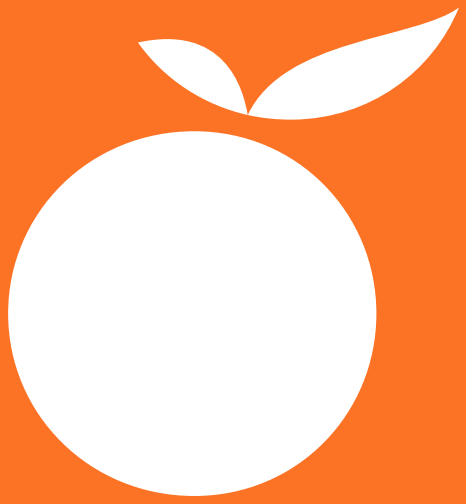
tt performance suite

System Requirements



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System Requirements - tt performance suite 2020
15 December 2020 – Version 1.1

Contents

1 tt knowledge force – Client

1.1 Hardware

Component	Requirement
Processor	Minimal: Single-core 2.6GHz Recommended: Dual-core 2.6GHz
Memory	Minimal: 4 GB Recommended: 8 GB (for 64bit operating systems)
Hard drive capacity	~750 MB for program data
Screen resolution	Minimal: 1024 x 768 Recommended: 1920 x 1080
Multimedia hardware	16-bit sound card and speakers or headphones

1.2 Software

Component	Requirement
Operating system	Windows 7 (SP 1, 32- or 64-bit) or Windows 8 or 8.1 (only Windows Desktop, no Metro Interface, no apps) Windows 10
Additional software	Microsoft Visual C++ Redistributable Package
Browser	Internet Explorer 11
Browser settings	JavaScript needs to be activated
Permissions	Administrator rights are required during installation; however, there will be no changes to the system folder.

Please note that it is required that all components that take part in the end-to-end-communication (i.e. tt knowledge force client to and from the server component(s), as well as end-user to and from the server component(s)) support at least HTTP protocol version 1.1.

Please note that in order to use all functionality of the ttkf client policies must allow the ttkf process to start an external process named “Gifcreator.exe”.

Please note that for proper functionality of the tt performance suite the windows display-zoom needs to be set to 100%.

1.2.1 Optional software components

Depending on the use case of the **tt knowledge force**, additional software-components are required.

1.2.2 Export formats

- .doc

- .html
- .pdf

Use case	Requirement
Output formats for MS Office	MS Office 2007 or MS Office 2010 or MS Office 2013 or MS Office 2016 or MS Office 2019 **Attention:** The evaluation version of MS Office 2010 is not supported!
Word import and export	MS Office 2007 or MS Office 2010 or MS Office 2013 or MS Office 2016 or MS Office 2019 **Attention:** The evaluation version of MS Office 2010 is not supported.
PowerPoint import and export	MS Office 2007 or MS Office 2010 or MS Office 2013 or MS Office 2016 or MS Office 2019 **Attention:** The evaluation version of MS Office 2010 is not supported!
Text-to-speech	The text-to-speech engine needs to support SAPI 5; The ttps client supports Readspeaker and Acapela via Voice-as-a-Service natively.
Multimedia support	The following components need to be installed in case of the Internet Explorer: Windows Media Player-Plug-in or -ActiveX Control from version 7.1 (usually included in Internet Explorer) and MP3-Codec “Fraunhofer MPEG Layer-3 Codec”

1.3 Single Sign On

In order to make use of Single-Sign-On-Mechanisms with the ttps client the protocol needs to be NTLM; other methods of authentifiction are currently not supported in the client scenario.

1.4 Third party software

McAfee

Please note that a locally used virus scanner from McAfee may reduce the performance of the authoring component.

You are advised to change the anti-virus program's settings so the tt knowledge force installation folder is excluded from the scanning process.

HP Quicktest

Please note that HP Quicktest can only be installed on the same computer as the authoring software under specific conditions: the user under which the authoring software is launched may *not* have reading permissions to the folder in which the Quicktest executable resides.

HP Sprinter

Please note that the installation will cause write access problems to the tt knowledge force client profile folder which may result in a failure to load the WYSIWYG view.

Check Point

Please note that the virus scanner from Check Point End Security may strongly reduce the performance of the tt knowledge force client.

Desktop Management Software

In case of using multiple monitors supported by desktop management software (for instance ATI Hydravision), this can cause problems with the object recognition during (re-)recording and guiding through applications.

Bamboo Drivers

As soon as Bamboo-drivers for drawing tablet and the corresponding pen are installed these drivers will interfere with the correct display and object-recognition of the guide-client.

Microsoft Snipping Tool

As long as this tool is running it will interfere with correct object-recognition needed for recording as well as playing guides.

Microsoft Security Policies

If you experience problems with editing in the WYSIWYG View (i.e. no editing possible) please check if the MS Security Policy “Local Machine Lockdown” is enabled. If so, please disable this policy.

1.5 Technology

The associated Java VM is included in the installation package and therefore does not have to be pre-installed. Java VMs which are installed in parallel do not impact on the software's executability.

1.6 Installation

The installation via a setup routine does not copy files to the Windows or System directories. During setup, the software is registered as an installed program, the program files are copied and the following file types are registered:

- **.ttcp** (tt content package) – document source archive which contains the sources and resources associated with a document; based on the ZIP format
- **.ttlk** (tt license key) – automatically installs the license file with a double-click
- **.ttcfg** (tt configuration package) – archive containing the configuration-specific data
- **.ttlkr** (tt license key request) – file containing the request for a local license key.
- **.ttopt** (tt options) – transport file for user preferences
- **.ttscp** (tt smart component package) – transport file for SmartComponents

Special note for the Windows 7 (or newer) operating system

When User Account Control (UAC) is activated, the recording of, as well as the guidance through programs or processes that require administrator rights can only be accomplished if the tt knowledge force client and/or the tt guide client also run with administrator rights.

Special note for environments with activated Windows-group-policy: "Security zones use only machine settings"

In order to guarantee proper functionality of our software this policy needs to be set to the default-value (deactivated), or the following Registry-Values need to be set:

64 Bit Windows:
[HKEY_LOCAL_MACHINE\Software\Wow6432Node\Microsoft\Internet Explorer\MAIN\FeatureControl\FEATURE_BROWSER_EMULATION]
"TTKnowledgeForceBrowser.exe"=dword:0000270f

32 Bit Windows:
[HKEY_LOCAL_MACHINE\Software\Microsoft\Internet Explorer\MAIN\FeatureControl\FEATURE_BROWSER_EMULATION]
"TTKnowledgeForceBrowser.exe"=dword:0000270f

Our tt knowledge force installer tries to set the above mentioned values during the installation process.

1.6.1 Placing the authoring environment's profile folder on a UNC path

If the profile folder of the tt knowledge force client is installed on a UNC path, it must be ensured that the corresponding server is set to the "Intranet" security zone in the Internet Explorer security settings. This is required irrespective of whether the profile folder is addressed

via UNC path, or as a "connected network drive". If all relevant endpoints are members of a windows domain, these security settings are not relevant, or more precisely, are set automatically by IE. If all UNC paths are automatically assigned to the "Intranet zone" via a global security policy, no manual adjustment is required. Please also note that in this case, the performance of the tt knowledge force client is highly dependent on the network performance, so that performance impacts may occur.

1.6.2 Running tt knowledge force client with activated proxy

In case that a proxy is configured it is necessary to exclude "localhost" / "127.0.0.1" from the access via proxy. This can be done in the Internet Explorer: Internetoptions -> Connections -> LAN-Settings -> in the area "Proxyserver". Here the option "Exclude Proxyserver for local addresses" needs to be checked.

1.7 Working with Citrix

There are two main scenarios to gain access to a Citrix system: Namely access via a Browser-Plugin or an explicit, locally installed, application: "Citrix receiver". The set of supported features depend on the set-up and are described below.

1.7.1 Browser-Plug-In

In case of the Browser-Plug-In-Approach one can differentiate between a "published Desktop"-approach and the publish of individual applications. For both cases different features are supported, which are described below.

1.7.1.1 Published Desktop

Both, the **ttps client** as well as the **tt guide,** are fully functional and record and discover contexts within the same published desktop.

1.7.1.2 Published Application

We do not recommend or support this scenario for the use of **ttps client** and/or **tt guide**, where cross-application-communication is needed, since each application will be openend within it's own browser-tab. The individual tabs are isolated, preventing inter-application-communication such that object- and context recognition functionality will not be available in this set-up.

1.7.2 Local installation of Citrix application "Citrix Receiver"

In the published application szenario both, the **ttps client** as well as the **tt guide,** are fully functional to record and discover contexts if the supported application is a "published application" as well.

