESOURCES	19
4. SECURITY RECOMMENDATIONS FOR SOLUTION.....	20

The Purpose of This Document

The document covers:

- system and hardware requirements for MacroBASE software
- recommended configuration for software modules
- startup resources requirements for Merit ERP solution
- estimated resources growth for Merit ERP solution

1. System requirements

1.1. Basic server modules

- The database server (MacroSERVER)
- The application server (MacroAppSERVER)
- The HTML terminal server (MacroInTermSERVER)

	MacroSERVER Database server	MacroAppSERVER Application server	MacroInTermSERVER HTML Terminal Server
64-bit operating systems			
Windows 10	✓1)	✓1) 2)	✓1)
Windows 11	✓1)	✓1) 2)	✓1)
Windows Server 2016	✓	✓2)	✓
Windows Server 2019	✓	✓2)	✓
Windows Server 2022	✓	✓2)	✓
Linux	✓	✓2)	✓

1) desktop versions are not recommended due to its low efficiency

2) the application server and the database server must be installed on the same machine

1.1.1. Remarks

- The customer is obliged to acquire the appropriate number of licenses required for the use of third-party programs, regardless of whether Asseco Business Solutions S.A. intermediated or anywise advised in this matter. The parties exclude completely liability of Asseco Business Solutions S.A. for the consequences of not acquiring the appropriate number of licenses.
- In case of choosing Microsoft Windows Server for server solution the certain number of client access licenses is required (Microsoft Windows Server CAL). According to the terms of End User License Agreement (EULA) each access from a user or a device to the server must be licensed.
- All key solution components are distributed in **64-bit** versions. The ODBC/JDBC drivers are distributed in both 32-bit and 64-bit versions. The **x86-64** processor architecture is required.
- MacroSERVER allows to manage maximum of 8191 simultaneous user sessions on the database server.

- Both the application server and the HTML terminal server use Java software (Eclipse Temurin – Adoptium version 17 64-bit). Appropriate Java environment is included in MacroBASE installation package. The Java software installed on the machine is not used and not required. Server installation includes also 32-bit version of Java software which can be used for third party modules.

For detailed information and requirements for Java 17 please visit: <https://adoptium.net>.

- Virtual environment utilization: database server (MacroSERVER), application server (MacroAppSERVER) and HTML terminal server (MacroInTermSERVER) can be installed and run in virtual environments.

1.2. Basic application server client modules

- HTML Client running in a web browser (inTerm)
- JAVA Client (jTerm)
- Device support module for HTML Client (inDevice)

	inTerm HTML Client	jTerm JAVA Client	inDevice Device support module
64-bit operating systems			
Windows 10	✓1)	✓	✓
Windows 11	✓1)	✓	✓
Windows Server 2016	✓1)	✓	✓
Windows Server 2019	✓1)	✓	✓
Windows Server 2022	✓1)	✓	✓
Linux	✓1)	✓3)	
Android	✓1) 2)		
MacOS	✓1) 2)		
iOS, iPadOS	✓1) 2)		

1) inTerm running in a web browser

2) The supported operating system version depends on minimum supported web browser versions

3) jTerm works in the graphic X Window System environment

1.2.1. Remarks

- The customer is obliged to acquire the appropriate number of licenses required for the use of third-party programs, regardless of whether Asseco Business Solutions S.A. intermediated or anyway advised in this matter. The parties exclude completely liability of Asseco Business Solutions S.A. for the consequences of not acquiring the appropriate number of licenses.
- Both jTerm and inDevice require are distributed in **64-bit** versions. The **x86-64** processor architecture is required.

- Both jTerm and inDevice use Java software (Eclipse Temurin – Adoptium version 17 64-bit). Appropriate Java environment is included in MacroBASE installation package. The Java software installed on the machine is not used and not required. Client's installation includes 32-bit version of Java software which can be used for third party modules.

