CAWT - COM Automation With Tcl

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# Introduction

CAWT is a high-level Tcl interface for scripting Microsoft Windows® applications having a COM interface. It uses [Twapi](http://twapi.magicsplat.com/) for automation via the COM interface.

Currently packages for Microsoft Excel, Word, PowerPoint, OneNote, Outlook, SAPI, Internet Explorer, MathWorks Matlab, Adobe Acrobat Reader and Google Earth are available.

Note: Only Microsoft Office packages Excel, Word, PowerPoint and Outlook are in active development. The other packages are proof-of-concept examples only.

CAWT sources are available at <https://sourceforge.net/projects/cawt/>.

The CAWT homepage is at <http://www.cawt.tcl3d.org/>

The CAWT user distribution contains the Tcl sources, documentation (this document and a reference manual), several test programs showing the use of the CAWT functionality and the needed external libraries Twapi, TkImg, Base64 and Tablelist (see chapter 1.2 for details).

The CAWT developer distribution additionally contains scripts for generating the documentation, the distribution packages and the CAWT Starkit and Starpack. It also includes the external packages Ruff! and textutil (see chapter 1.2 for details). The developer distribution is intended for programmers who want to extend the CAWT package.

## Architecture overview

The CAWT package currently consists of the following sub-packages:

|  |  |
| --- | --- |
| CawtCore | Basic automation functionality. |
| CawtOffice | Basic Microsoft Office automation functionality. |
|  |  |
| CawtEarth | Automation functionality for Google Earth. |
| CawtExcel | Automation functionality for Microsoft Excel. |
| CawtExplorer | Automation functionality for Microsoft Internet Explorer. |
| CawtMatlab | Automation functionality for MathWorks Matlab. |
| CawtOcr | Automation functionality for Microsoft Document Imaging. |
| CawtOneNote | Automation functionality for Microsoft OneNote |
| CawtOutlook | Automation functionality for Microsoft Outlook. |
| CawtPpt | Automation functionality for Microsoft PowerPoint. |
| CawtReader | Automation functionality for Adobe Acrobat Reader. |
| CawtSapi | Automation functionality for Microsoft Speech API. |
| CawtWord | Automation functionality for Microsoft Word. |

Each sub-package is implemented as a separate Tcl package and can be loaded explicitly with the Tcl package command, ex. package require cawtexcel. All available CAWT sub-packages can be loaded with a single command: package require cawt.

Note: Package names are all lower case.

The next figure shows the architecture of the CAWT package.

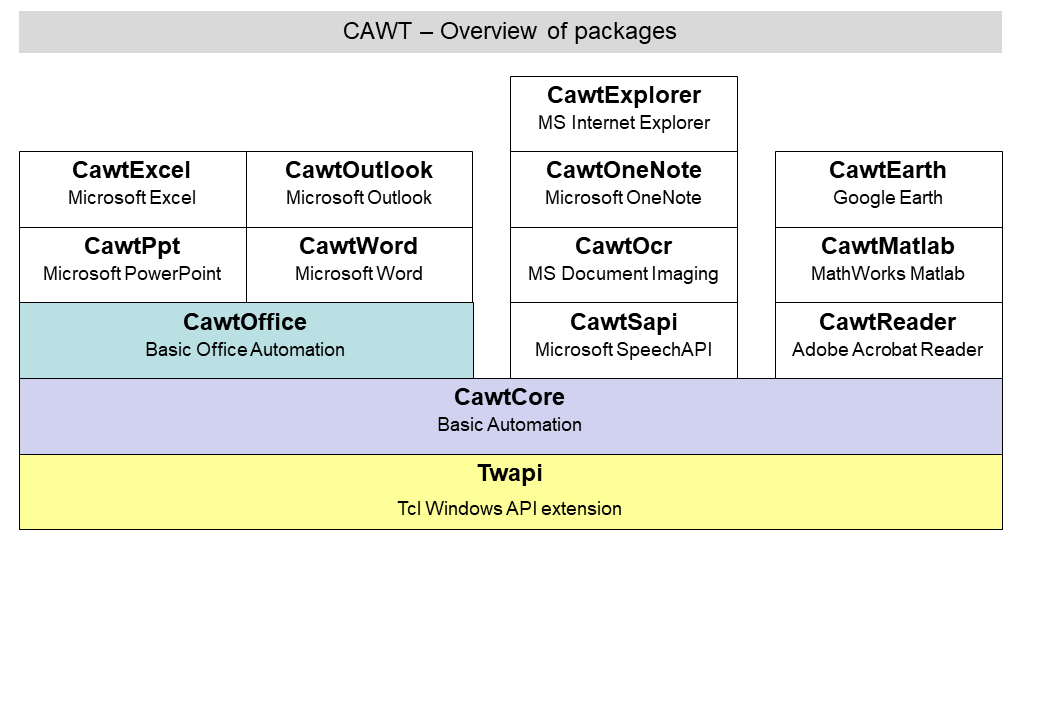


Figure 1: Overview of CAWT packages

## Dependencies

The following table shows a list of the external Tcl packages used in the CAWT infrastructure.

|  |  |  |  |
| --- | --- | --- | --- |
| **Lib** | **Version** | **Comment** | **URL** |
| **Libraries needed for the CAWT package** | | | |
| Twapi | >= 4.4 | Mandatory: Included in CAWT user distribution. | <http://twapi.magicsplat.com/> |
| tDOM | >= 0.9 | Optional: Included in CAWT user distribution. | <http://tdom.org/> |
| TkImg | >= 1.4.1 | Optional: Included in CAWT user distribution. | <http://sourceforge.net/projects/tkimg/> |
| Base64 |  | Optional: Included in CAWT user distribution. | <http://sourceforge.net/projects/tcllib/> |
| Tablelist | >= 6 | Optional: Included in CAWT user distribution. | <http://www.nemethi.de> |
| **Libraries needed for generating the CAWT documentation** | | | |
| Ruff! | >= 1.0 | Included in CAWT developer distribution. | <https://ruff.magicsplat.com/> |
| Tcllib |  | Ruff! needs the textutil module from Tcllib. (textutil included in CAWT developer distribution) | <http://sourceforge.net/projects/tcllib/> |

Note:

tDOM Mandatory for the CawtOneNote package.

TkImg: Needed for some functionalities (see the CawtExcel package for further details).

Base64: Needed for photo image to clipboard functionality.

Tablelist: Needed only for the excelTablelist module.

## Installation and Usage

Installation of CAWT is simple and fast.

If you just want to play with the test programs to get an impression on how CAWT works, unzip the user distribution file in a folder of your choice. Then open a shell window, go to folder TestPrograms of the CAWT distribution and execute a test program with a line as follows:

> tclsh Excel-01\_Basic.tcl

See also chapter 5 for scripts to run all or groups of test programs in batch mode.

If you want to use CAWT as a package for your own applications, the Cawt folder should be copied into the library section of your Tcl installation (ex. C:\Tcl\lib). If write access to this Tcl directory is not permitted, you can copy the Cawt directory somewhere else, eg. C:\myCawt. To have Tcl look for packages in this location, you must set the TCLLIBPATH environment variable with the above specified directory name as value. Note that on Windows the path must be written with slashes (not backslashes):

> set TCLLIBPATH = C:/myCawt.

If suitable versions of Twapi, ***tDOM***, TkImg, Base64 or Tablelist are already available on your machine, you may remove the appropriate folders from the Externals subfolder. Otherwise you should move these packages into the same folder, where you have copied Cawt to.

Note:

***CAWT*** is also available via ***BAWT*** (Build Automation With Tcl) at

<http://www.bawt.tcl3d.org/index.html>

# Packages in Detail

This chapter explains the different packages of CAWT.

For a detailed description of the available procedures in the different sub-packages see the CAWT reference manual available at the CAWT homepage or in the distribution.

## CawtCore: Basic automation functionality

The procedures of package CawtCore are implemented in namespace Cawt.

They provide functionality for the following domains:

|  |  |
| --- | --- |
| **Domain** | **Examples** |
| Package information | HavePkg, GetPkgVersion |
| Conversion functionality | CentiMetersToPoints, TclBool |
| COM access via Twapi | GetOrCreateApp, IsValidId, Destroy |
| Application embedding | EmbedApp, SetEmbedTimeout |
| Event handling | SetEventCallback |
| Color handling | GetColor, GetColorNames, RgbToOfficeColor |
| Interpolation handling | oo::class Interpolate |
| Image utilities | ClipboardToImg, ImgToClipboard |
| Date utilities | XmlDateToIsoDate, OutlookDateToSeconds |
| String utilities | CountWords |
| Testing utilities | CheckString, CheckNumber, CheckMatrix |

The following table lists all procedures available in namespace Cawt.