When published applications are released, the respective application is made available to the end user as a Desktop link, for example. The applications are started via individual icons and

are always opened in separate windows. From a user perspective, the only obvious difference is the fact that there is a lower color depth in the application, as well as a lower color depth in the taskbar icon and a tooltip for the icon stating "Application name\\Remote" (depending on the configuration). The word \\Remote indicates that this is a server-based application. This scenario is compatible with ttps client.

Please note that the overlay mode of tt guide will not work in this setting.

Exception 1

tt performance suite runs on a local PC and each target application runs as a published application on the terminal server. In this scenario, object and context recognition are not supported.

Exception 2

The Citrix server is part of a server farm, and applications that are started are distributed to the various servers via load balancing (automatic load distribution). In this scenario, it may happen that the tt knowledge force client and/or tt guide and the target application that is to be recorded are opened on different servers when published applications are started. When this happens, our clients cannot establish a connection with the target application, thus object and context recognition are impossible.

How to bypass this problem for content creation: All authors who use tt knowledge force client to record, log on to a dedicated server. Alternatively, it would also be possible to use a group policy to make a particular server always available to a user group.

1.8 General information on Citrix and MS terminal server

In such environments, it is often the case that the users' profile sizes are restricted to 20 MB. However, due to technical reasons, this is not sufficient to operate tt knowledge force.

How to bypass this problem: A central configuration file can be used to re-route the directories required by tt knowledge force so that they are no longer in the user profile. In doing so, you need to ensure that this configuration is performed centrally for all users in a terminal server environment. Here, for example, it's a good idea to use a "home drive H:" (or similar), which is made available to each user via mapping. Rerouting to an identical drive for several users is not possible and would also not be a good idea due to reasons relating to data privacy protection. Rerouting to UNC paths \\Server\Release\Directory is not supported. With an average document size of ~3 MB (without sound), as well as ~10MB of local configuration data, we recommend making at least 50-100 MB of disk space available to each author.

2 tt knowledge force – Content

The following requirements need to be met in order to play a WBT:

2.1 Hardware

Component	Requirement
Processor	Minimal: from 1.0 GHz Recommended: 1.5 GHz or more
Memory	Minimal: 512 MB Recommended: 1 GB
Screen resolution	Depends on the size of the application that is recorded and the content that is produced. However, at least approx. 100 pixels higher than the recording resolution because parts of the browser interface have to be visible (Internet Explorer). 16-bit color depth
Multimedia Hardware	16-bit sound card and speakers or headphones

2.2 Software

Component	Requirement
Operating system	Windows 7 (SP1, 32- or 64-bit) or Windows 8 or 8.1 or Windows 10
Browser	Internet Explorer 11 Edge 44 (EdgeHTML 18) on Windows 10 Firefox 68 & 69 Safari 12.1 (on Mac OS X 10.12.6) Chrome 76 & 77 **Attention:** Please note that due to the different technological basis, minor differences in the display of content between Internet Explorer and Firefox, Safari and Chrome might occur. **Attention:** Please note that Flash content is not supported in the Safari browser. **Attention:** Please note that due to a security feature in new Firefox versions, it is no longer possible to redirect at the end of a learning-object (LO) (which is loaded via an encrypted connection) to a non-secure site. In this case, the LO will not close and no progress will be stored. **Attention:** Please note that due to a browser security feature, locally stored content cannot be played back in Chrome. **Attention:** Please note that due to browser security policies the glossary is not available on locally accessed content (IE and Chrome). **Attention:** Please note that the privacy-modes of the browsers are not supported.

	Attention: Please note that in case a host, on which an E-Learning is started, has set specific options for compatibility-view and the topmost window does not contain the "X-UA-Compatible" meta tag, the exported content will not be displayed correctly. **Attention:** Please note that devices, which work with "touch-interactions" (e.g. tablets, phones, hybrid-notebooks) are not supported.
Browser settings	JavaScript and session cookies have to be activated.
Multimedia support	Internet Explorer: Audio: always uses native HTML5-Audio element Video: always uses native HTML5-Video element Firefox: Audio: always uses native HTML5-Audio element Video: always uses "Flash Player plugin" (version 6 or higher) Safari: Audio: always uses native HTML5-Audio element Video: always uses native HTML5-Video element **Attention:** Please note that due to increasing browser restrictions, the automatic playback of videos containing a sound-track can not be guaranteed on all browsers.

2.3 WBTs on Apple iPad

Automatic playback of sounds on iPad

Apples policy on the play back for multimedia content is that a specific user interaction is required in order to initiate the playback.

This policy has the following consequences for automatic playback of multimedia content embedded in tt knowledge force learning objects:

- only the first sound on a page can be played automatically
- all additional sounds on that page will not be played automatically, even if the learning object is designed that way and it works in other browsers
- if more than the first sound is to be played on one page, the rest needs to be initiated by a trigger
- sounds on the very first page of a learning object cannot be played automatically at all
- if a learning object is opened with the "resume" function at a step that is not the very first one, the sounds on that step cannot be played automatically
- it is not recommended to use sounds in the page exit area, since they cannot be played automatically plus their use will prevent the sounds of the following page from being played automatically

2.4 Technology

Web browser application based on HTML and JavaScript. A web server is not required; WBTs can be played / viewed on a local browser (except Chrome and IE).

No installation is necessary; the exported content files are automatically loaded in the browser when the corresponding start file is accessed.

2.5 Installation

No installation necessary, the exported content files are automatically loaded in the browser when the corresponding start file is accessed.

2.6 Storage of training data

Training data can be stored via SCORM, AICC or locally via cookies (i.e. indexedDB for HTML5 content). Student data is stored in a database on a user-specific basis in conjunction with the Web Publisher.

SCORM versions 1.2 and 2004 (3rd & 4th edition) are supported.

2.7 Browser settings

To ensure optimal performance, you are advised not to select the "Every visit to the page" browser cache setting.

If using Internet Explorer, the default settings have to be changed as follows in order to deactivate the display of the Information Bar message when accessing a lesson that is stored on the local file system:

Tools >Internet options >"Advanced" tab >Security > select the "Allow active content to run in files on My Computer" checkbox > click the OK button.

Start WBT from CD

To start a WBT from a CD, you also need to select the "Allow active content from CDs to run on My Computer" checkbox on the same tab.

2.8 Use of SmartComponents

SmartComponents in conjunction with the tt player API extend the functional scope of the tt knowledge force player. While playing the WBT, the SmartComponents are loaded once and on demand into the browser cache of the client PC.

Please note that SmartComponents may impact the performance of the tt knowledge force player. Rectification of these issues lies solely in the responsibility of the developer of the SmartComponent in question.

SmartComponents must be placed at their designated position within the tt player. A modification at any other place within the tt player is not allowed.

tts may alter the software, the API (or both) at any time without guaranteeing the playability of existing components.

tts is not obligated to rectify any errors that have the root cause in the SmartComponent or answer any questions / provide support for rectification of these external errors.

If a customer places his/her own SmartComponents within the tt player, the customer acts on his/her own and sole responsibility.

2.9 Network bandwidth used when playing WBTs

For this, four exemplary settings have been defined:

1. MS Office 2007, high-quality simulation, refined graphics
2. MS Office 2007, high-quality simulation, refined graphics, with sound (MP3, 56 kBit/s)
3. SAP basic course, normal simulation depth, little refinement
4. SAP basic course, normal sim. depth, little refinement, with sound (MP3, 56 kBit/s).

The WBTs were worked through by learners, which resulted in the following exemplary values:

Scenario	used time	transferred data	Average transfer rate	Maximal transfer rate
1	7min 43s	5.0 MB download 0.5 MB upload	11.0 kB/s download 1.0 kB/s upload	247.0 kB/s download 38.0 kB/s upload
2	9min 50s	7.5 MB download 0.5 MB upload	12.7 kB/s download 0.8 kB/s upload	293.0 kB/s download 36.8 kB/s upload
3	5min 45s	2.6 MB download 0.3 MB upload	7.8 kB/s download 0.8 kB/s upload	72.2 kB/s download 31.0 kB/s upload
4	11min 44s	5.0 MB download 0.3 MB upload	7.3 kB/s download 0.4 kB/s upload	208.0 kB/s download 34.2 kB/s upload

Hint: Contents 1 and 2, as well as 3 and 4, are identical. The only difference lies in the presence or absence of speaker sounds. In most cases, users will work through WBTs without sound at a quicker pace than WBTs that contain sound. Therefore, versions with sound do not necessarily need a higher bandwidth - as reflected in the test results.