For detailed information and requirements for Java 17 please visit: <https://adoptium.net>

- Technical requirements for digital signature functionality:
 - middleware using the PKCS#11 interface (version 2.01 or higher) or Microsoft CryptoAPI;
 - cryptographic card reader compatible with the PC/SC specification;
 - card interoperating with any standard card reader that is compatible with PC/SC.
- In case of operations like:
 - data export into a spreadsheet,
 - creating auto-report in a spreadsheet format or a spreadsheet with pivot table,
 - creating attachments from templates in the Merit ERP,
 - budgeting in the Macrologic Merit ERP (CTR domain – Controlling)

client software requires installation of Microsoft Office 365 (or other version compatible with features used). For HR documents, it is necessary to install the ODBC driver on the server.

- Reporting in Macrologic ERP (CTR – Controlling) requires Qlik Sense Server or MS SQL Standard.
- Requirements for Outlook add-on:
 - Microsoft Outlook 365 desktop version,
 - Access to MacroWebAPI webservice from Outlook application,
 - Permission to install Microsoft Office add-ons.

1.3. Additional modules

- Integration platform server – MacroWebApiSERVER
- Server for webTerm web client – MacroWebSERVER
- Qlik Sense Server for charts and analysis
- Mobilny magazyn – Web Services
- Data Search Module – using ElasticSearch version 7.2 engine

	MacroWebApi SERVER	MacroWeb SERVER	Qlik Sense Server	Mobilny Magazyn	ElasticSearch
64-bit operating systems					
Windows 10	✓	✓		✓1)	✓2)
Windows 11	✓	✓		✓1)	✓2)
Windows Server 2016	✓	✓	✓	✓1)	✓2)
Windows Server 2019	✓	✓	✓	✓1)	✓2)
Windows Server 2022	✓	✓	✓	✓1)	✓2)
Linux	✓	✓		✓1)	✓2)

1) Requires HTTP Tomcat 8.5.x (at least)

2) Requires ElasticSearch server (7.2)