| **CawtCore Procedure** | **Short description** |
| --- | --- |
| [CentiMetersToPoints](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::CentiMetersToPoints) | Convert centimeter value into points. |
| [CheckBoolean](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::CheckBoolean) | Check, if two boolean values are identical. |
| [CheckComObjects](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::CheckComObjects) | Check, if the number of COM objects fits expected value. |
| [CheckFile](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::CheckFile) | Check, if two files are identical. |
| [CheckList](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::CheckList) | Check, if two lists are identical. |
| [CheckMatrix](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::CheckMatrix) | Check, if two matrices are identical. |
| [CheckNumber](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::CheckNumber) | Check, if two numerical values are identical. |
| [CheckString](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::CheckString) | Check, if two string values are identical. |
| [ClipboardToImg](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::ClipboardToImg) | Copy the clipboard content into a photo image. |
| [ConcatFiles](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::ConcatFiles) | Concatenates files into one file. |
| [CountWords](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::CountWords) | Count words contained in a string. |
| [Destroy](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::Destroy) | Destroy one or all COM objects. |
| [EmbedApp](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::EmbedApp) | Embed an application into a Tk frame. |
| [GetColor](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::GetColor) | Convert a color representation into an Office color number. |
| [GetColorNames](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::GetColorNames) | Get all supported Tcl color names. |
| [GetComObjects](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::GetComObjects) | Get the COM objects currently in use as a list. |
| [GetDotsPerInch](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::GetDotsPerInch) | Get the dots-per-inch value used for conversions. |
| [GetNumComObjects](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::GetNumComObjects) | Get the number of COM objects currently in use. |
| [GetOrCreateApp](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::GetOrCreateApp) | Use or create an instance of an application. |
| [GetPkgVersion](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::GetPkgVersion) | Get the version of a CAWT sub-package. |
| [GetProgramByExtension](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::GetProgramByExtension) | Get path to program for a given file extension. |
| [GetTmpDir](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::GetTmpDir) | Try different environment variables. |
| [HavePkg](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::HavePkg) | Check, if a CAWT sub-package is available. |
| [ImgToClipboard](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::ImgToClipboard) | Copy a photo image into the clipboard. |
| [InchesToPoints](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::InchesToPoints) | Convert inch value into points. |
| [IsAppIdValid](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::IsAppIdValid) | Check, if an application identifier is valid. |
| [IsComObject](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::IsComObject) | Check, if parameter is a COM object. |
| [IsHexColor](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::IsHexColor) | Check, if specified color is a valid Tcl hexadecimal color string. |
| [IsNameColor](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::IsNameColor) | Check, if specified color is a valid Tcl color name. |
| [IsoDateToOfficeDate](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::IsoDateToOfficeDate) | Return ISO date string as Office date. |
| [IsoDateToOutlookDate](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::IsoDateToOutlookDate) | Obsolete: Replaced with IsoDateToOfficeDate in version 2.4.4 |
| [IsoDateToSeconds](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::IsoDateToSeconds) | Return ISO date string as seconds. |
| [IsoDateToXmlDate](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::IsoDateToXmlDate) | Return ISO date string as XML date string. |
| [IsOfficeColor](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::IsOfficeColor) | Check, if specified color is a valid Office color number. |
| [IsRgbColor](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::IsRgbColor) | Check, if specified color is a valid RGB representation. |
| [IsUnicodeFile](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::IsUnicodeFile) | Check, if a file is encoded in Unicode. |
| [IsValidId](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::IsValidId) | Obsolete: Replaced with IsComObject in version 2.0.0 |
| [IsValidUrlAddress](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::IsValidUrlAddress) | Check, if supplied address is a valid URL. |
| [KillApp](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::KillApp) | Kill all running instances of an application. |
| [OfficeColorToRgb](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::OfficeColorToRgb) | Convert an Office color number into a RGB color list. |
| [OfficeDateToIsoDate](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::OfficeDateToIsoDate) | Return Office date as ISO date string. |
| [OfficeDateToSeconds](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::OfficeDateToSeconds) | Return Office date as seconds. |
| [OutlookDateToIsoDate](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::OutlookDateToIsoDate) | Obsolete: Replaced with OfficeDateToIsoDate in version 2.4.4 |
| [OutlookDateToSeconds](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::OutlookDateToSeconds) | Obsolete: Replaced with OfficeDateToSeconds in version 2.4.4 |
| [PointsToCentiMeters](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::PointsToCentiMeters) | Convert value in points into centimeters. |
| [PointsToInches](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::PointsToInches) | Convert value in points into inches. |
| [PopComObjects](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::PopComObjects) | Pop last entry from COM objects stack. |
| [PrintNumComObjects](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::PrintNumComObjects) | Print the number of currently available COM objects to stdout. |
| [PushComObjects](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::PushComObjects) | Push current list of COM objects onto a stack. |
| [RgbToOfficeColor](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::RgbToOfficeColor) | Convert a RGB color into an Office color number. |
| [SecondsToIsoDate](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::SecondsToIsoDate) | Return date in seconds as ISO date string. |
| [SecondsToOfficeDate](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::SecondsToOfficeDate) | Return date in seconds as Office date. |
| [SecondsToOutlookDate](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::SecondsToOutlookDate) | Obsolete: Replaced with SecondsToOfficeDate in version 2.4.4 |
| [SecondsToXmlDate](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::SecondsToXmlDate) | Return date in seconds as XML date string. |
| [SetClipboardWaitTime](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::SetClipboardWaitTime) | Set the time to wait until clipboard content is ready. |
| [SetDotsPerInch](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::SetDotsPerInch) | Set the dots-per-inch value used for conversions. |
| [SetEmbedTimeout](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::SetEmbedTimeout) | Set the timeout to wait for the embedded application to start. |
| [SetEventCallback](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::SetEventCallback) | Set an event callback procedure. |
| [SplitFile](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::SplitFile) | Split a file into several output files. |
| [TclBool](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::TclBool) | Cast a value to a boolean. |
| [TclInt](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::TclInt) | Cast a value to an integer with boolean range. |
| [TclString](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::TclString) | Cast a value to a string. |
| [ValueToPoints](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::ValueToPoints) | Convert a value into points. |
| [WaitClipboardReady](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::WaitClipboardReady) | Wait until clipboard content is ready. |
| [XmlDateToIsoDate](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::XmlDateToIsoDate) | Return XML date string as ISO date string. |
| [XmlDateToSeconds](http://www.cawt.tcl3d.org/download/CawtReference_Cawt.html#::Cawt::XmlDateToSeconds) | Return XML date string as seconds. |

Table 1: CawtCore Reference

## CawtOffice: Basic Microsoft Office automation functionality

The procedures of package CawtOffice are implemented in namespace Office.

They provide functionality for the following domains:

|  |  |
| --- | --- |
| **Domain** | **Examples** |
| Office application functionality | GetApplicationName, GetApplicationId |
| Office document properties | SetDocumentProperty, GetDocumentProperty |
| Office environment | GetUserName, GetUserPath, GetActivePrinter |
| Office macros | AddMacro, RunMacro |

Namespace Office has an internal namespace Enum with procedures for all enumeration types of this package. The procedure names correspond to the name of the enumeration type and return a list of enumeration names and values. See the reference manual for a list of all enumeration types.

**Example:**

proc MsoBarRow {} {

# msoBarRowFirst - 0

# msoBarRowLast - -1

return { msoBarRowFirst 0 msoBarRowLast -1 }

}

## CawtEarth: Automation for Google Earth

The name of the controlled application is GoogleEarth.ApplicationGE.

The procedures of package CawtEarth are implemented in namespace Earth.

They provide functionality for the following domains:

|  |  |
| --- | --- |
| **Domain** | **Examples** |
| Application handling | Open, Quit |
| Camera positioning | SetCamera |

See the test programs Earth-\*.tcl for examples on how to use the procedures of this package.

## CawtExcel: Automation for Microsoft Excel

The name of the controlled application is Excel.Application.

The procedures of package CawtExcel are implemented in namespace Excel.

They provide functionality for the following domains:

|  |  |
| --- | --- |
| **Domain** | **Examples** |
| Application handling | Open, Quit, GetVersion |
| Workbook handling | OpenWorkbook, AddWorkbook, SaveAs, Close |
| Worksheet handling | AddWorksheet, DeleteWorksheet, CopyWorksheet |
| Row handling | InsertRow, DeleteRow, HideRow |
| Column handling | InsertColumn, DeleteColumn, HideColumn |
| Chart handling | ChartObjToClipboard, CreateChart, AddLineChart |
| Insert values | SetCellValue, SetRowValues, SetMatrixValues |
| Retrieve values | GetCellValue, GetRowValues, GetMatrixValues |
| Formatting functionality | SetColumnWidth, SetHyperlink, SetRangeTextColor |
| Clipboard functionality | ClipboardToMatrix, ClipboardToWorksheet |
| External file handling | Csv, Raw Images, MediaWiki, Wikit, Matlab files |
| External table tools handling | Tablelist, Word tables |

Namespace Excel has an internal namespace Enum with procedures for all enumeration types of this package. The procedure names correspond to the name of the enumeration type and return a list of enumeration names and values. See the reference manual for a list of all enumeration types.

**Example:**

proc XlAxisGroup {} {

# xlPrimary - 1

# xlSecondary - 2

return { xlPrimary 1 xlSecondary 2 }

}

The commands are grouped and implemented in the following modules:

| Implementation file | Description |
| --- | --- |
| excelConst.tcl | All Excel enumeration types. |
| excelBasic.tcl | Basic Excel commands. |
| excelUtil.tcl | Higher-level utility commands. |
| excelChart.tcl | Higher-level commands for chart creation. |
| excelCsv.tcl | Commands for reading/writing CSV files. |
| excelTablelist.tcl | Exchange Excel data with Tablelist. |
| excelMatlabFile.tcl | Exchange Excel data with Matlab MAT-Files. Level 4 files only. |
| excelWord.tcl | Exchange Excel data with Word tables. |
| excelImgRaw.tcl | Exchange Excel data with Tk photo images. 1-channel floating-point RAW files only. |
| excelMediaWiki.tcl | Exchange Excel data with MediaWiki tables. |
| excelWikit.tcl | Exchange Excel data with Wikit tables. |
| excelHtml.tcl | Export Excel data to HTML files. |

See the following URL’s for details on table file formats:

Matlab: <http://www.mathworks.com/help/pdf_doc/matlab/matfile_format.pdf>

Raw images: <http://docs.activestate.com/activetcl/8.6/tcl/img/doc/img-raw.html>

MediaWiki: <https://meta.wikimedia.org/wiki/Help:Table>

Wikit: <https://wiki.tcl-lang.org/page/Formatting+Rules>

See the test programs Excel-\*.tcl for examples on how to use the procedures of this package.

The next chapters explain the Excel modules dealing with data exchange.