Downloading the WBT player files is done automatically - and only once for all WBTs. Therefore, the test results with activated browser cache are based on the assumption that the WBT player has already been cached.

For comparison only – Test results via http with deactivated browser cache or when accessing the WBT via file server (both methods not recommended):

Scenario	used time	transferred data	Average transfer rate	Maximal transfer rate
1	4min 52s	14.5 MB download 5.6 MB upload	50.6 kB/s download 19.7 kB/s upload	774.0 kB/s download 217.0 kB/s upload
2	10min 19s	23.7 MB download 8.9 MB upload	39.2 kB/s download 14.7 kB/s upload	738.0 kB/s download 260.0 kB/s upload
3	7min 21s	19.1 MB download 6.8 MB upload	44.2 kB/s download 15.8 kB/s upload	742.0 kB/s download 186.0 kB/s upload
4	12min 14s	24.9 MB download 8.5 MB upload	34.7 kB/s download 11.8 kB/s upload	942.0 kB/s download 256.0 kB/s upload

2.10 HTML5 export

Hardware

Component	Requirement
Processor	Minimal: Dual-core from 1.6 GHz Recommended: Quad-core from 2.6 GHz
Memory	Minimal: 1 GB Recommended: 4 GB

Software

Component	Requirement
Operating system	Windows 7 (SP1, 32- or 64-bit), or Windows 8 or 8.1 or Windows 10 iOS 12.0.1 Android 5.1.1 („Lollipop“) Android 7.1.1 („Nougat“) Please note that the functionality is tested and verified on reference devices (see below). Support cases must be reproducible on these reference devices.
Browser	Internet Explorer 11 Edge 44 (EdgeHTML 18) on Windows 10 Firefox 68 & 69 Safari 12.1 (on Mac OS X 10.12.6) Chrome 76 & 77 **Attention:** Please note that minor differences in the display of content between Internet Explorer and Firefox, Safari and Chrome might occur. **Attention:** Please note that due to a browser-security-feature, locally stored content cannot be played back in Internet Explorer and Chrome. **Attention**: Please note that some differences in the touch-behaviour within the Edge-browser might occur on some mobile Windows devices.
Browser settings	JavaScript and session cookies have to be activated.

Please find the currently supported functions described in detail in the HTML5 Authoring Guidelines.

2.10.1 Reference Devices for Android

- Samsung Tab 3
- Nexus 9
- Nexus 10

3 tt guide – Client

The following requirements need to be met in order to run tt guide client:

3.1 Hardware

Component	Requirement
Processor	Minimal: Single-core 1.5 GHz Recommended: Dual-core 2.0 GHz
Memory	Minimal: 2.0 GB
Hard drive	~15 MB
Screen resolution	Depends on the size of the recorded application and the produced content. However, at least approx. 100 pixels higher than the recording resolution, because parts of the browser interface must be visible (Internet Explorer). At least 16-bit color depth.

3.2 Software

Component	Requirement
Operating system	Windows 7 (SP 1, 32- or 64-bit) or Windows 8 or 8.1 (only Windows Desktop, no Metro Interface, no Apps) or Windows 10 **Attention:** Please note that display-magnifications above 100% are not supported. **Attention:** Please note that devices, which work with "touch-interactions" (e.g. tablets, phones, hybrid-notebooks) are not supported.
Browser	Internet Explorer 11 Edge 44 (EdgeHTML 18) on Windows 10 **Attention:** Please note that the tt guide client requires one of the above IE versions to be installed and executable on the system. **Attention:** Please note that on a Windows 10 system, the client uses IE11 to display the results and therefore IE11 needs to be installed.
Permissions	The execution of a local application has to be permitted. In addition to that, the user must have the permission to establish an http(s) -connection to the portal server.

3.3 Installation and distribution

We provide different MSI installation packages that allow for the following ways to install or distribute the client software:

1. Manual installation with administrator rights
2. Manual installation without administrator rights (e. g. by end users) in the profile folder
3. Centralized distribution using client-specific MSI distribution mechanisms
4. Integrating the product with an existing software solution. Thanks to the existing API (based on Windows DLLs), it is possible to integrate the product into an existing application and rolling them out together. The tt guide client can then be started as an individual process and run externally, or run in the bundled application's process. This variant greatly benefits from the fact that the program is compact, has low resource demands, and does not rely on third-party components.

All distribution and installation variants share the fact that no additional components have to be installed and that no changes are made to the Windows system folder or the registry (HKEY_LOCAL_MACHINE) (Exception: MSI-based program registration when installing with administrator rights).

All MSI packages we provide are digitally signed, thus making it possible to identify us as the manufacturer and preventing unauthorized changes to the files by third parties.

Special note for Windows 7 (or newer) operating system

When User Account Control (UAC) is activated, recording of / guidance through programs or processes that require administrator rights can only be accomplished if the tt guide client also runs with administrator rights.

Special note for environments with activated Windows-group-policy: “Security zones use only machine settings”

In order to guarantee proper functionality of our software this policy needs to be set to the default-value (deactivated), or the following Registry-Values need to be set:

64 Bit Windows:
[HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\Microsoft\Internet Explorer\Main\FeatureControl\FEATURE_BROWSER_EMULATION]
"TTGuide.exe"=dword:00002af9

32 Bit Windows - tt guide:
[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Internet Explorer\Main\FeatureControl\FEATURE_BROWSER_EMULATION]
"TTGuide.exe"=dword:00002af9

Pleas note that the value that is to be set (i.e. dword:00002af9) depends on the installed version of Internet Explorer, so please use the following values:

IE 11: 00002AF9

3.4 Supported applications for guidance in Overlay Mode

The immersive step-by-step guidance which makes use of the Overlay Mode is only supported for the following applications:

- Office 2013
- Office 2016
- Office 2019
- SAP GUI (excluding embedded web application(s) and Netweaver Business Client).

In case of SAP in combination with Win10 and Win8.1 (Update KB3000850) the Windows "Control FlowGuard" must be deactivated for SAP GUI in order to record and playback.

3.5 Security and Privacy

The installed product is a generic Windows Client Application that runs in **a single process*** and can thus be started / terminated explicitly.

The program does neither create nor use background programs or services. It also does not establish a network or internet connection, or use socket services or comparable (network) mechanisms.

When using the server, an optional Internet Explorer web browser control is used for the integrated search feature. If installed, the browser control will use the connection and security settings defined for the installed Internet Explorer.

All executable files (.exe and DLL) that are provided by us have exclusively been created using Microsoft Visual C++ 2012 (MFC 11.0). In addition to that, all binary components named above are digitally signed. You can thus identify tts as their author.

*** Note:** On 64-bit operating systems, a so-called Bridge Process is additionally started (only in play mode) to make object recognition possible for 64-bit processes.

Privacy protection

As stated before, a user's interactions and (text) entries are stored as images and data during recording. It is important to note that this **only happens during recording**. It **does not happen** during any other usage of the product, e. g. **during help mode**. Only the data and entries necessary for the help mode are stored, and only for the visible, recorded application. Via the program's user interface, you can check, edit, and delete the recorded data any time. For password fields that can be recognized as such, no entries will be recorded in the first place.
During help mode, no actions, screen shots, entries, or other user data are recorded, saved, or transmitted (see above, the client software does not maintain any internet or network connection). Put clearly, it is not the aim of the product to spy on or control users; the sole purpose is to guide them through the desired application.

To ensure maximum security of the data generated during recording, the Guide exchange format is highly encrypted, thus keeping it safe while being transported via e-mail or through the intra-/internet. The product also contains mechanisms and automatic features that remove /

neutralize personal data or sensitive company data prior to publishing, as well as easy to use functions for manual editing of (image) data.

In addition to that, unpublished Guides can only be played back on the PC on which they were recorded. They cannot be opened on other PCs, which helps to prevent unintentional circulation of untested Guides.

3.6 Uploading of Guides

Individual Guides are stored locally as simple and very compact files (single file format). They can be copied/moved in the file system, as well as exchanged (e. g. via email). If a Guide is to be published and uploaded to the server, it is sent to the portal using the locally installed Internet Explorer.

More precisely put, the client starts the browser via COM interface, hands the file over as a Base64String data stream, and then instructs the browser to send it to the specified URL using http 'post'.

As this procedure makes use of the browser (and therefore the browser's standard functions, settings, and security features), the product itself does neither need a network/internet connection, nor a specific network configuration (e.g. proxy, tunnel or the like).

The only piece of information that must be provided is the server's URL – which can be preconfigured for all users, as described above.