1.3.1. Remarks

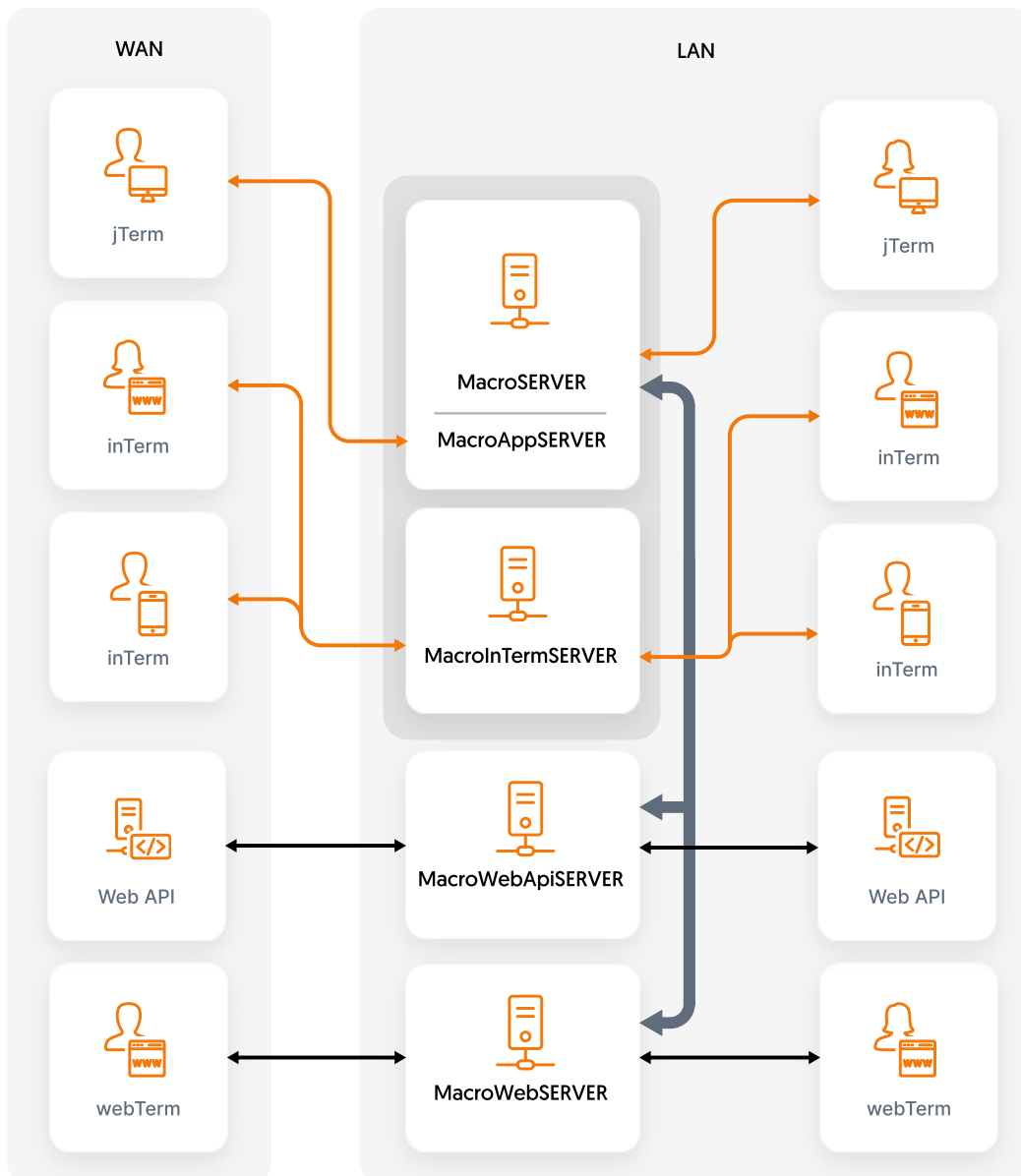
- The customer is obliged to acquire the appropriate number of licenses required for the use of third-party programs, regardless of whether Macrologic intermediated or anywise advised in this matter. The parties exclude completely liability of Macrologic for the consequences of not getting the appropriate number of licenses.
- In case of choosing Microsoft Windows Server for server solution the certain number of client access licenses is required (Microsoft Windows Server CAL). According to the terms of End User License Agreement (EULA) each access from a user or a device to the server must be licensed.
- Additional modules are distributed in **64-bit** versions. The **x86-64** processor architecture is required.
- The MacroWebSERVER uses Java software (Eclipse Temurin – Adoptium version 17 64-bit). Appropriate Java environment is included in the MacroBASE installation package. The Java software installed on the machine is not used and not required.
For detailed information and requirements for Java 17 please visit: <https://adoptium.net>.
- For web client webTerm the following web browser is recommended:
 - Google Chrome, Edge (current versions)
- Due to the risk of competition for key server resources, it is recommended to install Qlik Sense on a separate machine from MacroSERVER and MacroAppSERVER.

Detailed information about Qlik Sense system requirements can be found in document “Install and Upgrade Qlik Sense.pdf” attached with the installer program and at <http://help.qlik.com>.

- Context help system works in web browsers (recommended):
 - Google Chrome, Firefox, Edge, Safari (current versions)
- B2B, B2C, Rodo Utility, Businesslink, Portal HR work on internet browsers:
 - Google Chrome, Edge, Safari, Opera (current versions)

1.4. Core solution architecture

The basic architecture of the solution is shown in the diagram below:



2. Hardware requirements and specific requirements for modules

The recommended parameter specification is shown in tables below:

2.1. Database server and the application server (running on the same machine)

Recommended	
Processor	2 x quad core processors, 3.50 GHz, 15 MB cache; 64-bit processors, x86-64 architecture
RAM	512 MB + memory_size_for_applications ^{1) 3)} (see j.) + 136 MB × <i>number_of_app_instances_running</i> ^{4) 5) 6)} DDRSDRAM 2 x 200 MHz, rounded to the size of single memory module
HDD storage	SCSI/SAS or SSD 18 GB ²⁾ , RAID 1 or RAID 5
Additional requirements	<ul style="list-style-type: none"> Compatibility with Eclipse Temurin (Adoptium) version 17 (x64)

1) size of the additional internal memory also depends on the number of application domains in use and size of managed data (see j.).