### Module excelCsv

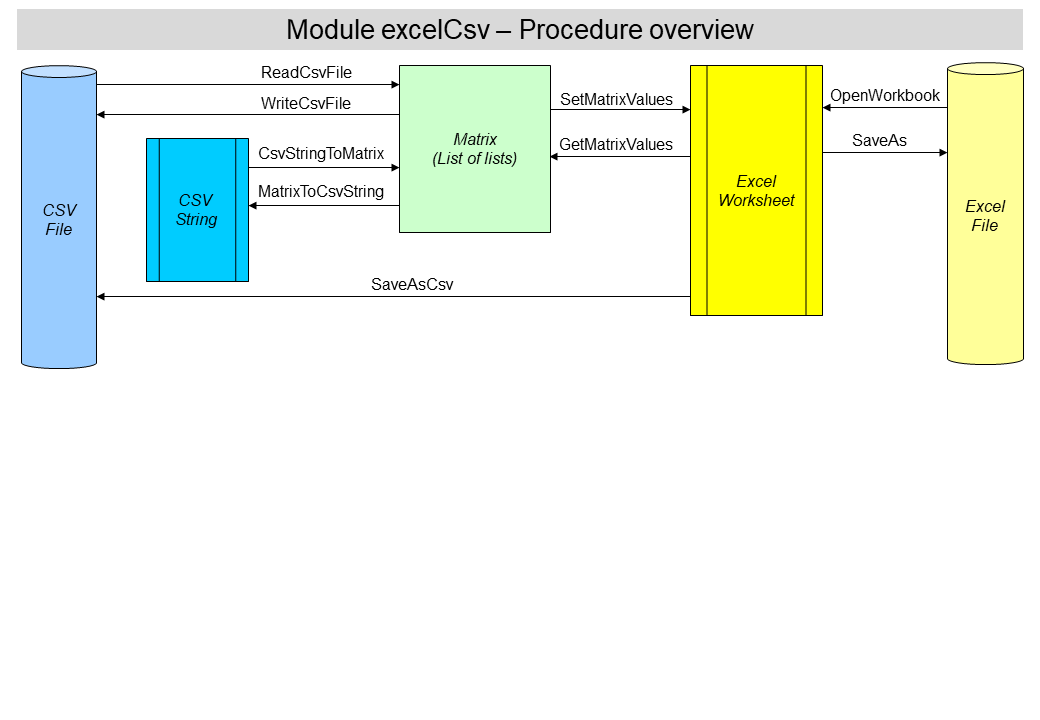


Figure 2: Module excelCsv

### Module excelTablelist

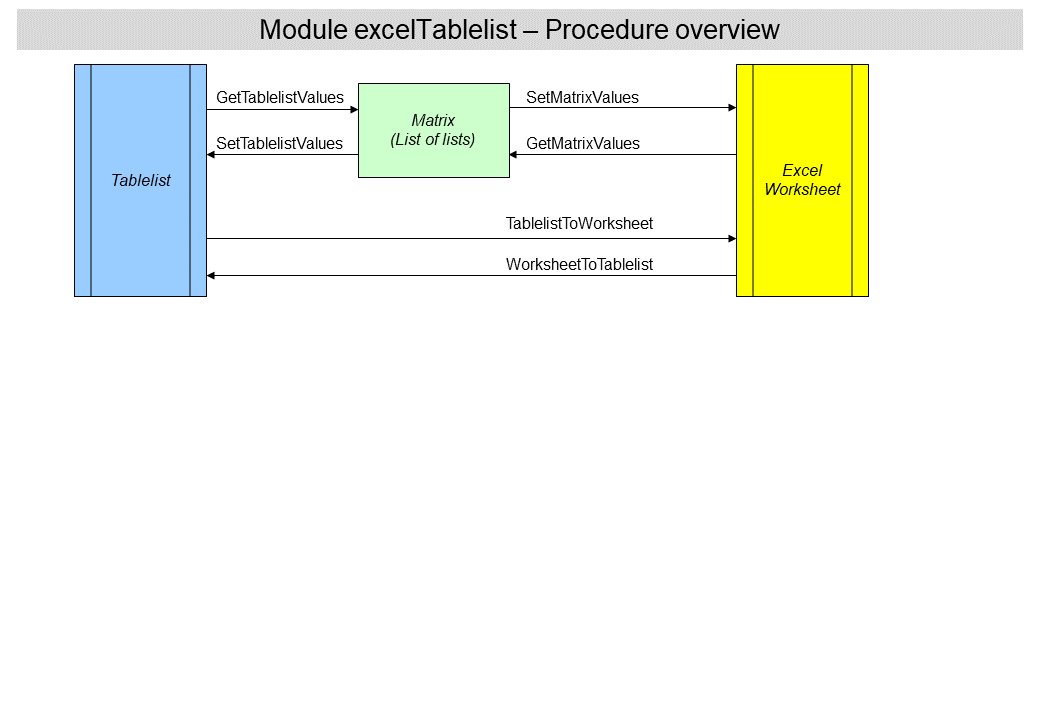


Figure 3: Module excelTablelist

### Module excelMatlabFile

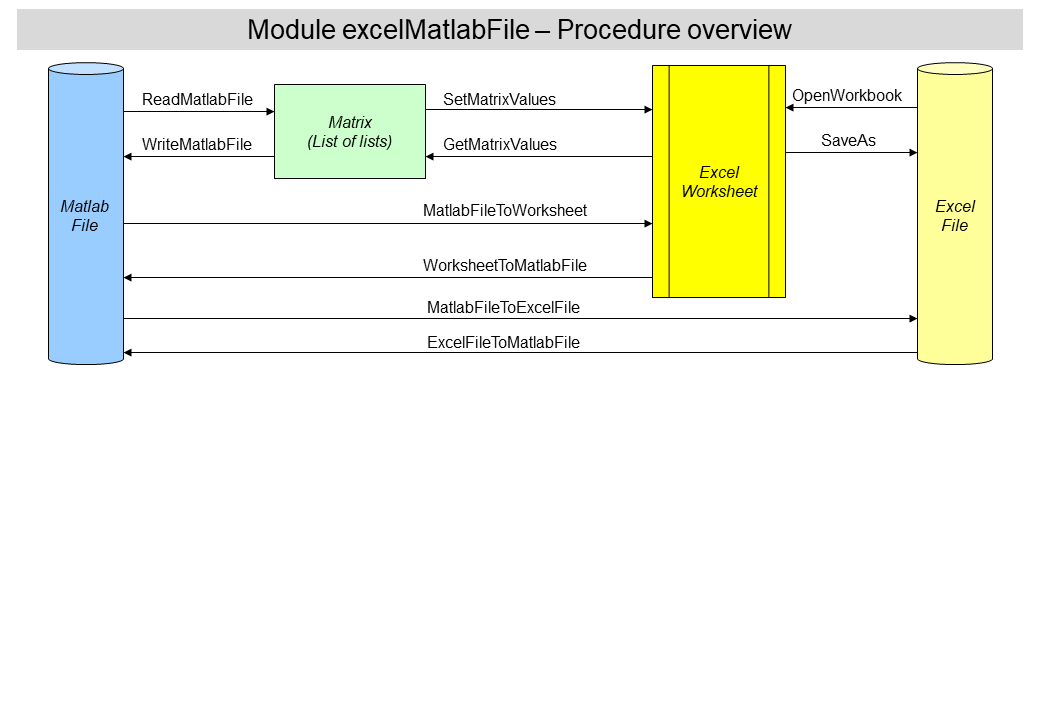


Figure 4: Module excelMatlabFile

### Module excelWord

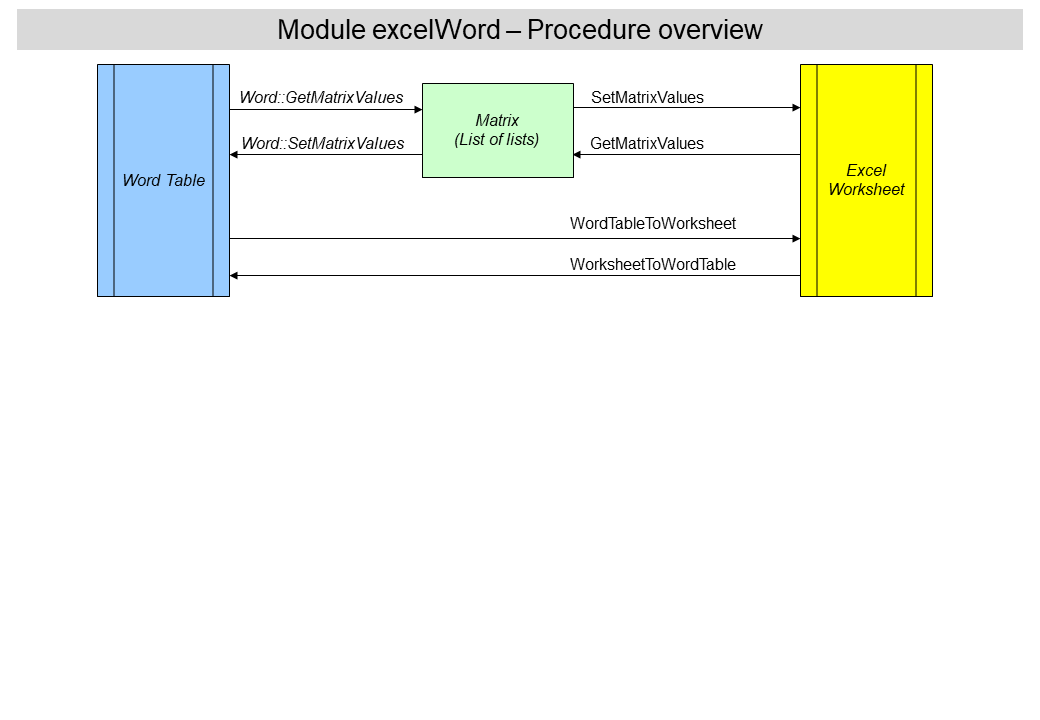


Figure 5: Module excelWord

### Module excelImgRaw

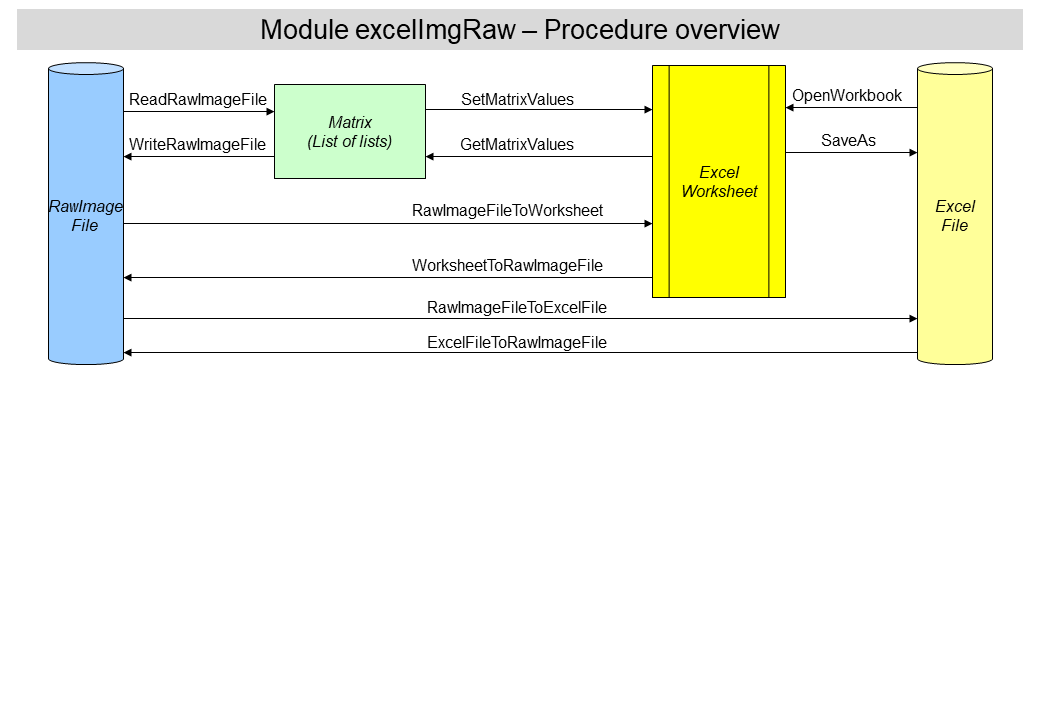


Figure 6: Module excelImgRaw

### Module excelMediaWiki

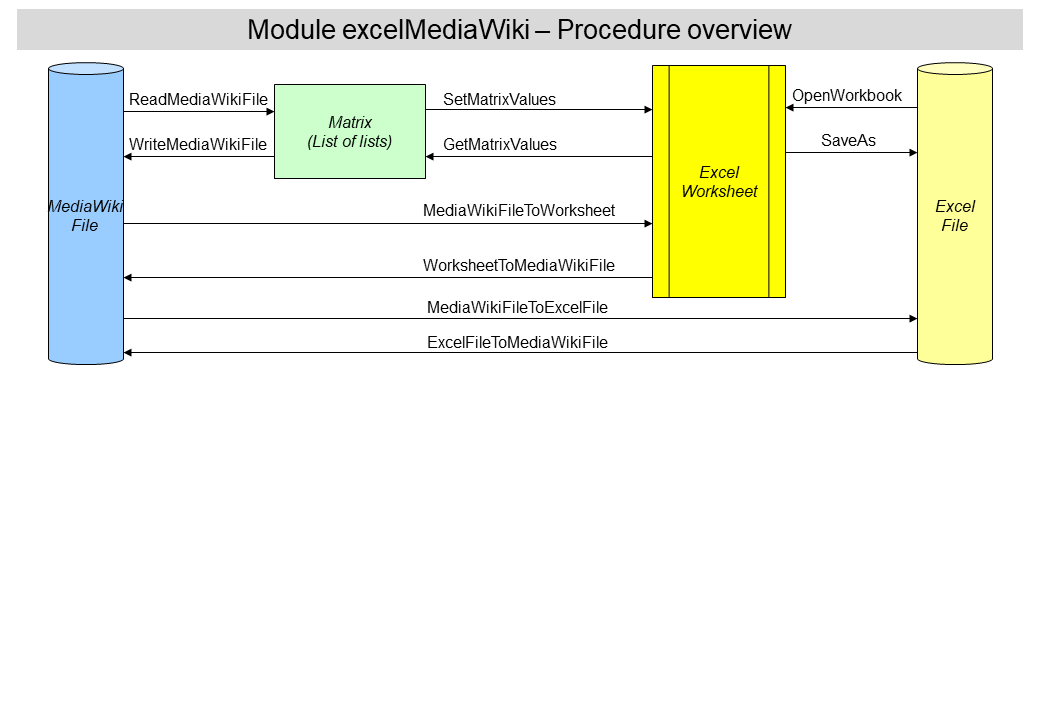


Figure 7: Module excelMediaWiki

### Module excelWikit

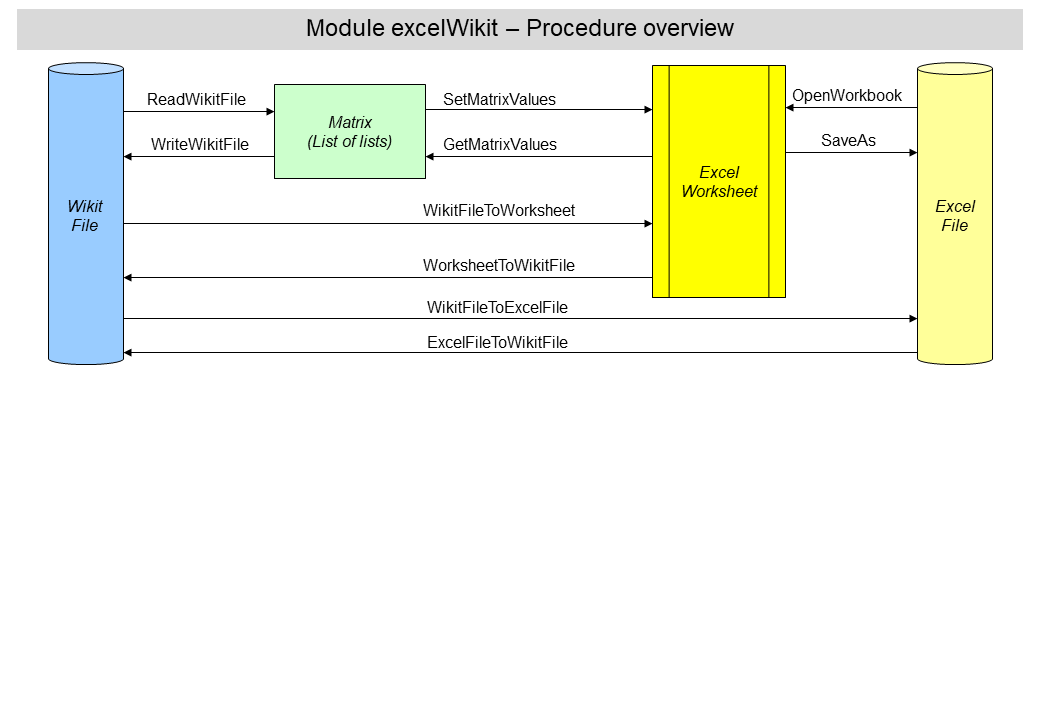