3.7 Downloading of Guides

As the Guides are stored in a single file, they can simply be downloaded with the browser and stored locally.

3.8 Third-party content

Desktop Management software
In case of using multiple monitors supported by desktop management software (for instance ATI Hydravision), problems with the object recognition during (re-)recording and guiding through applications may arise.

Bamboo Drivers
As soon as Bamboo drivers for a drawing tablet and the corresponding pen are installed, these drivers will interfere with the correct display and object recognition of the guide client.

Microsoft Snipping Tool
As long as this tool is running it will interfere with correct object recognition needed for recording as well as playing guides.

4 tt guide – Content

4.1 Bandwidth and file sizes - Download

The data required for accessing / playing a Guide averages around 5-10 KB per step. This means that a typical Guide (~10 steps) will require roughly **50–100 KB**. Due to the extremely low file sizes, the files are loaded 'en bloc'.

4.2 Bandwidth and file sizes - Upload

Data usage is higher for uploads, as a preview video for the portal is created in addition to the Guide itself. This amounts to 20–40 KB per step, resulting in a total of 200–400 KB for an average Guide containing 10 steps.

5 Object recognition

5.1 General

In order to provide object recognition in different applications, the product uses interfaces such as Microsoft Active Accessibility (MSAA) or the Java Access Bridge (JAB). Based on those interfaces, we can achieve very high levels of object recognition for the standard applications listed below, as well as for most software and web applications available, without the need to adapt the software and/or configuration.

It is, however, **essential** that the application supports those APIs correctly and provides plausible data.

5.2 Object recognition for standard applications

The following table lists the requirements that need to be met to achieve object recognition during recordings, as well as context identification.

The first column depicts the use case (i. e. the application that is to be recorded) and the second column the requirements for this application that need to be fulfilled.

Software	Version(s) / notes
Microsoft Windows	Windows 7, Windows 8.1 (only Windows Desktop, no Metro Interface, no Apps) , Windows 10 E.g. system programs, system settings, system configuration, desktop, start menu, windows explorer, design settings, network administration, printer setup, program installation, etc.
Microsoft Office	Office 2013, Office 2016, Office 2019, Office 365
Browsers, web-enabled applications in general	Microsoft Internet Explorer 11 Chrome (32-bit) 733 **Attention:** For recording of Internet Explorer the enhanced protected mode of the Internet Explorer has to be deactivated.
SAPGUI	SAPGUI 7.5 PL 6 SAPGUI 7.6* **Attention:** GUI Scripting must be installed and activated on the client and activated on the server side. sapgui/user_scripting_set_readonly is sufficient, no rights are needed to control SAPGUI. **Attention:** In combination with Win10 and Win8.1 (Update KB3000850) the Windows "Control Flow Guard" must be deactivated in order to record SAP "in-process". Otherwise the recorder switches to an alternative mode, which will result in slower recording performance.
Java applications	Java 8 (min. update 20 – tested and verified with update 131) Java 9

Please note that due to a defect in the chrome browser, the accessibility mode cannot be set automatically anymore, so object and context recognition is not possible for the chrome-builds beginning from build #43. As a workaround, the accessibility flag can be set manually.

5.3 Object recognition in SAP GUI

The SAP GUI Scripting interface from SAP is used – and is therefore a prerequisite – for recording and guiding within the SAP GUI. Scripting is activated by default during the SAP GUI installation. Should this not be the case on the client computer, it can be easily installed via the SAP GUI installation.

To ensure object and context recognition in this context, two settings need to be set within the SAP GUI:

1. "Notify When a Script Attaches to a Running GUI" and
2. "Notify When a Script Opens a Connection".

Both need to be **deactivated**. These settings can be found in the GUI Options ("Adjust the local layout" button or via the shortcut Alt+F12->Options menu item) on the "Scripting" tab.

Important note: To ensure an optimal context and object recognition, our product attempts to automatically set the above options - provided that the user possesses the necessary rights. This behavior can be deactivated upon request. Furthermore, SAP GUI Scripting has to be activated on the server side. In order to do so, the profile parameter *sapgui/user_scripting* has to be set to the value *TRUE*. If this is not the case, please proceed in the following way:

1. Call up the RZ11 transaction
2. Enter *sapgui/user_scripting* in the field
3. Click "Change value"
4. As the new value, enter *TRUE*
5. Click "Save".

Please refer to SAP Note No. 480149 for further information.

5.3.1 Security Aspects

For notes on security-related aspects, please refer to the following SAP documentation ("SAP GUI Scripting Security Guide"):

https://help.sap.com/saphelp_nw73ehp1/helpdata/en/49/38dea6c657200be10000000a42189c/content.htm

As the tt guide client only needs read access to the SAP GUI, activating SAP GUI Scripting will not impact security. A more concise description of the security setting can be found in the document given above, from which the following quote was taken:

> [...]
>
> ***Modes for server side protection***

The profile parameter described in the previous chapter controls the availability of SAP GUI Scripting in an all-or-nothing kind of way. Some users have asked for a more fine grained approach. This would allow them to enable only those features of SAP GUI Scripting that are required for their specific application.

In response to these requests we have added two additional profile parameters that modify the behavior of the sapgui/user_scripting profile parameter.

sapgui/user_scripting_disable_recording

This parameter disables all SAP GUI Scripting events for the system on which it is set. It is still possible to run previously recorded or written scripts. However, it is not possible to record new scripts or log any other type of information in response to SAP GUI Scripting events.

sapgui/user_scripting_set_readonly

In SAP GUI Scripting's read only mode only a subset of the API can be used from a script. This comprises read access to properties and calling read only functions.

Please note that the read only restriction applies to the state of the SAP GUI session on the server. This implies that you may not execute any call which changes the data stream sent to the server, even if no actual database update is attempted.

[...]

For the tt guide client, both the ***sapgui/user_scripting_set_readonly*** and the ***sapgui/user_scripting_disable_recording*** parameters can be set to TRUE. As described above, the SAP GUI cannot be controlled using tt guide client or any other third-party software. It is also not possible to record user interactions in the SAP GUI. Thus, there is no increased security risk.

In the following section, tts comments on the security-related aspects outlined by SAP (excerpt from the SAP document given above):

[...]

8.0 Security Q&A

1. *Can a script corrupt the SAP system's data?*

   No. All changes done from a script are subject to the same data validation rules as end user interaction.

2. *Can a script influence the system performance?*

   Yes. A script executes significantly faster than an end user, and may therefore put more load onto the system.

   Comment by tts: This is not the case, as the sapgui/*user*_scripting_set_readonly parameter can be set to TRUE.

3. *Can a script access data for which the end user does not have the necessary privileges?*

   No. The script has only access to the data to which the end user has access rights.

4. *Can a script export data that the end user could otherwise not export?*

   Yes. Even if the download of a list is not allowed, an end user can extract the data from SAP GUI. Of course, the end user could also create a screen shot instead. SAP GUI Scripting can only export data that is displayed on the screen.

5. *Can a script record end user interaction with SAP GUI?*

   Yes. However, the end user will be notified about this, unless he disabled the notification.

   Comment by tts: This is not the case, as the sapgui/user_scripting_disable_recording parameter can be set to TRUE.

6. *Can a script record passwords?*

   No. Therefore, a script cannot be played back if the user running it does not have an account on the SAP system.

7. *Can a script run in the background without the end user's knowledge?*

   No. The end user will be notified when the script starts, unless she disabled the notification. In addition, SAP GUI Scripting needs to display SAP GUI for running a script.

8. *Can SAP GUI Scripting be used to corrupt the client PC?*

   No. The functionality of SAP GUI Scripting is limited to driving SAP GUI. However, if you use Visual Basic Script and the Windows Script Host to access the SAP GUI Scripting interface, the functionality of the VBS language or the Windows Script Host object model might very well be used to perform arbitrary operations on the client PC.

[…]

Special note when using tt guide client while "sapgui/user_scripting_set_readonly" is set to *true*

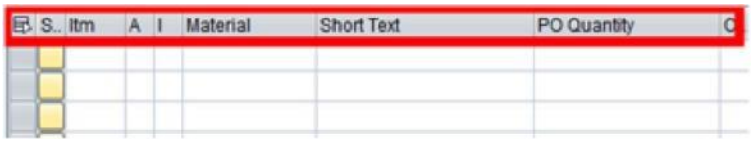
In this mode, there are two restrictions by design:

1) Input values automatically / Smart Link "Enter automatically": Since values can't be entered automatically as a whole per scripting API – **("read only"),** –, these will be entered into the input fields per Windows keyboard automation key by key. The function therefore is restored but behaves differently for the user and is a little bit slower.
2) Activate / focus input fields automatically: This function is also "by design" not available per SAP Scripting. For this reason, there exists a second alternative method in tt guide client which activates the input field via mouse automation. Since the tt guide client, as a default for security reasons, is not allowed to do mouse clicks itself, this has to be explicitly activated in the configuration.