2) size of the HDD storage also depends on the size of managed data (see j.).

3) default *number_of_app_instances_running* is a number of all business logic application instances run by all users simultaneously. **It's not usually a sum of licensed users of the MacroSERVER**, one user is able to run an application more than once using one licensed access (see 2.9.d).

5) default size of an internal memory allocated by the MacroAppSERVER for a single application is 16 MB of available memory. This value can be adjusted in the application configuration.

6) size of RAM depends on the number of application server's clients and size of processed data.

2.2. HTML terminal server MacroInTermSERVER

Recommended	
RAM	2048 MB ²⁾ + 24 MB × <i>number_of_application_tabs_opened</i> ²⁾
HDD Storage	at least 1 GB
Additional requirements	<ul style="list-style-type: none"> • Compatibility with Eclipse Temurin (Adoptium) version 17 (x64) • In case of use inDevice module the connections to terminal server should be made using HTTPS protocol ³⁾

1) RAM size needed depends also on server configuration, e.g.: number of report export processes, RAM size assigned for single process.

2) *number_of_application_tabs_opened* is the total number of tabs for applications running in web browsers for inTerm client by all current users at the same moment. **It's not usually a sum of licensed users of the MacroSERVER**, one user is able to open an application tab more than once using one licensed access (see 2.9.e).

3) default web browser security settings can block connections with inDevice if the connections are not secure.

2.3. HTML Client inTerm (user's machine)

Recommended	
Processor	the requirements of the manufacturer of the operating system are sufficient
RAM	the requirements of the manufacturer of the operating system are sufficient
HDD Storage	additional space depending on the number of downloaded files (e.g.: reports)
Additional requirements	<ul style="list-style-type: none"> • At least one web browser available: Google Chrome, Edge, Safari (current versions) ¹⁾ • In case of use of inDevice module compatibility with Eclipse Temurin (Adoptium) version 17 (x64) is required

1) Browser versions on which the inTerm client software was run and tested:

Windows: Google Chrome 123.0.6312.123, Edge 123.0.2420.97

Linux: Google Chrome 123.0.6312.105

MacOS: Google Chrome 123.0.6312.123, Safari 17.4

Android: Google Chrome 123.0.6312.118

iOS, iPadOS: Safari 17.4

2.4. JAVA Client jTerm (user's machine)

Recommended	
Processor	the requirements of the manufacturer of the operating system are sufficient
RAM	<ul style="list-style-type: none"> at least 4GB RAM for Windows and Linux (for graphical Java environment)
HDD Storage	approximately 1 GB for an application client's software
Additional requirements	<ul style="list-style-type: none"> Compatibility with Eclipse Temurin (Adoptium) version 17 (x64). For jTerm running on Linux: X Window System graphical environment Appropriate screen resolution ¹⁾

1) The graphical interface in Merit ERP was designed for FULL HD (1920x1080) resolution, Arial font size 9pt and 125% DPI; These parameters bring the user the best comfort of work.

2.5. Integration platform server – MacroWebApiSERVER

Recommended	
RAM	1 GB ^{1) 2)} or more
HDD Storage	40 GB or more
Additional requirements	<ul style="list-style-type: none"> Compatibility with Eclipse Temurin (Adoptium) version 17 (x64) Configured MJDBC connection Merit ERP

1) minimum of 256MB of RAM should be dedicated for Java process, 512MB or more is recommended

2) in case of large amount of data transfers (incl. attachments) increasing the amount of RAM assigned for each Java process should be considered

2.6. Server for webTerm web client – MacroWebSERVER

Recommended	
RAM	1 GB ^{1) 2)} or more
HDD Storage	40 GB or more
Additional requirements	<ul style="list-style-type: none"> Compatibility with Eclipse Temurin (Adoptium) version 17 (x64) Apache Tomcat Server version 8.5.X or newer (version 8.5.96 is distributed in installation package) – 64-bit Configured MJDBC connection Merit ERP