Figure 8: Module excelWikit

### Module excelHtml

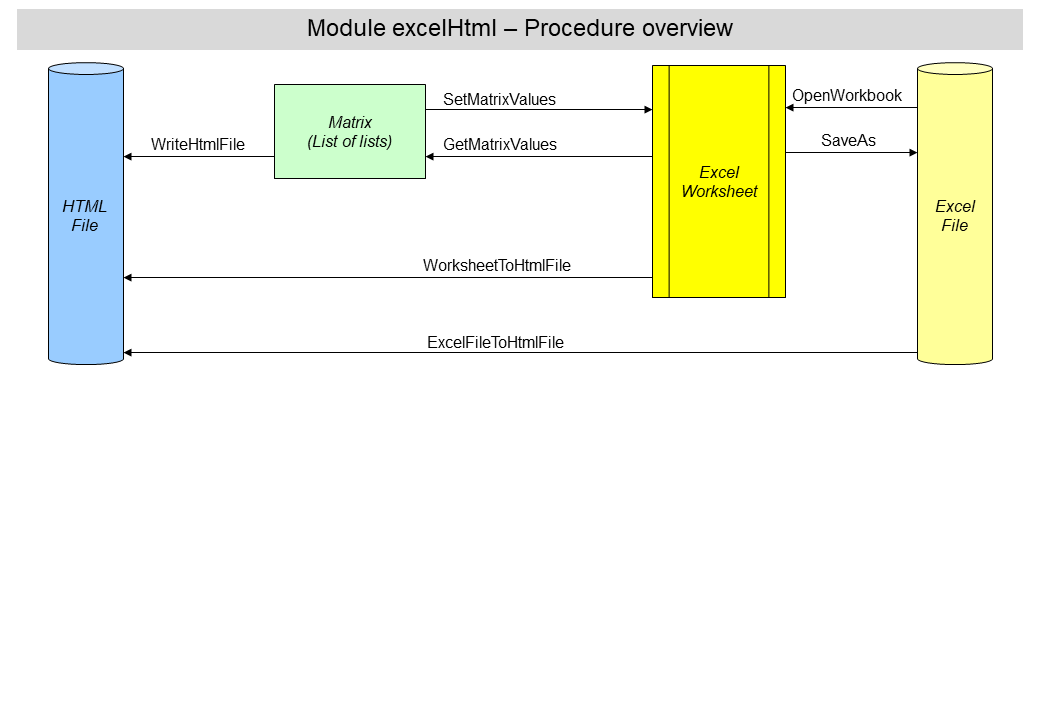


Figure 9: Module excelHtml

## CawtExplorer: Automation for Internet Explorer

The name of the controlled application is InternetExplorer.Application.

The procedures of package CawtExplorer are implemented in namespace Explorer.

They provide functionality for the following domains:

|  |  |
| --- | --- |
| **Domain** | **Examples** |
| Application handling | Open, Quit |
| URL navigation | Navigate, GoBack, GoHome |

See the test programs Explorer-\*.tcl for examples on how to use the procedures of this package.