We also note that both functions are there for convenience reasons only, it doesn't pose a problem to use tt guide client without these functions.

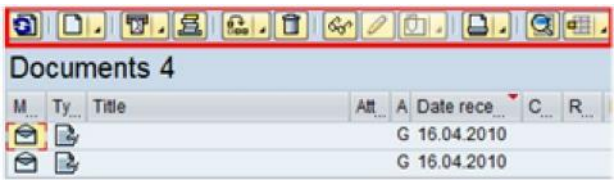
Due to known issues in the SAP GUI scripting interface, the following issues can occur during the "read only" mode with object recognition (highlighting the target object):

- Table heads in SAP table controls:



  This problem does not occur when using SAPGUI 7.2 with patch level 14 or higher or SAPGUI 7.3 with patch level 2 or higher.

- Buttons in SAP grid views and SAP table tree views:

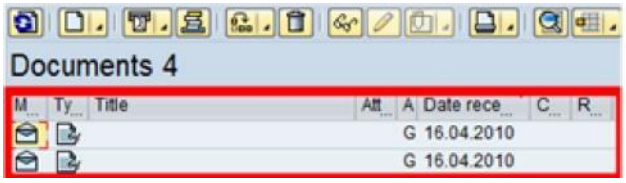


  This problem does not occur when using SAPGUI 7.2 with patch level 14 or higher or SAPGUI 7.3 with patch level 2 or higher.

- Column marker in SAP table controls:

  This does not occur when using SAPGUI 7.3 with patch level 6 or higher.

- Table heads, rows and cells in SAP grid views:



  This does not occur when using SAPGUI 7.3 with patch level 6 or higher.

Hints for these topics can be found in the sap notes 1578980 and 1751279.

5.3.2 Characteristics of F4 help

The SAP GUI scripting interface used does not support F4 help in standard mode (referred to as amodal or control mode). Therefore, a running tt guide client will interrupt the connection to the SAP GUI scripting interface if F4 help is opened, to make sure that the help is opened in amodal mode nonetheless.

Please note that in this variant of F4 help, it is not possible to detect individual table rows as objects, but only the table as a whole (with free selection).

If detecting individual table rows is crucial even in F4 help (which will only be necessary if you need to record the help itself), you have to change the F4 help to modal (dialog based) for all SAP users that use tt guide client. Please proceed as laid out in SAP Note 977584.

For general information on this topic, please see SAP Note 977583.

5.3.3 Object recognition in SAP Netweaver Business Client (NWBC)

Object recognition via the SAP-scripting interface for the NWBC is solely possible with the NWBC Client. If this SAP component is accessed via a browser, the MSAA interface will be used. Since this provides less information, this set-up is not recommended. Please note that object information from the central SAP-content area of the NWBC Client can be retrieved via the SAP-scripting-API. Object information for structural and navigational elements in the left- and upper area cannot be accessed.

5.4 Object recognition in cross-platform and cross-language cases

A basic prerequisite for cross-platform object recognition is that the process of the application(s) must be identical and the object name of the interaction object (like input fields, buttons) should match between the systems / platforms.

Please note that context recognition is explicitly ruled out if the GUI language of the recorded application is different from the one found in the live application.

Thus, we advise you, particularly in the case when creating Guides, to create separate recordings for each GUI language, as we explicitly do not support cross-language object recognition. Of course, it is possible to use different instruction languages for the same GUI language without the need for a rerecording.

Example: There is an enterprise-wide IT system that features an English GUI. The Guides for such a system would only have to be recorded once. Using our language packs, you could then translate the instructional and explanatory texts into all other languages needed.

5.5 Object recognition for JAVA applications

To record Java applications, the Java Access Bridge (JAB) is used. It is integrated into the Java runtime environment (JRE) and acts as an interface between native Windows programs and Java applications.

This allows receiving information on control elements within a Java application. Access to the Java Accessibility API is not limited to actual applications, but also encompasses the applets that run within a browser window.

The procedure to be applied when installing JAB depends on the type of JRE installation and may vary from application to application. To determine the correct procedure, please carefully read this entire chapter before commencing the actual installation process.

5.5.1.1 Using centrally installed JREs

Centrally installed JREs can be identified by the fact that they can be found in the 'Add or Remove Programs' (or – since MS Vista – 'Programs and Features') list in the Windows Control Panel. Applications that use such a JRE do not have a 'jre' sub-folder.

In this case, a single installation in the central JRE(s) is fully sufficient. This also applies to applets, as they require a JRE installed in this manner due to browser integration.

5.5.1.2 Applications with a local JRE

Some Java applications use a local JRE that is not contained in the Windows Registry. Such an application is usually not started via a jar file, but instead via an .exe or a .bat file, and the program folder contains a 'jre' sub-folder. In this case, there usually is no JRE to be found in the 'Add or Remove Programs' / 'Programs and Features' list of the Windows Control Panel.

5.5.1.3 Installing the Java Access Bridge

Manual installation for local JREs:

- Locate the JRE that is used by the application.
- Switch over to the JRE's 'jre\lib' directory.
- Copy the accessibility.properties file into this folder. Should the file already exist in this folder, you need to merge the files so that the file that already exists also includes the contents of the appropriate JAB installation file.
- Switch over to the JRE's 'jre\lib\ext' directory.

Copy the following files into this directory:

  - *access-bridge.jar* and one of the following additional files
  - *jaccess-1_2.jar* for Java 2 Version 1.2.x **or**
  - *jaccess-1_3.jar* for Java 2 Version 1.3.x **or**
  - *jaccess-1_4.jar* for Java 2 Version 1.4.x (or higher).

Install the JAB Windows DLLs:

  - *JavaAccessBridge.dll*
  - *JAWTAccessBridge.dll*
  - *WindowsAccessBridge.dll*

- for a **32-bit Windows**, copy the DLLs mentioned above into the *Windows\System32* directory
- for a **64-bit Windows**, copy the DLLs into the *Windows\SysWow64* directory.

5.5.2 JAB for Java 8

For these Java versions the JAB that is provided with the corresponding JRE is used.
No additional installation is required. By default the access bridge is disabled.
For each installed JRE the JAB can be individually activated via the file "accessibility.properties". The assistive technologies property specifies the assistive technologies to load into the JVM. It takes a comma-separated list as input.
For example, if you set this property to "com.sun.java.accessibility.AccessBridge", the Java Access Bridge is enabled.

Availability of JAB versions:

2.0.0: is provided along with tt performance suite client package

2.0.4: is provided along with standard JRE 7 Update 60

1.8: is provided along with standard JRE 8 Update 20

Compatibility overview:

	JAB 2.0.0	JAB 2.0.4	JAB 1.8
Java 8	✘	(✓)*	✓

* JAB 2.0.4 is delivered with JRE 8 until update 20

5.6 Object recognition for third-party and custom-built applications

As outlined above, object recognition works for most software products available for Microsoft Windows, as well as for custom software, due to the fact that the MSAA interface is usually available and supported with no extra effort.

In most cases, this also holds true if the software in question was developed using Microsoft products such as MS NET, Visual C++ and/or Visual Basic, or if Microsoft Common Controls are used.

6 Web Workbench

6.1 Minimal requirements

The Web Workbench depicts the browser-based access to the "Document Management area" of the tt knowledge performance suite.

In order to use this, the corresponding server needs to be installed and running. For the requirements that need to be met on the server side, please refer to chapter 7.

Should any of the requirements defined herein not be met, the proper functioning of the Web Workbench cannot be guaranteed and there exists no claim to establish this.

6.2 Software

Component	Requirement
Operating system	Windows 7 (SP1, 32- or 64-bit), or Windows 8 and 8.1 or Windows 10
Browser	Internet Explorer 11 Firefox 69 & 68

	Attention: Please note that due to the different technological basis, minor differences in the display of content between Internet Explorer and Firefox might occur. **Attention:** Please note that display-magnifications above 100% are not supported.
Browser settings	JavaScript and session cookies have to be activated.

6.3 Hardware

Component	Requirement
Processor	Minimal: Single-core 2.6GHz Recommended: Dual-core 2.6GHz Please note that these are average values and that the required hardware is strongly dependent on the use case, i. e. the expected number of authors / end users, respectively.
Memory	Minimal: 512 MB Recommended: 2 GB Please note that these are average values and that the required hardware is strongly dependent on the use case, i. e. the expected number of authors / end users, respectively. These values depict the amount of RAM that should be available for the Java process.