1) minimum of 256MB of RAM should be dedicated for Java process, 512MB or more is recommended

2) in case of large amount of data transfers (incl. attachments) increasing the amount of RAM assigned for each Java process should be considered

2.7. Data Search Engine – ElasticSearch

Recommended	
RAM	8 GB + 1 GB (if TICA service for searching in attachments is enabled)
HDD Storage	Depends on the amount of data and the number of tables to search ¹⁾ Additional storage when searching in attachments is enabled ²⁾
Additional Requirements	<ul style="list-style-type: none"> • ElasticSearch 7.2 must be installed as a service ³⁾ • If searching in attachments is enabled, TICA server must be installed as a service

1) The storage space required for the standard “sync” definition of the ElasticSearch branch can be estimated as 1.2% of the Merit ERP storage size. For example, if Merit ERP make use of 10 GB data storage at least 120 MB of additional disk space for ElasticSearch data must be provided.

2) Amount of additional storage for ElasticSearch can be estimated as 30% of total attachment storage in Merit ERP.

3) The ElasticSearch service must be installed and run together with MacroAppSERVER on the same machine. All data exchanged via the REST ES API between modules use a localhost connection only. No external network access to ElasticSearch server is possible.

2.8. Mobile warehouse management

Requirements for data collectors operating on **Android**:

Requirements	
Operating system	Android version 6.0 or higher
Display	at least 640 x 480
RAM	minimum 1 GB
Device	<ul style="list-style-type: none"> • Wi-Fi enabled • Barcode scanner or Bluetooth enabled with BT barcode scanner
Additional Requirements	<ul style="list-style-type: none"> • Access to Merit ERP data via MacroWebAPI interfaces

2.9. Remarks to hardware parameters

- Internal memory requirements both for workstations and servers depend on their operating system. The operating system requirements depend on its configuration and need to be consulted with the person responsible for installation and configuration.
- Using smaller internal memory can cause part of the information that exceeds system RAM capacity is stored in the temporary file on the hard disk drive. This may lead to system slowdown. Therefore, it is recommended to provide more internal memory for servers.

- c. In case of working with the application server it is important to consider influence of number of running instances of an application on the size of required RAM: it is recommended to reserve approximately **136 MB of RAM** per each running instance of an application. A size of RAM reserved for a single instance of an application should be related to a size of the data managed by this application.
- d. Within one JAVA client instance more than one application instance can be run (each application instance on separate tab). Each application instance, whether running on a single or multiple clients, is counted towards the total number of applications currently served by the server. The amount of RAM dedicated for the application server should be properly adjusted. For Merit ERP we assume at least 3 application instances per single user and 4 additional instances for Merit process management.
- e. In case of use web browser HTML client inTerm single application instance is opened in browser tab. Each application tab, whether running on a single or multiple browser windows, is counted towards the total number of applications currently served by the terminal server MacroInTermServer. The amount of RAM dedicated for the terminal server should be properly adjusted. For Merit ERP we assume at least 3 application tabs per single user.

2.10. Network environment parameters

- f. A properly configured TCP/IP version 4 protocol is necessary.
- g. **1 Gb/s** is recommended for LAN capacity.
- h. For a WAN (in three-tier architecture) a network with a capacity that provides minimum **128 Kb/s** per each user is recommended.
- i. List of port numbers used by each module. All port numbers, except for these marked with an asterisk, are configurable during the installation or maintenance process.