Note: If running on Windows Vista or 7, you have to lower the security settings like follows:

Internet Options -> Security -> Trusted Sites : Low

Internet Options -> Security -> Internet : Medium + unchecked Enable Protected Mode

Internet Options -> Security -> Restricted Sites : unchecked Enable Protected Mode

## CawtMatlab: Automation for MathWorks Matlab

The name of the controlled application is Matlab.Application.

The procedures of package CawtMatlab are implemented in namespace Matlab.

They provide functionality for the following domains:

|  |  |
| --- | --- |
| **Domain** | **Examples** |
| Application handling | Open, Quit |
| Command execution | ExecCmd |

See the test programs Matlab-\*.tcl for examples on how to use the procedures of this package.

## CawtOcr: Automation for Microsoft Document Imaging

The name of the controlled application is MODI.Document.

The procedures of package CawtOcr are implemented in namespace Ocr.

They provide functionality for the following domains:

|  |  |
| --- | --- |
| **Domain** | **Examples** |
| Application handling | Open, Close |
| Character recognition | Scan, GetFullText, GetWord, GetWordStatistics |

See the test programs Ocr-\*.tcl for examples on how to use the procedures of this package.

## CawtOneNote: Automation for Microsoft OneNote

The name of the controlled application is OneNote.Application.

The procedures of package CawtOneNote are implemented in namespace OneNote.

They provide functionality for the following domains:

|  |  |
| --- | --- |
| **Domain** | **Examples** |
| Application handling | Open, Quit, GetVersion |
| Retrieving information | GetNotebooks, GetSections, GetPages |

See the test programs OneNote-\*.tcl for examples on how to use the procedures of this package.

## CawtOutlook: Automation for Microsoft Outlook

The name of the controlled application is Outlook.Application.

The procedures of package CawtOutlook are implemented in namespace Outlook.

They provide functionality for the following domains:

|  |  |
| --- | --- |
| **Domain** | **Examples** |
| Application handling | Open, Quit, GetVersion |
| Mail handling | CreateMail, CreateHtmlMail, SendMail |
| Calendar handling | AddCalendar, DeleteCalendar, GetCalendarId |
| Category handling | AddCategory, DeleteCategory, GetCategoryId |
| Contact handling | AddContact, GetContactProperties |
| Appointment handling | AddAppointment, DeleteAppointment |
| Holiday filehandling | ReadHolidayFile, ApplyHolidayFile |

Namespace Outlook has an internal namespace Enum with procedures for all enumeration types of this package. The procedure names correspond to the name of the enumeration type and return a list of enumeration names and values. See the reference manual for a list of all enumeration types.

**Example:**

proc OlAlignment {} {

# olAlignmentLeft - 0

# olAlignmentRight - 1

return { olAlignmentLeft 0 olAlignmentRight 1 }

}

The commands are grouped and implemented in the following modules:

| Implementation file | Description |
| --- | --- |
| outlookConst.tcl | All Outlook enumeration types. |
| outlookBasic.tcl | Basic Outlook commands. |
| outlookCalendar.tcl | Outlook calendar commands. |
| outlookColor.tcl | Outlook commands related to color handling. |
| outlookContact.tcl | Outlook contact commands. |
| outlookMail.tcl | Outlook mail commands. |

See the test programs Outlook-\*.tcl for examples on how to use the procedures of this package.

Note: The Outlook test programs send test mails and modify the Outlook calendar.

## CawtPpt: Automation for Microsoft PowerPoint

The name of the controlled application is PowerPoint.Application.

The procedures of package CawtPpt are implemented in namespace Ppt.

They provide functionality for the following domains:

|  |  |
| --- | --- |
| **Domain** | **Examples** |
| Application handling | Open, Quit, GetVersion |
| Presentation handling | OpenPres, AddPres, SaveAs, Close |
| Slide handling | AddSlide, CopySlide, ShowSlide, ExportSlide |
| SlideShow handling | UseSlideShow, SlideShowFirst, SlideShowNext |
| Shape handling | AddShape, ConfigureShape, ConnectShapes |
| Custom layout handling | GetNumCustomLayouts, GetCustomLayoutName |

Namespace Ppt has an internal namespace Enum with procedures for all enumeration types of this package. The procedure names correspond to the name of the enumeration type and return a list of enumeration names and values. See the reference manual for a list of all enumeration types.

**Example:**

proc PpArrangeStyle {} {

# ppArrangeCascade - 2

# ppArrangeTiled - 1

return { ppArrangeCascade 2 ppArrangeTiled 1 }

}

See the test programs Ppt-\*.tcl for examples on how to use the procedures of this package.

## CawtReader: Automation for Acrobat Reader

Note: Acrobat Reader is currently not controlled by the COM interface, but uses the program command line options.

The procedures of package CawtReader are implemented in namespace Reader.

They provide functionality for the following domains:

|  |  |
| --- | --- |
| **Domain** | **Examples** |
| Application handling | Open, OpenNew, Quit, SetReaderProg |

See the test programs Reader-\*.tcl for examples on how to use the procedures of this package.

## CawtSapi: Automation for Microsoft Speech API

The name of the controlled application is sapi.SpVoice.

The procedures of package CawtSapi are implemented in namespace Sapi.

They provide functionality for the following domains:

|  |  |
| --- | --- |
| **Domain** | **Examples** |
| Application handling | Open |
| Voice handling | GetVoiceByName, GetVoiceNames, SetVoice |
| Speaking | SetSpeakOptions, Speak |

See the test programs Sapi-\*.tcl for examples on how to use the procedures of this package.

## CawtWord: Automation for Microsoft Word

The name of the controlled application is Word.Application.

The procedures of package CawtWord are implemented in namespace Word.

They provide functionality for the following domains:

|  |  |
| --- | --- |
| **Domain** | **Examples** |
| Application handling | Open, Quit, GetVersion |
| Document handling | OpenDocument, AddDocument, SaveAs, Close |
| Table handling | AddTable, GetNumRows, SetCellValue, GetCellValue |
| Text handling | AddParagraph, AppendText, AddText |
| Range handling | GetStartRange, GetRangeStartIndex, ExtendRange |
| Search/Replace functionality | FindString, ReplaceString, ReplaceByProc, Search |
| Formatting functionality | SetRangeFontBold, SetRangeBackgroundColor |
| Caption handling | InsertCaption, ConfigureCaption |
| Bookmark handling | AddBookmark, GetBookmarkName, SetLinkToBookmark |
| Hyperlink handling | GetHyperlinksAsDict, GetNumHyperlinks |
| List handling | GetListGalleryId, GetListTemplateId, InsertList |

Namespace Word has an internal namespace Enum with procedures for all enumeration types of this package. The procedure names correspond to the name of the enumeration type and return a list of enumeration names and values. See the reference manual for a list of all enumeration types.

**Example:**

proc WdBookmarkSortBy {} {

# wdSortByLocation - 1

# wdSortByName - 0

return { wdSortByLocation 1 wdSortByName 0 }

}

See the test programs Word-\*.tcl for examples on how to use the procedures of this package.

# Miscellaneous CAWT information

This chapter contains miscellaneous information about CAWT.

## License information

The CAWT package is copyrighted by Paul Obermeier and distributed under the 3-clause BSD license. See file CAWT-License.txt in the CAWT distribution for the license text.

CAWT relies on several other Tcl packages. See the table in chapter 1.2 for links to these packages to get their license information.

# CAWT applications

CAWT includes the following scripts, which can be used as standalone applications:

* EnumExplorer.tcl
* OneNoteInfo.tcl
* Word2Pdf.tcl
* WordAbbrCheck.tcl

## Application EnumExplorer.tcl

The application EnumExplorer.tcl can be used to explore the common Office enumerations as well as the enumerations of the Office applications Excel, OneNote, Outlook, PowerPoint, Sapi and Word.

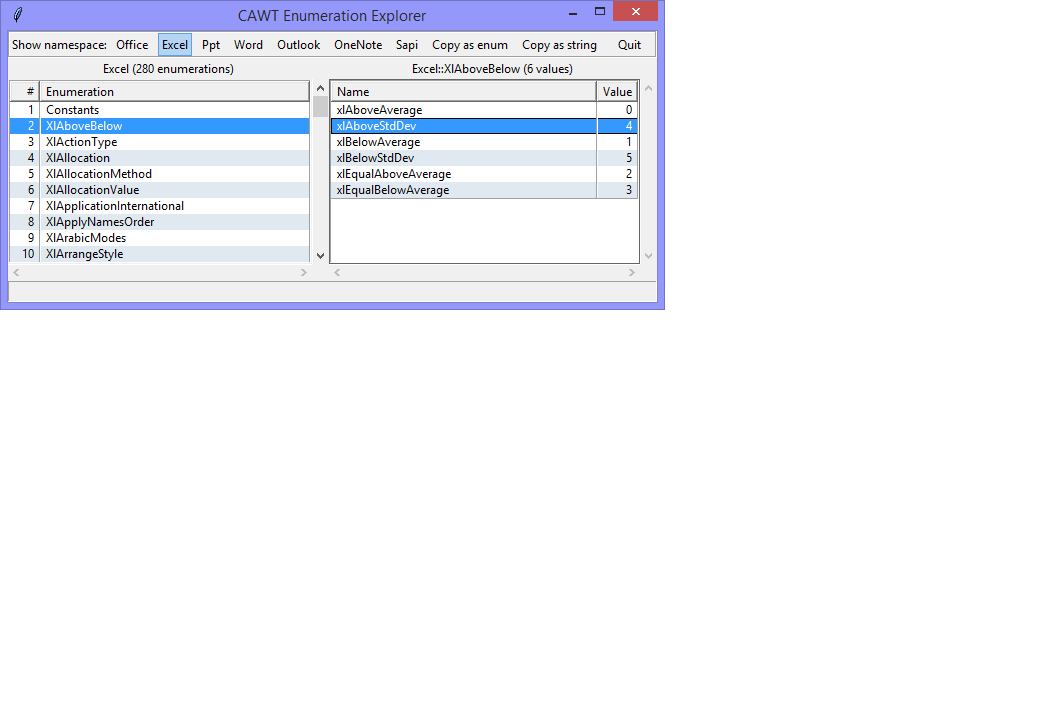


Figure 10: Screenshot of EnumExplorer.tcl

If started with option --help, it prints out a usage message:

> tclsh EnumExplorer.tcl --help

Usage: EnumExplorer.tcl [Namespace]

Start enumeration explorer and display specified namespace.