7 Server components

7.1 Hardware

Component	Requirement
Processor	Minimal: Single-core 2.6 GHz Recommended: Dual-core 2.6 GHz (for Web Workbench) Quad-core 2.6 GHz (for Web Publisher) Please note that these are average values and that the required hardware is strongly dependent on the use case, i. e. the expected number of authors / end users, respectively.
Memory	Minimal: 2 GB Recommended: 4 GB Please note that these are average values and that the required hardware is strongly dependent on the use case, i. e. the expected number of authors / end users, respectively. These values depict the amount of RAM that should be available for the Java process.
Hard drive	200 MB for program data Repository: ~ 1 GB / 500 Documents Database: ~ 100 MB / 500 Documents **Attention:** These values represent averages! The actual amount of data can vary greatly, depending on the complexity and media-richness of the stored objects.

	Attention: If version management is activated, the amount of required disk space is increased significantly. For a rough estimate, multiply the values given above with the average number of document versions. **Attention:** For optimal performance, we recommend the use of SSD hard drives.

7.2 Software

Component	Requirement
Operating system	Windows Server 2011 or Windows Server 2012 or Windows Server 2012 R2 Windows Server 2016 Windows Server 2019 Linux
Browser settings	JavaScript and session cookies have to be activated.
Permissions	Administrator-rights are required for the installation.
Application server	Apache Tomcat 8.5 Apache Tomcat 9 JDK11 **Attention:** The corresponding Java Development Kit (JDK) needs to be installed on the server; the Java Runtime Environment (JRE) alone is not sufficient.
Database	MSSQL Server 2014 MSSQL Server 2016 MSSQL Server 2017 Oracle 18c **Attention:** Please note that the database tables need to be UTF-8 encoded.
Storage Service	MinIO v2020.06.22
Reverse Proxy (optional)	Tomcat connector for Apache HTTP Server (mod_jk or mod_proxy_ajp) **Attention:** Tomcat connector for Microsoft IIS (ISAPI Redirector) is not supported.

7.3 Technology

Server application based on the Java Enterprise Edition (JEE) framework Oracle.

7.4 Installation

Attention: In order to upload content created in the authoring environment to the server component, all components that take part in the network communication (e. g. proxy, VPN software, etc.) must support HTTP 1.1 incl. chunked transfer coding.

Please note that the http-communication to the server needs to be either http or https exclusively; a mixed scenario (http along with https) is not supported. We do recommend to use https.

Please note that "tomcat-jdbc-1.0.8.5.jar" is not compatible with Tomcat 7.

For "search-functionality" within workbench and publisher we require a Solr 7.4 being available.

7.5 LDAP

The following section lists the known restrictions of the provided LDAP interface:

- Only "internal" authentication with user name and password is supported. Alternative mechanisms in accordance with SASL (RFC 2222) are not possible.
- Start-TLS (RFC-2830) is currently not supported.
- LDAP groups have to be associated to user entries. Users associated with groups are not supported.

7.6 SAML

SAML is supported in the version 2.0. With respect to the bindings, the tt performance suite supports "HTTP POST".

7.7 Dashboard

For Dashboard functionality

- Matomo version <= 3.11.0 and
- CustomDimensions Plugin version <= 3.1.8 is mandatory.

Newer versions will result in unspecified behavior and thus are not supported.

7.8 Third-party software

FortiClient

It is a known issue that if the FortiClient virus scanner is installed on the operating server, statification of WBTs is not possible.

McAfee

Please note that a locally used virus scanner from McAfee may reduce the perfor-mance of the authoring component.
You are advised to change the anti-virus program's settings so the TT Knowledge Force installation folder is excluded from the scanning process.

HP Quicktest

Please note that HP Quicktest can only be installed in parallel with the authoring software under specific conditions: the user, under which the authoring software is launched, may not have reading permissions on the folder in which the Quicktest ex-ecutable resides.

HP Sprinter

Please note that the installation will cause write access problems to the TT Knowledge Force Client profile folder which may result in a failure to load the WYSIWYG view.

Check Point

Please note that the virus scanner from Check Point End Security may strongly re-duce the performance of the TT Knowledge Force Client.
System Requirements – TT Performance Suite 2015

Desktop Management Software

In case of using multiple monitors supported by desktop management software (for instance ATI Hydravision), this can cause problems with the object recognition during (re-)recording and guiding through applications.

Bamboo Drivers

As soon as Bamboo-drivers for drawing tablet and the corresponding pen are in-stalled these drivers will interfere with the correct display and object-recognition of the guide-client.
Microsoft Snipping Tool
As long as this tool is running it will interfere with correct object-recognition needed for recording as well as playing guides.

Microsoft Security Policies

If you experience problems with editing in the WYSIWYG View (i.e. no editing possi-ble) please check if the MS Security Policy “Local Machine Lockdown” is enabled. If so, please disable this policy.

8 QuickAccess (QA)

8.1 Push Notifications

Please note that push notifications can only be used on Windows 10 operating system.

Please note, that in order to display the notifications properly, certain settings-requirements in Windows 10 need to be met:

- the notification-assistant needs to be turned off
- the setting "Notifications from apps and other senders are to be collected" needs to be turned on
- in addition to the above mentioned general setting, Windows 10 allows for app-specific notifications control. Here notification-collection from QuickAccess needs to be enabled as well.

We recommend using this feature on Window10 builds higher than 1804, since in earlier builds defects in the Windows pop-up-notifications have been reported.

8.2 QA for SAP

Please note that this module is only supported for already existing installations.

8.2.1 Technology

Client-side: A SAPGUI enhancement that is activated via the function modules transported in SAP Basis (package in the /TTS/ namespace). Documents are displayed via a Web browser which is installed on the client system. Server-side: An HTTP request is used to trigger a search for content on the Publisher and content is then fed to the client via HTTP protocol.

For more information, please refer to our installation guidelines.

8.3 Web-QA

Please note that in case of Internet Explorer the corresponding Web-QA-server (i.e. ttps publisher) needs to be added to the trusted sites.

9 Open-source products

9.1 Server

Name	Version	License	Link
ANTLR	2.7.7	BSD	http://www.antlr2.org/
XMP Library for Java	5.1.3	BSD	http://www.adobe.com/devnet/xmp.html
Amazon AWS SDK	1.11.355	Apache License 2.0	https://github.com/aws/aws-sdk-java

Metadata Extractor	2.10.1	Apache License 2.0	https://github.com/drewnoakes/metadata-extractor
Jackson	2.6.0, 2.9.0, 2.9.5 2.6.7, 2.9.5, 2.9.8 2.6.7.1, 2.8.11.3, 2.9.5, 2.9.8 2.6.7	Apache License 2.0	http://wiki.fasterxml.com/JacksonHome
ClassMate	1.3.4	Apache License 2.0	http://github.com/FasterXML/java-classmate
Caffeine Cache	2.6.2	Apache License 2.0	https://github.com/ben-manes/caffeine
WAFFLE JNA	1.9.1	EPL	http://dblock.github.com/waffle/
FindBugs JSR305	3.0.2	Apache License 2.0	http://findbugs.sourceforge.net/
Error Prone Annotations	2.2.0	Apache License 2.0	
Google Guava	27.1-jre	Apache License 2.0	https://github.com/google/guava
Google DiffMatchPatch	0.0.0-20120106	Apache License 2.0	https://code.google.com/p/google-diff-match-patch/
Jayway JSON Path	2.2.0	Apache License 2.0	https://github.com/jayway/JsonPath
C3P0	0.9.5.2	GNU LGPL 2.1, EPL 1.0	https://github.com/swaldman/c3p0
Mchange Commons Java	0.2.11	GNU LGPL 2.1, EPL 1.0	https://github.com/swaldman/mchange-commons-java
Java Inject	1.0.0	Apache License 2.0	
Apache XML Commons Serializer	2.7.1	Apache License 2.0	https://xml.apache.org/xalan-j/downloads.html
Apache Struts	1.2.9	Apache License 2.0	http://struts.apache.org/
Apache Velocity	1.6.2	Apache License 2.0	https://velocity.apache.org/engine/index.html
Xalan Java	2.7.1	Apache License 2.0	https://xml.apache.org/xalan-j/downloads.html
Apache Xerces XML Support	2.9.1	Apache License 2.0	https://xerces.apache.org/xerces-j/
CGLib	2.2.0	Apache License 2.0	https://sourceforge.net/projects/cglib/
SpringSource Org Logicalcobwebs Proxool	0.9.1		