	Port#	Direction	Purpose
MacroSERVER	* 443	outbound	HTTPS connection to host services.macrologic.pl to download released updates. ¹⁾
MacroAppSERVER	5580	inbound	Accepts connections from application server clients (jTerm / MacroInTermSERVER). ²⁾
	7777	inbound	Accepts connection to instant messaging server from application server clients (jTerm).
	* 443	outbound	HTTPS connections: <ul style="list-style-type: none"> • with host services.macrologic.pl to download released updates. ¹⁾ • with host mstats.macrologic.pl to upload anonymous statistic data on the use of functions in the application. ⁴⁾ • with cloud services B2B, B2C, RODO Utility, Businesslink, Portal HR • with Qlik server
	* 5000	outbound	Connects to host abc-notifications.assecobs.pl (notification service for Businesslink and Portal HR)
	* 4242	outbound	Connects to Qlik Sense Repository Service (QRS) for i.e.: Qlik Sense user and license management directly from Merit application. ⁵⁾
	* 4243	outbound	Connects to Qlik Sense Proxy Service (QPS) enabling Single Sign-On (SSO) configuration for Merit users in Qlik Sense. ⁵⁾
MacroInTermSERVER (HTML terminal server)	5580	outbound	Connects to the application server. ²⁾
	8888	inbound	Default port for inTerm clients using HTTP protocol (no default port for HTTPS) ⁶⁾
	7777	outbound	Connects to instant messaging server.
	* 443	outbound	HTTPS connections: <ul style="list-style-type: none"> • with host services.macrologic.pl to send user satisfaction survey.
MacroWebApiSERVER (integration platform server)	5580	outbound	Connects to the application server. ²⁾
	8090	inbound	Default port used by server for HTTP protocol
MacroWebSERVER Mobilny Magazyn Context Help System	8080	inbound	Default port used by CMS for HTTP protocol.
	8443	inbound	Default port used by CMS for HTTPS protocol (if use of HTTPS connections is enabled). ³⁾
	8005	inbound	Technical port (shutdown port) used for shutting down the Apache Tomcat server (internally used by MacroWebSERVER).

	Port#	Direction	Purpose
Qlik Sense	<i>All the information about ports used in Qlik Sense environment can be found at http://help.qlik.com.</i>		
inTerm (user's web browser)	8888	outbound	Connects to HTML terminal server MacroInTermSERVER ⁶⁾
	8080 or 8443	outbound	Connects to Context Help System
jTerm (JAVA client)	5580	outbound	Connects to the Application Server. ²⁾
	7777	outbound	Connects to instant messaging server.
	* 443	outbound	Connections (HTTPS) with hosts: <ul style="list-style-type: none"> • services.macrologic.pl – license keys download and sending user satisfaction survey • portal.macrologic.pl – bug report submits • avp.macrologic.pl – Asseco Value Proposition portal • cas.macrologic.pl – CAS service (for AVP)
	8080 or 8443	outbound	Connects to Context Help System
webTerm (user's web browser)	8080	outbound	Connects to the MacroWebSERVER service using HTTP protocol
	8443	outbound	Connects to the Macrologic ERP CMS service using HTTPS protocol (if use of HTTPS connections is enabled) ³⁾
	8080 or 8443	outbound	Connects to Context Help System
ElasticSearch (data search engine)	* 9200	-	An unused port 9200 is required. No outbound or inbound traffic from this port. MacroAppServer communicates with Elasticsearch on localhost:9200
	* 9998	-	Connection for TIKa service if searching in attachments is enabled

*) Port number is fixed and cannot be configured

1) Update packages are downloaded from remote server. The capacity of this connection affects the time of download and applying updates. Downloading updates online is optional, the procedure of applying updates can also be performed offline.

2) We must provide sufficient bandwidth for each established connection to the Application Server (see 2.10.h).

3) Use of HTTPS connections is disabled by default.

4) The port and HTTPS connection with mstats.macrologic.pl is used only with the client's approval to upload statistics to the software manufacturer.

5) Ports required in case of Merit and Qlik Sense Enterprise on Windows (QSEoW) user integration.

6) If proxy is used, root / for http:// and /mws for ws:// (websockets) must be redirected.

j. List of key host addresses used for integration with third party services.