If no namespace is given, the first namespace in this list is used:

Office Excel Ppt Word Outlook OneNote Sapi

Pressing the "Copy as enum" button or the "C" key copies the

currently selected enumeration as Tcl variable to the clipboard.

Example: $Excel::xlAboveStdDev

Pressing the "Copy as string" button or the "c" key copies the

currently selected enumeration name to the clipboard.

Example: xlAboveStdDev

## Application OneNoteInfo.tcl

The application OneNoteInfo.tcl can be used to either retrieve information about OneNote notebooks, sections or pages as well as send Outlook mails about changed pages.

If started with option --help, it prints out a usage message:

> tclsh OneNoteInfo.tcl --help

Usage: OneNoteInfo.tcl [Options]

Utility program to retrieve information from OneNote.

Actions:

--help : Print help message and exit.

--print : Print information about notebooks, sections or pages to stdout.

If no other option is given, print a list of all notebook names.

If --notebook is given, print all section names of that notebook.

If --section and --notebook are given, print all page names of

that section.

--check : Find recently changed pages.

Use options --days and --mail to change default behaviour.

Default is: Look back 1 days. Print found page names to stdout.

Options:

--notebook <string>: Check or print specified notebook.

--section <string> : Check or print specified section.

--page <string> : Check or print specified page.

--xml <string> : Print information in OneNote XML format.

--days <int> : Specify number of days for recently changed pages.

--mail <string> : Send list of recently changed pages via Outlook mail.

If given string is a valid file name, scan that file

for mail addresses. Each line must contain key

"always" or "option" followed by a mail address.

Otherwise the string is expected to be a mail address.

--test : Build Outlook mail, but do not send. Use for testing.

**Example:** Find all pages changed in the last 20 days and send that information via Outlook HTML mail to a list of defined users. The table of changed pages contains links to the corresponding notebooks, sections and pages.

> tclsh OneNoteInfo.tcl --check --days 20 --notebook CAWT --mail OneNoteMailList.txt

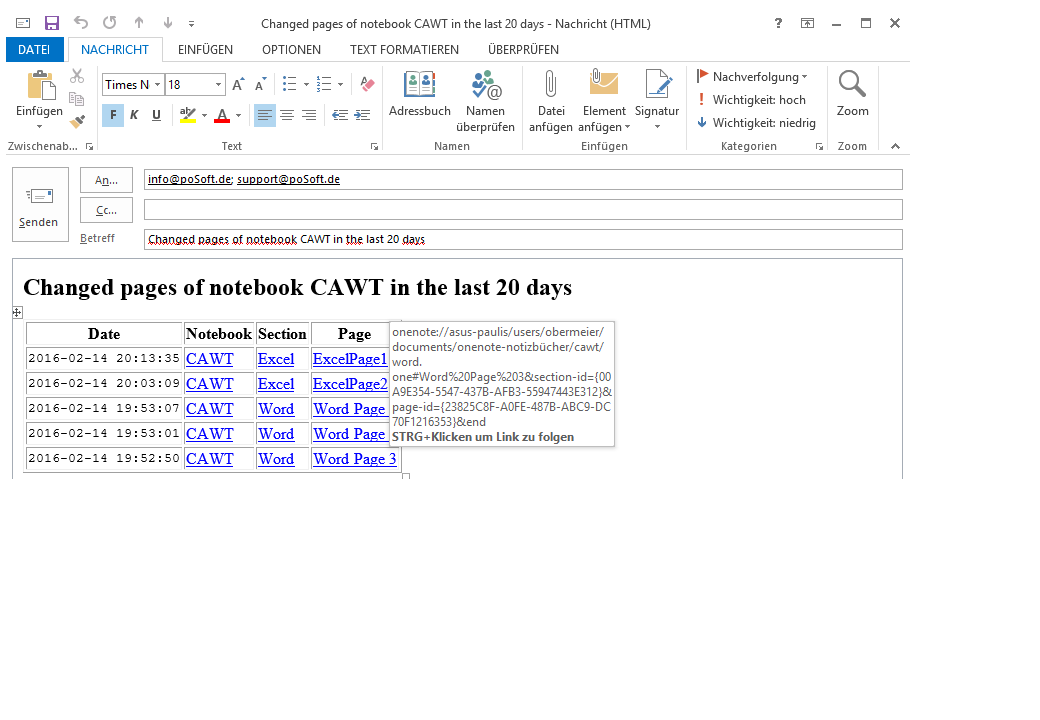


Figure 11: Auto-generated Outlook mail from OneNoteInfo.tcl

## Application Word2Pdf.tcl

The application Word2Pdf.tcl can be used to convert a Word file to a PDF file.

Note, that PDF export is supported by Word since version 2007.

If started with option --help, it prints out a usage message:

> tclsh Word2Pdf.tcl --help

Usage: Word2Pdf.tcl [Options] WordFile PdfFile

Options: None at the moment.

## Application WordAbbrCheck.tcl

The application WordAbbrCheck.tcl can be used to list and count the words contained in a Word document. The output may be used to check for used abbreviations in the document, which are not contained in an abbreviation table.

Note: The functionality of this program is available with a graphical user interface in the poApps Office module. poApps is available at <http://www.poSoft.de>.

If started with option --help, it prints out a usage message:

> tclsh WordAbbrCheck.tcl --help

Usage: WordAbbrCheck.tcl [Options] WordFile

Open a Word document and perform several checks and statistics.

If no options are specified, the number of words in the document

are counted.

Options:

--help : Print this help message.

--showfiles : Open log and result files after generation.

--outfile <string> : Store results in given file.

Use "stdout" to print to standard output.

Default: Results are stored in a file with

same root name as input file, but extension ".txt".

--minlength <int> : Only count words having more than minlength

characters. Default: 2 characters.

--maxlength <int> : Only count words having less than maxlength

characters. Default: Unlimited.

--nonumbers : Only count words which are no numbers.

--sortmode <string>: Sorting mode of word output.

Default: length.

Possible values: dictionary, length, increasing, decreasing.

--csv : Write result data in CSV format.

Default: Space seperated.

--printtables : Print table names of the Word file and exit.

--abbr <string> : Title of a table in the Word file containing

abbreviations. It is assumed, that the abbreviations

start in row 2 and are listed in column 1.

--links : Check validity of internal and external links.

# Test programs

This chapter gives an overview of the available test programs and describes how to execute the tests.

## Test overview

The following test and demonstration programs are currently available:

|  |  |
| --- | --- |
| **Test Program** | **Description** |
| Cawt-01\_Basic.tcl | Test basic functionality of the CawtCore package. |
| Cawt-02\_Color.tcl | Test color functionality of the CawtCore package. |
| Cawt-03\_Date.tcl | Test date conversion functionality of the CawtCore package. |
| Cawt-04\_String.tcl | Test string functionalities of the CawtCore package. |
| Cawt-05\_File.tcl | Test file handling functionality of the CawtCore package. |
| Cawt-06\_Img.tcl | Test image handling functionality of the CawtCore package. |
| Cawt-07\_ComObj.tcl | Test COM object functionality of the CawtCore package. |
| Cawt-08\_TestUtil.tcl | Test Check functionality of the CawtCore package. |
| Cawt-09\_Embed.tcl | Test embedding procedures of the CawtCore package. |
| Cawt-10\_Interpolate.tcl | Test interpolation functionality of the CawtCore package. |
| Cawt-11\_Url.tcl | Test CawtCore procedures for checking URL addresses. |
| Earth-01\_Basic.tcl | Test basic functionality of the CawtEarth package. |
| Earth-02\_MunichTour.tcl | Load position information into an Excel sheet, read back that information and create a Tk GUI with buttons corresponding to these positions. |
| Excel-01\_Basic.tcl | Test basic functionality of the CawtExcel package. |
| Excel-02\_Misc.tcl | Test miscellaneous CawtExcel procedures like setting colors, column width, inserting formulas and searching. |
| Excel-03\_Add.tcl | Test CawtExcel procedures for adding and deleting workbooks and worksheets. |
| Excel-04\_Insert.tcl | Test CawtExcel procedures for inserting data as rows, columns or matrices. |
| Excel-05\_Ranges.tcl | Test CawtExcel procedures for retrieving the number of (used) rows and columns. |
| Excel-06\_Chart.tcl | Test CawtExcel procedures for creating charts and exporting charts as Tk photo images. |
| Excel-07\_Csv.tcl | Test CawtExcel procedures related to CSV files. |
| Excel-07\_CsvUniCode.tcl | Test CawtExcel procedures related to CSV files. |
| Excel-08\_Tablelist.tcl | Test CawtExcel procedures to exchange data between Excel and Tablelist. |
| Excel-08\_TablelistSelection.tcl | Test CawtExcel procedures to exchange data between Excel and Tablelist. |
| Excel-09\_WordTable.tcl | Test CawtExcel procedures to exchange data between Excel and Word tables. |
| Excel-10\_Matrix.tcl | Test CawtExcel procedures to read data into a matrix and write matrix data into Matlab or RAW image files. |
| Excel-11\_RawImage-16bit.tcl | Test CawtExcel procedures to exchange data between Excel and 16-bit integer RAW images. |
| Excel-11\_RawImage.tcl | Test CawtExcel procedures to exchange data between Excel and 32-bit floating point RAW images. |
| Excel-12\_MatlabFile.tcl | Test CawtExcel procedures to exchange data between Excel and Matlab files. |
| Excel-13\_MediaWiki.tcl | Test CawtExcel procedures to exchange data between Excel and MediaWiki tables. |
| Excel-14\_Wikit.tcl | Test CawtExcel procedures to exchange data between Excel and Wikit tables. |
| Excel-15\_Clipboard.tcl | Test CawtExcel procedures to exchange data between Excel and the Windows clipboard. |
| Excel-16\_SetGet.tcl | Test CawtExcel procedures for setting and getting cell values. |
| Excel-17\_Diff.tcl | Test CawtExcel procedure for diff'ing Excel files. |
| Excel-17\_DiffEqual.tcl | Test CawtExcel procedure for diff'ing Excel files. |
| Excel-18\_SparseMatrix.tcl | Test CawtExcel procedures for handling sparse matrices. |
| Excel-19\_MarkLink.tcl | Test CawtExcel procedures related to marking and linking cells. |
| Excel-20\_ImgUtil.tcl | Test CawtExcel procedures for dealing with images. |
| Excel-21\_ImgCell.tcl | Test CawtExcel procedures for inserting images using cell background colors. |
| Excel-22\_Html.tcl | Test CawtExcel procedures to export Excel data to a HTML file. |
| Excel-23\_Font-Attributes.tcl | Test CawtExcel procedures related to font attribute handling. |
| Excel-23\_Font.tcl | Test CawtExcel procedures related to font handling. |
| Excel-24\_Format.tcl | Test CawtExcel procedures related to specifying number formats. |
| Excel-25\_Properties.tcl | Test CawtExcel procedures related to property handling. |
| Excel-26\_PageSetup.tcl | Test CawtExcel procedures related to page setup and printing. |
| Excel-27\_RowColumn.tcl | Test CawtExcel procedures for row and column handling: Insert, delete, hide, duplicate. |
| Excel-28\_NamedRange.tcl | Test CawtExcel procedures related to named ranges. |
| Excel-29\_EmptySheet.tcl | Test CawtExcel procedures dealing with empty worksheets. |
| Excel-30\_SelectRange.tcl | Test miscellaneous CawtExcel procedures like setting colors, column width, inserting formulas and searching. |
| Excel-31\_Import.tcl | Test CawtExcel procedures related to import functionality. |
| Excel-32\_Quit.tcl | Test quitting Excel without saving modified worksheets. |
| Excel-33\_AddAndRunMacro.tcl | Test CawtOffice procedures to add Excel macros (Sub and Function) from a string and run these macros. |
| Excel-33\_ImportAndRunMacro.tcl | Test CawtOffice procedures to add Excel macros (Sub and Function) from a source file and run these macros. |
| Excel-33\_RunMacro.tcl | Test CawtOffice procedures to run macros (Sub and Function) contained in an Excel file. |
| Excel-34\_Events.tcl | Test event handling functionality of Excel. |
| Excel-35\_Styles.tcl | Test CawtExcel procedures related to Styles handling. |
| Excel-36\_Embed.tcl | Test CawtExcel procedures for embedding an Excel workbook into a Tk frame. |
| Excel-37\_WorksheetName.tcl | Test CawtExcel procedures for mapping worksheet names. |
| Excel-38\_Interpolate.tcl | Test interpolation functionality of the CawtCore package in Excel example. |
| Explorer-01\_Basic.tcl | Test basic functionality of the CawtExplorer package. |
| Explorer-02\_Misc.tcl | Test miscellaneous CawtExplorer functions like navigating to an URL and using fillscreen mode. |
| Explorer-03\_Events.tcl | Test event handling functionality of Internet Explorer. |
| Matlab-01\_Basic.tcl | Test basic functionality of the CawtMatlab package. |
| Matlab-02\_MFile.tcl | Test CawtMatlab procedures for executing Matlab commands. |
| Ocr-01\_Basic.tcl | Test basic functionality of the CawtOcr package. |
| Ocr-02\_Misc.tcl | Test miscellaneous CawtOcr procedures. |
| OneNote-01\_Basic.tcl | Test basic functionality of the CawtOneNote package. |
| Outlook-01\_Basic.tcl | Test basic functionality of the CawtOutlook package. |
| Outlook-02\_Mail.tcl | Test mail functionality of the CawtOutlook package. Note: This script sends two test mails (in text and HTML format) to cawt@tcl3d.org. |
| Outlook-03\_Holiday.tcl | Test holiday appointment functionality of the CawtOutlook package. Note: This script sets appointments in your Outlook calendar. |
| Outlook-04\_Appointment.tcl | Test appointment functionality of the CawtOutlook package. Note: This script sets appointments in your Outlook calendar. |
| Outlook-05\_MailFolders.tcl | Test mail folder functionality of the CawtOutlook package. |
| Outlook-06\_ContactFolders.tcl | Test contact functionality of the CawtOutlook package. |
| Ppt-01\_Basic.tcl | Test basic functionality of the CawtPpt package. |
| Ppt-02\_Misc.tcl | Test miscellaneous CawtPpt procedures like adding slides, inserting images and saving slides as image files. |
| Ppt-03\_Add.tcl | Test CawtPpt procedures for adding and copying slides. |
| Ppt-04\_Present.tcl | Test CawtPpt procedures for presenting a slide show. |
| Ppt-05\_Export.tcl | Test CawtPpt procedures for exporting a PowerPoint presentation as HTML slide show. |
| Ppt-06\_CustomLayout.tcl | Test CawtPpt procedures for using PowerPoint custom layouts. |
| Ppt-07\_Properties.tcl | Test CawtPpt procedures related to property handling. |
| Ppt-08\_Comments.tcl | Test CawtPpt procedures for handling PowerPoint comments. |
| Ppt-09\_Shapes.tcl | Test CawtPpt procedures related to creating, manipulating and connecting shapes. |
| Ppt-10\_AllShapes.tcl | Test CawtPpt procedure for creating all available shapes. |
| Ppt-11\_AllConnectors.tcl | Test CawtPpt procedure for creating all available connectors. |
| Ppt-12\_Quit.tcl | Test quitting PowerPoint without saving modified presentations. |
| Ppt-13\_Media.tcl | Test CawtPpt procedures related to media content, i.e. images and videos. |
| Ppt-14\_CreateVideo.tcl | Test creating videos from PowerPoint slides. |
| Ppt-15\_ButtonEvent.tcl | Test CawtPpt procedures for simulating button events. |
| Ppt-16\_Embed.tcl | Test CawtPpt procedures for embedding a PowerPoint presentation into a Tk frame. |
| Reader-01\_Basic.tcl | Test basic functionality of the CawtReader package. |
| Reader-02\_Embed.tcl | Test CawtExcel procedures for embedding an Acrobat Reader window into a Tk frame. |
| Sapi-01\_Basic.tcl | Test basic functionality of the CawtSapi package. |
| Sapi-02\_Speak.tcl | Test speaking voices of the CawtSapi package. |
| Sapi-03\_SpeakOptions.tcl | Test speaking options of the CawtSapi package. |
| Sapi-04\_SpeakFlags.tcl | Test speaking flags of the CawtSapi package. |
| Word-01\_Basic.tcl | Test basic functionality of the CawtWord package. |
| Word-02\_Table.tcl | Test CawtWord procedures related to Word table management. |
| Word-02\_TableWidth.tcl | Test CawtWord procedures related to Word table width management. |
| Word-03\_Text.tcl | Test CawtWord procedures for handling text. |
| Word-04\_Find.tcl | Test CawtWord procedures related to simple search and replace functionality. |
| Word-04\_FindGeneric.tcl | Test CawtWord procedures related to generic search and replace functionality. |
| Word-05\_Report.tcl | Test CawtWord procedures needed for generating a test report. |
| Word-06\_Diff.tcl | Test CawtWord procedure for diff'ing Word files. |
| Word-07\_Link.tcl | Test CawtWord procedures for handling links and inserting files. |
| Word-08\_ImgUtil.tcl | Test CawtWord procedures for dealing with images. |
| Word-09\_Controls.tcl | Test CawtWord procedures for handling content controls. |
| Word-10\_Properties.tcl | Test CawtWord procedures related to property handling. |
| Word-11\_Tables.tcl | Test CawtWord procedures related to Word table management. |
| Word-12\_LargeTable.tcl | Test CawtWord procedures to insert a large Word table. |
| Word-13\_MultiTables.tcl | Test CawtWord procedures to insert multiple Word tables across multiple pages. |
| Word-14\_Quit.tcl | Test quitting Word without saving modified documents. |
| Word-15\_MergeCells.tcl | Test CawtWord procedures related to Word table cell merging. |
| Word-16\_ReplaceImages.tcl | Test CawtWord procedures for replacing images stored as InlinesShapes and Shapes. |
| Word-17\_Subdocuments.tcl | Test CawtWord procedures related to subdocument handling. |
| Word-18\_PageSetup.tcl | Test Word page setup setter and getter procedures. |
| Word-19\_Heading.tcl | Test CawtWord procedures related to Word headings. |
| Word-19\_HeadingDict.tcl | Test CawtWord procedures related to Word headings. |
| Word-20\_Font.tcl | Test CawtWord procedures for handling fonts. |
| Word-21\_RunMacro.tcl | Test CawtOffice procedures to run a macro contained in a Word file. |
| Word-22\_Events.tcl | Test event handling functionality of Word. |
| Word-23\_Embed.tcl | Test CawtWord procedures for embedding a Word document into a Tk frame. |

Table 2: Test Programs

The CAWT sub-packages have been tested successfully with the above mentioned programs on the following operating systems and COM application versions:

|  |  |  |
| --- | --- | --- |
| **Package** | **Operating system** | **Application version** |
| CawtEarth | Windows 7, 8, 10 | 6.2, 7.1.2 |
| CawtExcel | Windows 7, 8, 10, 11 | 2013, 2016, 2019 (\*) |
| CawtExplorer | Windows 7, 8 (\*\*) | IE 8, IE 9, IE 11 |
| CawtMatlab | Windows 7 | R2007b |
| CawtOcr | Windows 7, 8 | 2013 |
| CawtOneNote | Windows 7, 8, 10, 11 | 2013, 2016 |
| CawtOutlook | Windows 7, 8, 10, 11 | 2013, 2016, 2019 (\*) |
| CawtPpt | Windows 7, 8, 10, 11 | 2013, 2016, 2019 (\*) |
| CawtReader | Windows 7, 8, 10 | DC |
| CawtSapi | Windows 8, 10 | 5.3, 5.4 |
| CawtWord | Windows 7, 8, 10, 11 | 2013, 2016, 2019 (\*) |

(\*) Older Office versions may work, but are not tested anymore.