Simple API for CSS	1.3.0	W3C	https://www.w3.org/Style/CSS/SAC/
Castor	1.2.0	Apache License 2.0	http://castor-data-binding.github.io/castor/
JDOM	1.1.0	Apache-style open source license	http://jdom.org/
JSON	1.1.0	Public Domain	http://www.JSON.org/
Istack Common Utility Code Runtime	3.0.7	CDDL 1.1, GPL2 w/CPE	
JavaMail API	1.6.2	CDDL/GPLv2+CE	
Old JAXB	2.3.0	CDDL+GPL License	
FastInfoset	1.2.15	Apache License 2.0	http://fi.java.net/
ArchUnit	0.9.2	Apache License 2.0	https://github.com/TNG/ArchUnit
HikariCP Java6	2.3.13	Apache License 2.0	https://github.com/brettwooldridge/HikariCP
Apache Commons	1.8.1 1.9.3 1.9, 1.10 3.2.2 1.3.3 2.2, 2.5 2.6 1.1.1, 1.1.3, 1.2	Apache License 2.0	http://commons.apache.org/
User Agent Utils	1.21	New BSD License	https://github.com/HaraldWalker/user-agent-utils
Dropwizard Metrics	4.0.3	Apache License 2.0	
Micrometer	1.1.1	Apache License 2.0	https://github.com/micrometer-metrics/micrometer
Netty	3.10.6	Apache License 2.0	http://netty.io/
Vavr	0.10.0	Apache License 2.0	http://vavr.io/
JavaBeans Activation Framework	1.1.1	CDDL 1.0	http://java.sun.com/javase/technologies/desktop/javabeans/jaf/index.jsp
JavaBeans Activation Framework API	1.2.0	CDDL/GPLv2+CE	
Javax Annotation API	1.3.2	CDDL/GPLv2+CE	
JSR 352 API	1.0	Apache License 2.0	

Expression Language 3.0 API	3.0.0	CDDL/GPLv2+CE	
JavaMail API JAR	1.6.2	CDDL/GPLv2+CE	
Javax Persistence API	2.2	EPL v1.0, EDL v1.0	
JavaServer Pages API	1.2.2 2.3.3	CDDL/GPLv2+CE	http://jcp.org/en/jsr/detail?id=52 https://javaee.github.io/javaee-jsp-api
Java Servlet API	3.1.0	CDDL/GPLv2+CE	
Bean Validation API	2.0.1.Final	Apache License 2.0	http://beanvalidation.org/
JAXB API	2.3.1	CDDL 1.1, GPL2 w/CPE	
JLine	0.9.94	BSD	
Joda Time	2.8.1, 2.10.1	Apache License 2.0	http://www.joda.org/joda-time/
JUnit 4	4.12	EPL 1.0	http://junit.org/
Apache Log4J	1.2.17	Apache License 2.0	https://logging.apache.org/log4j/1.2/index.html
Byte Buddy	1.9.3, 1.9.5 1.9.3	Apache License 2.0	
Java Native Access	4.5.1	LGPL v2.1, Apache License 2.0	https://github.com/java-native-access/jna
JSON Smart	2.2.1 1.1	Apache License 2.0	https://netplex.github.io/json-smart/
Ehcache	2.10.6	Apache License 2.0	http://ehcache.org/
Sitemesh	2.4.2	Apache License 1.1	http://www.opensymphony.com/sitemesh/
Apache Commons	4.3 3.6.1 1.8.1	Apache License 2.0	http://commons.apache.org/
Apache HttpComponents	HttpClient:3.1.0 4.5.3, 4.5.5 HttpCore:4.4.6,4.4.9 HttpMime:4.5.3	Apache License 2.0	https://hc.apache.org/
Apache XML Security for Java	1.5.8	Apache License 2.0	https://santuario.apache.org/
Apache Solr Solrj	7.5.0	Apache License 2.0	https://lucene.apache.org/solr/
Apache Taglib	1.2.5	Apache License 2.0	https://tomcat.apache.org/taglibs/index.html
Apache Batik	1.10	Apache License 2.0	https://xmlgraphics.apache.org/batik/

Apache XML Graphics Commons	2.2	Apache License 2.0	http://xmlgraphics.apache.org/commons/
Apache Yetus Audience Annotations	0.5.0	Apache License 2.0	
Apache Zookeeper	3.4.13	Apache License 2.0	https://zookeeper.apache.org/
Apiguardian API	1.0.0	Apache License 2.0	https://github.com/apiguardian-team/apiguardian
AspectJ	1.8.10	EPL v1.0	http://www.aspectj.org/
Awaitility	3.0.0	Apache License 2.0	http://awaitility.org/
Bouncy Castle	1.60	MIT	http://www.bouncycastle.org/java.html
Checker Qual	2.5.2	MIT	https://checkerframework.org/
Old Jackson	1.9.13	Apache License 2.0	http://jackson.codehaus.org/
Jettison	1.2	Apache License 2.0	
Animal Sniffer Annotations	1.17	MIT	
Stax2 API	3.1.4	BSD	http://wiki.fasterxml.com/WoodstoxStax2
Woodstox	4.4.1	Apache License 2.0	http://woodstox.codehaus.org/
Dom4J	2.1.1	-	http://dom4j.github.io/
EasyMock	4.0.2	Apache License 2.0	
Apache Freemarker	2.3.23	Apache License 2.0	http://freemarker.org/
JAXB	2.3.1	CDDL+GPL License	
Expression Language 3.0	3.0.0	CDDL/GPLv2+CE	http://el-spec.java.net/
Hamcrest	2.1 1.3 1.3	BSD License 3 BSD License 2 BSD License 2	http://hamcrest.org/JavaHamcrest/
HdrHistogram	2.1.9	CC0	http://hdrhistogram.github.io/HdrHistogram/
Hibernate	5.4.1 5.1.	LGPL 2.1	http://hibernate.org/orm
Hibernate Validator	6.0.15	Apache License 2.0	http://hibernate.org/validator/
HSQLDB	2.4.1	HSQLDB License (BSD)	http://hsqldb.org/

Javassist	3.21.0-GA, 3.24.0-GA	MPL 1.1, LGPL 2.1, Apache License 2.0	http://www.javassist.org/
JBoss Logging 3	3.3.2	Apache License 2.0	http://www.jboss.org/
JBoss Transaction API	1.1.1.Final	CDL, GPL v2	
Java Annotation Indexer	2.0.5.Final	Apache License 2.0	
JDBDT	1.1.0	MIT	http://jdbdt.org/
JSoup Java HTML Parser	1.11.2	MIT	https://jsoup.org/
JUnit 5	5.4.1 1.4.1	EPL v2.0	https://junit.org/junit5/
Extended StAX API	1.8	CDDL+GPL License	
LatencyUtils	2.0.3	CC0 1.0	http://latencyutils.github.io/LatencyUtils/
Mockito	2.23.4	MIT	https://github.com/mockito/mockito
Noggit	0.8	Apache License 2.0	https://github.com/yonik/noggit
Objenesis	3.0.1	Apache License 2.0	http://objenesis.org/
OpenSAML	2.6.5 1.5.5 1.4.6	Apache License 2.0	https://wiki.shibboleth.net/confluence/display/OpenSAML/Home/
Opentest4j	1.1.1	Apache License 2.0	https://github.com/ota4j-team/opentest4j
ASM	5.0.3	BSD	
Quartz Job Scheduler	2.3.0	Apache License 2.0	http://www.quartz-scheduler.org/
SLF4J	1.7.(16|24|25|26) 1.7.25, 1.7.26 1.7.24	MIT	http://www.slf4j.org/
Spring Batch	4.1.1	Apache License 2.0	http://projects.spring.io/spring-batch/
Spring Boot	1.5.19	Apache License 2.0	http://projects.spring.io/spring-boot/
Spring Retry	1.2.4	Apache License 2.0	http://www.springsource.org/
Spring OAUTH	2.3.5	Apache License 2.0	
Spring Security	5.1.4	Apache License 2.0	http://spring.io/spring-security