Host	Prot.	Source	Purpose
ewib.nbp.pl	HTTPS	MacroInTermSERVER	<ul style="list-style-type: none"> • Communication with NBP and EBC services. • Exchange rates download.
www.nbp.pl	HTTP	jTerm	
www.ecb.europa.eu	HTTPS	MacroAppSERVER	
pue.zus.pl	HTTPS	inTerm (inDevice) jTerm	• Communications with ZUS platform for eZLA documents
www.gov.pl	HTTPS	MacroInTermSERVER jTerm	• Auxiliary services for handling JPK and VAT documents
www.mf.gov.pl	HTTPS		
crd.gov.pl	HTTP		
www.e-deklaracje.gov.pl	HTTP		
bramka.e-deklaracje.mf.gov.pl	HTTPS	inTerm (inDevice) jTerm	• MF gateways for sending e-declarations and JPK
test-bramka.e-deklaracje.gov.pl	HTTPS		
e-dokumenty.mf.gov.pl	HTTPS		
test-e-dokumenty.mf.gov.pl	HTTPS		
taxdocumentstorage\N\st.blob.core.windows.net ¹⁾	HTTPS		
taxdocumentstorage\N\blob.core.windows.net ¹⁾	HTTPS		
www.macrologic.pl	HTTPS	MacroInTermSERVER jTerm	• Asseco BS website for updating e-declaration schemes
wl-api.mf.gov.pl:9091	HTTPS	MacroInTermSERVER jTerm	• Taxpayers whitelist (BLP)
waproapi.assecobs.pl	HTTPS	MacroAppSERVER	
ec.europa.eu	HTTPS	MacroInTermSERVER jTerm	• EU tax id check in the VIES database
api.dane.gov.pl	HTTPS	MacroAppSERVER	• Download tax office data
wyszukiwarkaregon.stat.gov.pl	HTTPS	MacroAppSERVER	• Retrieving information about the counterparty (GUS)
uslugaterytws1.stat.gov.pl	HTTPS	MacroAppSERVER	• Retrieving address data (TERYT)
app.skanuj.to	HTTPS	MacroInTermSERVER jTerm	• Skanuj.to scanning service
wartowiedziec.macrologic.pl	HTTPS	jTerm inTerm (web browser)	• information displayed on Merit ERP desktop
europa-west1-dialogflow.googleapis.com www.gstatic.com update.googleapis.com www.google.pl dialogflow.googleapis.com fonts.googleapis.com oauth2.googleapis.com	HTTPS	jTerm inTerm (web browser)	• Genius Assistant (DialogFlow)

Host	Prot.	Source	Purpose
1) <i>NN</i> can be a symbol in the range <00 .. 99>. Information about a specific address to be used is retrieved dynamically during the process of communication with the service provider.			

3. Requirements for individual domains of Merit ERP solution

- The size of an internal memory and hard disc drive capacity should be increased depending on the size of processed data.
- To help evaluate amount of resources, the table below shows three groups of clients per each application, where numbers show amount of data stored in the most typical tables of these applications.

	Size A	Size B	Size C
FINANCE area <i>Number of accounting documents (per month)</i> <ul style="list-style-type: none"> • FKS – Finanse • FST – Środki trwałe • HBN – Płatności elektroniczne • KAS – Kasa • CTR – Controlling • KON – Konsolidacja sprawozdań • OBE – Obieg wniosków • OBG – Obieg dokumentów • SEO – System e-obiegu dokumentów 	< 100	100 - 1000	> 1000
HR area <i>Number of employees in one installation</i> <ul style="list-style-type: none"> • PKD – Kadry • PPL – Płace • PBA – Badanie opinii • PED – Elektroniczna dokumentacja pracownicza • PRC – Czas pracy • PPK – Pracownicze plany kapitałowe • POR – Portal HR • PEP – Paperless HR • PKW – Pracownik • POC – Oceny pracownicze • PSZ – Obsługa szkoleń • ROD – Zarządzanie danymi osobowymi • PKZ – Kasy zapomogowo pożyczkowe • PBH – Bezpieczeństwo i higiena pracy 	< 100	100 - 1000	> 1000