Spring WS	3.0.7	Apache License 2.0	
Spring	5.1.5	Apache License 2.0	https://github.com/spring-projects/spring-framework
Ion Java	1.0.2	Apache License 2.0	https://github.com/amznlabs/ion-java/
JSON Taglib	0.4.1	Apache License 2.0	http://json-taglib.sourceforge.net
Not Yet Common SSL	0.3.11	Apache License 2.0	http://juliusdavies.ca/commons-ssl/
Google XMemCached	1.4.1	Apache License 2.0	https://code.google.com/archive/p/xmemcached/
HTML Cleaner	2.7	BSD	http://htmlcleaner.sourceforge.net/
Apache POI	4.0.0	Apache License 2.0	http://jakarta.apache.org/poi/
OWASP Enterprise Security API	2.0.1	BSD, CC BY-SA 3.0	http://www.esapi.org/
Imgscalr	4.2.0	Apache License 2.0	http://www.thebuzzmedia.com/software/imgscalr-java-image-scaling-library/
JGroups	2.7.0-GA	Apache License 2.0	http://www.jgroups.org/
XMLUnit for Java	1.3	BSD	http://xmlunit.sourceforge.net/
XML Commons External Components XML APIs Extensions	1.3.04	Apache License 2.0	http://xml.apache.org/commons/components/external/
MinIO	V2020.06.22	Apache	https://min.io/

9.2 Client

Name	Version	License	Link
Java Servlet API	3.1.0	CDDL1	https://java.net/projects/servlet-spec/
Eclipse	3.5.0	Eclipse Foundation Software User Agreement	http://www.eclipse.org/
Spring	3.2.4	https://pivotal.io/terms-of-use	http://spring.io/

Java Mail	1.4.1	CDDL1	https://java.net/projects/glassfish/javaee5/mail/
Java Inject	1.0.0	Apache License 2.0	
Java Native Access	4.1.0	Apache License 2.0	https://github.com/java-native-access/jna
Google Guice	4.2.0	Apache License 2.0	https://github.com/google/guice
Google Guava	24.1-jre	Apache License 2.0	https://github.com/google/guava
Google Soundlibs	1.9.5	Apache License 2.0	https://github.com/pdudits/soundlibs
Saxon	8.8.0	Mozilla Public License	http://saxon.sourceforge.net/ (see Saxon B)
Jaxen	1.1.1	The Werken Company License	http://www.jaxen.org/
Jackson	jackson:2.5.3 jackson-asl:1.9.9	Apache License 2.0	http://wiki.fasterxml.com/JacksonHome
JSON	1.1.0	Public Domain	http://www.JSON.org/
JSON Smart	1.2.0	-	https://netplex.github.io/json-smart/
Jayway JSON Path	0.9.1	Apache License 2.0	https://github.com/jayway/JsonPath
Apache Commons	io:2.5 codec:1.6.0 compress:1.8.1 collections:3.2.1 lang:2.4.0 logging:1.1.1 bcel:5.2.0 xml:1.3.4	Apache License 2.0	http://commons.apache.org/
Apache ServiceMix	2.0.3	Apache License 2.0	http://servicemix.apache.org/index.html

Apache HttpComponents	HttpClient: 4.5.9 HttpCore: 4.4.11 HttpMime: 4.5.9	Apache License 2.0	https://hc.apache.org/
Apache Jakarta POI	3.8.0	Apache License 2.0	http://jakarta.apache.org/poi/
Apache XML Commons	1.2.0	Apache License 2.0	https://xerces.apache.org/xml-commons/components/resolver/
Apache Xalan XML Serializer	2.7.1	Apache License 2.0	https://xml.apache.org/xalan-j/downloads.html
Apache Xerces XML Support	2.9.1	Apache License 2.0	https://xerces.apache.org/xerces-j/
Apache Regular Expression Library	1.5.0	Apache License 2.0	https://jakarta.apache.org/regexp/index.html
Apache Ant	1.8.1	Apache License 2.0	https://ant.apache.org/
Apache Batik	1.7.0	Apache License 2.0	https://xmlgraphics.apache.org/batik/
Apache Log4J	1.2.16	Apache License 2.0	https://logging.apache.org/log4j/1.2/index.html
Apache Groovy	2.0.1	Apache License 2.0	http://groovy-lang.org/download.html
AspectJ	1.6.12	EPL	http://www.aspectj.org
Code Generation Library	2.2.0	Apache License 2.0	https://sourceforge.net/projects/cglib/
Antlr	2.7.7	http://www.antlr2.org/license.html	http://www.antlr2.org/
JTidy	0.0.0-r938	http://jtidy.sourceforge.net/license.html	http://jtidy.sourceforge.net/
Objenesis	1.2.0	Apache License 2.0	http://objenesis.googlecode.com/svn/docs/index.html
JSoup	1.5.2	MIT	https://jsoup.org/

SAC	1.3.0	https://www.w3.org/Consortium/Legal/2002/copyright-software-20021231	https://www.w3.org/Style/CSS/SAC/
Castor	1.2.0	Apache License 2.0	http://castor-data-binding.github.io/castor/
AOP Alliance	1.0.0	Public Domain	http://aopalliance.sourceforge.net/
HTML Cleaner	2.7.0	BSD	http://htmlcleaner.sourceforge.net/
Hibernate Validator	4.2.0	Apache License 2.0	http://hibernate.org/validator/
Equals Verifier	1.7.5	Apache License 2.0	https://github.com/jqno/equalsverifier
JDeferred	1.2.3	Apache License 2.0	https://github.com/jdeferred/jdeferred
JDOM	1.1.0 and 2.0.5	Apache-style open source license	http://jdom.org/
Java Hamcrest	1.3.0	BSD-3-Clause	http://hamcrest.org/JavaHamcrest/
ObjectWeb ASM	1.5.3	http://asm.ow2.org/license.html	http://asm.ow2.org/
Joda Time	2.8.1	Apache License 2.0	http://www.joda.org/joda-time/
SLF4J	1.7.7	http://www.slf4j.org/license.html	http://www.slf4j.org/
Hunspell	1.3.2	LGPL	http://hunspell.github.io/
JACOB - Java COM Bridge	1.17	LGPL	https://sourceforge.net/projects/jacob-project/
LAME	3.97	LGPL	http://lame.sourceforge.net/
MP3 SPI for Java™Sound	1.9.5	LGPL	http://www.javazoom.net/mp3spi/mp3spi.html

Java Access Bridge (optional for recording)	2.0.4, 2.0.5, 7.0.760.13, 8.0.20.26, 8.0.40.26	Oracle Binary Code License Agreement	http://www.oracle.com/technetwork/articles/javase/index-jsp-136191.html
CXImage	6.0.0	zlib/libpng License (Zlib)	http://www.xdp.it/cximage.htm
libpng	1.2.24	libpng license	http://www.libpng.org/
TinyXML++	2.5.3	MIT/ZLib	https://github.com/rjpcomputing/ticpp
Zlib	1.2.3	ZLib	http://www.zlib.net/
Tessdll	2.04	Apache License 2.0	https://github.com/tesseract-ocr/tesseract
Crypto++	5.6.3	Boost Software License 1.0	http://www.cryptopp.com/
Polymer	0.4.0	BSD	https://www.polymer-project.org
MediatorJs	~0.9.7	MIT	https://github.com/ajacksified/Mediator.js
jQuery	~2.1.1	MIT	http://jquery.com/
jQuery.dotdotdot	1.7.2	MIT	http://dotdotdot.frebsite.nl
jquery-simple-combobox	1.1.16	MIT	https://github.com/ivkremer/jquery-simple-combobox
node-uuid	~1.4.1	MIT	https://github.com/broofa/node-uuid
Chromium Embedded Framework	74.0.3729.108	BSD	https://bitbucket.org/chromiumembedded/cef
Chromium	74.0.3729.108	BSD, LGPL, MIT	http://www.chromium.org/Home
C++ REST SDK	4.10.2	Apache License 2.0	https://github.com/Microsoft/cpprestsdk
Juniversalchardet	2.0.0	Mozilla Public License 1.1	https://github.com/albfernandez/juniversalchardet
JCrop	2.0.4	MIT	http://deepliquid.com/content/Jcrop.html
International Components for Unicode (ICU)	4.0.1	IBM ICU License	http://site.icu-project.org/

9.3 Player

Default Player

Name	Version	License	Link
SWFObject	2.2	MIT	http://code.google.com/p/swfobject/
iScroll	4.1.9	MIT	http://cubiq.org/iscroll-4
jQuery	1.12.4	MIT	http://jquery.com/
RequireJS	2.1.9	MIT or BSD	http://requirejs.org/
XRegExp	2.2.0	MIT	http://xregexp.com/

HTML5 Player

Name	Version	License	Link
jQuery	1.12.4	MIT	http://jquery.com/
RequireJS	2.1.5	MIT or BSD	http://requirejs.org/
MediatorJs	0.9.8	MIT	https://github.com/ajacksified/Mediator.js
Log4Javascript	1.4.9	Apache License 2.0	http://log4javascript.org/
jPlayer	2.9.2	MIT	http://www.jplayer.org
HammerJs	2.0.8	MIT	http://hammerjs.github.io/