	Size A	Size B	Size C
LOGISTICS area <i>Number of documents (per month)</i> <ul style="list-style-type: none"> • LMG – Magazyny • LMO – Magazyn mobilny i MWS • LSP – Sprzedaż • LZK – Zakupy • KKH – Kontakty • LSS – Punkt Sprzedaży • LTR – Transport • LUM – Umowy cykliczne • LUO – Odpady • TRE – Remonty i reklamacje • WYP – Wyposażenie • ZBL – Businesslink 	< 100	100 - 1000	> 1000
PRODUCTION area <i>Number of orders (per month)</i> <ul style="list-style-type: none"> • TTE – Produkcja • TPP – Plan produkcji 	< 100	100 - 1000	> 1000
COMMON USE area <i>Number of process instances (per month)</i> <ul style="list-style-type: none"> • ZPR – Obsługa procesów • ZWS – Wspólne • ZUI – Usługi integracyjne 	< 6500	6500 - 100000	> 100000

c. Approximated HDD storage, in megabytes per month, required for one month of system work, divided into three groups of clients

	Size A	Size B	Size C
Per month ^{1) 2)}	~759 MB	~4,2 GB	~8,0 GB
For 5 years ^{1) 2)}	~44 GB	~252 GB	~480 GB

d. amount of an additional RAM for each of group of clients

	Size A	Size B	Size C
Additional RAM ²⁾	960 MB	1.9 GB	2.5 GB and more

UWAGI:

1) HDD storage approximation assumes use of PED domain (Elektroniczna dokumentacja pracownicza) which covers keeping employee documents in electronic form. These documents are mostly in PDF format or scanned originals converted to PDF. Storing data in this form is imposed by regulations but requires a significant additional disk space. In case of not using PED, the approximated HDD storage required will be much lower.

2) The PEP (Paperless HR) domain refers to attachments that are handled and stored within the PED (Electronic Employee Documentation) domain. The valuation proposed considering the PED domain should be accepted.

3) In case of using Data Search Engine the required resources should be increased according to recommendations in paragraph 2.7.

3.1. Example of calculating requirements for resources

The following estimations do not include the additional resources for Data Search Engine described in paragraph 2.7.

- Example for single size B company:
 - Let us assume that size B company works with complete Merit ERP solution for 5 years.
 - Considering that users usually run more than one application instance, according to paragraph 2.9.d, we must count 3 instances per user and 4 additional instances for process management. Additionally, assuming that users will use web browser clients (inTerm), in accordance with the recommendations of point 2.9.e, 3 application tabs per user should be taken into account.
 - Application server RAM for 15 users:
 $512 \text{ MB} + 1.9 \text{ GB} + (15 \times 3 + 4) \times 136 \text{ MB} = 9122 \text{ MB} (8.9 \text{ GB})$
 Additional RAM for HTTP terminal server for 15 users:
 $2048 \text{ MB} + (15 \times 3) \times 24 \text{ MB} = 3128 \text{ MB} (3 \text{ GB})$
 The recommended total amount of RAM for the server is at least **12 GB**.
 - Calculation of required RAM for a different number of users for a size B company

Users	Application server RAM	Terminal server RAM	Total RAM
10	6.78 GB	2.67 GB	9.45 GB
20	10.65 GB	3.37 GB	14.02 GB
50	22.25 GB	5.48 GB	27.73 GB
100	41.59 GB	9.00 GB	50.58 GB
200	80.26 GB	16.03 GB	96.29 GB

- HDD storage required for 5 years of work is 252 GB.

4. Security recommendations for solution

To ensure optimal security for solutions based on MacroBASE technology and Merit ERP, we recommend considering the following guidelines:

- a. Encryption of connections between modules
 - Encrypting connections between the application server and jTerm desktop clients
 - Encrypting connections between the MacroInTermSERVER terminal server and the HTML inTerm client
- b. Securing user access to applications
 - Enforcing appropriate password complexity requirements (length, security level)
 - Requiring periodic password changes for users
 - Enforcing the use of multi-factor authentication (MFA/2FA) for users
- c. Securing data at rest
 - Enabling encryption for information stored in the database
 - Enforcing strong encryption (using the AES-128 algorithm) for resources containing sensitive data in compliance with regulations
- d. Software updates
 - Periodically checking for available patches and updates for components provided in the repository by Asseco Business Solutions
 - Utilizing the built-in mechanisms for downloading and applying patches implemented in the solution

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