(\*\*) See chapter 2.5 for known issues with Internet Explorer on Windows 7 and 8.

## Test execution

To execute a single test program, execute it with the Tcl shell:

> tclsh Excel-02\_Misc.tcl

To execute all test programs of a sub-package, use the utility script RunTest.tcl:

> tclsh RunTest.tcl Excel

To execute all test programs of CAWT, use the batch program RunTests.bat:

> RunTests.bat

Each test program accepts an optional string parameter. If this parameter is set to auto, the test program closes and quits the controlled application. If this parameter is not set, the controlled application stays open, so the results can be viewed directly in the application window.

The RunTest.tcl utility script, calls all test programs available for a sub-package by specifying the corresponding namespace name. The test programs are called with the above mentioned auto parameter. Additionally, the script can be supplied with optional parameters to switch off either the tests or to switch off the code coverage checks.

If called without any parameters, the script issues a help message onto standard output.

Usage: RunTest.tcl [Options] Namespace [Namespace]

Run the test programs and code coverage checks for specified namespace(s).

Namespaces usable: Cawt Excel Ppt Word OneNote Outlook Sapi Ocr Reader Earth Matlab Explorer.

Options:

--help : Display this usage message and exit.

--verbose: Show the detailed results of the tests. (Default: No)

--notests: Do not run the tests. (Default: Run tests)

--nocover: Do not run the coverage checks. (Default: Run coverage)

# Inside CAWT

The information in this chapter is for programmers, who want to extend and improve CAWT.

Download the developer distribution from the CAWT homepage or checkout the source code from SourceForge. This distribution contains in addition to the user distribution the documentation source files (a Word and a PowerPoint file), the Ruff! and textutil packages for generating the reference documentation out of the Tcl sources, as well as some additional utility scripts.

Create or update Office enumeration values

The files containing common Office enumerations (officeConst.tcl) as well as the enumeration values of the Office applications Excel (excelConst.tcl), PowerPoint (pptConst.tcl), Word (wordConst.tcl), Outlook (outlookConst.tcl) and SAPI (sapiConst.tcl) are automatically generated with script createConstFile.tcl.

The enumeration values of the current CAWT distribution are based on Microsoft Office 2019. If you have a newer Office version and want to update the enumeration files, execute the batch program createConstFiles.bat, which is located at the root directory of CAWT. Before calling the batch program, you should edit it to fit the locations of your Office programs.

Create or update CAWT documentation

The CAWT documentation comes in 2 parts, the user manual (this document) and a reference manual.

The reference manual is created with the help of the Ruff! package from inline documentation. So, if adding new procedures to the CAWT packages, be sure to also update the inline documentation.

The sources of the user manual are a Word template document and a PowerPoint presentation located in folder Documents/UserManual.

The final documentation is created by Tcl script genCawtDoc.tcl, which first creates the reference manual by calling Ruff!, and then the user manual.

The user manual is generated by exporting the slides of the presentation and inserting them into a copy of the Word template document. Additionally a list of test scripts and tables of all CAWT procedures (containing links to the reference manual) are inserted. Finally, some keywords representing the current date, year and CAWT version are replaced with their corresponding values. The final user manual document is then written in Word and PDF format into folder Documents/Final.

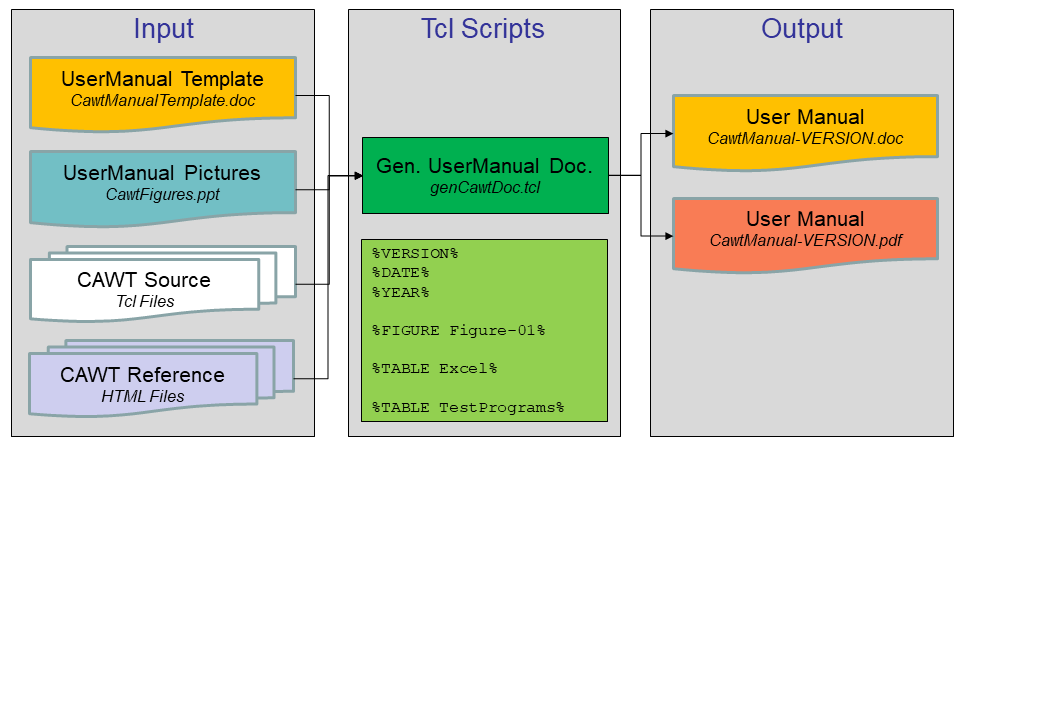


Figure 12: Documentation generation workflow

If specifying the strings ref or user as command line parameter for script genCawtDoc.tcl, only the reference manual resp. the user manual is generated.

Create a CAWT distribution

To create a distribution (both user and developer) call Tcl script makeDist.tcl.

Note, that you should have updated the documentation before creating a distribution.

The location of the distribution output files and the program to create ZIP files are listed at the top of file makeDist.tcl, and must be adapted to your local situation.

# Release history

The following table gives an overview of the release history of CAWT and its predecessors TcomOffice and TcomExcel.

|  |  |  |
| --- | --- | --- |
| **Version** | **Date** | **Release notes** |
| **TcomExcel** | | |
| 0.1 | 2008-09-11 | Initial release. Support for Excel 2000 and 2003. |
| 0.2 | 2009-09-19 | Extended functionality. Added support for Excel 2007. |
| 0.3 | 2010-10-29 | Bug fixes and extended test programs. |
| 0.3.1 | 2011-01-13 | Extended functionality. Added support for Excel 2010. |
| 0.3.2 | 2011-04-05 | Extended functionality. |
| **TcomOffice** | | |
| 0.4.0 | 2011-07-17 | New module TcomWord for Word automation. |
| 0.4.1 | 2011-08-28 | Extended functionality. |
| **CAWT** | | |
| 1.0.0 | 2012-12-23 | Replaced Tcom with Twapi for COM access.  Added support for PowerPoint, Internet Explorer, Google Earth and Matlab.  Added user and reference manual.  Unification of procedure names.  Supports Microsoft Office versions 2003, 2007, 2010. |
| 1.0.1 | 2013-04-28 | Extended Excel chart generation.  Updated Twapi version to 4.0a16.  Added support to generate a CAWT starkit. |
| 1.0.2 | 2013-07-28 | Updated Twapi version to 4.0b22.  Updated Img version to 1.4.1.  Added new module CawtOcr.  New procedures in CawtCore:   * Clipboard2Img, Img2Clipboard   New procedures in CawtExcel:   * SetRangeBorder |
| 1.0.3 | 2013-08-30 | New procedures in CawtExcel:   * ExcelFileToMediaWikiFile, ExcelFileToWikitFile * ExcelFileToRawImageFile, RawImageFileToExcelFile * ExcelFileToMatlabFile, MatlabFileToExcelFile * GetTablelistValues, SetTablelistValues |
| 1.0.4 | 2013-11-23 | Improved test suite.  Added support for Office 2013.  Added support for 64-bit Office.  Updated Img extension to version 1.4.2 (32-bit and 64-bit).  Update Tablelist to version 5.10.  New procedures in CawtWord:   * SaveAsPdf * UpdateFields * CropImage.   New procedures in CawtExcel:   * CopyWorksheetBefore, CopyWorksheetAfter * GetWorksheetIndexByName * IsWorksheetProtected, IsWorksheetVisible * SetWorksheetTabColor * UnhideWorksheet * DiffExcelFiles |
| 1.0.5 | 2014-01-26 | New procedures in CawtExcel:   * SetCommentDisplayMode, SetRangeComment * SetRangeMergeCells, GetRangeCharacters * SetRangeFontSubscript, SetRangeFontSuperscript |
| 1.0.6 | 2014-04-21 | Improved and extended test suite.  Updated Twapi version to 4.0b53 to fix a bug with sparse matrices as well as core dumps with Word 2013.  Improved and corrected handling of sparse matrices in Excel.  Bug fix in excelCsv module.  Possible incompatibility in GetRowValues and GetColumnValues: Changed startRow resp. startCol to default value 0 instead of 1.  New procedures in CawtExcel:   * GetWorksheetAsMatrix * GetMaxRows, GetMaxColumns * GetFirstUsedRow, GetLastUsedRow * GetFirstUsedColumn, GetLastUsedColumn |
| 1.0.7 | 2014-06-14 | Updated Twapi version to official 4.0.61.  CawtExcel:   * Added support for reading and writing CSV files with multi-line cells.   CawtPpt:   * Extended CopySlide to copy slides between presentations. * Extended AddPres with optional parameter for template file. * Extended AddSlide to supply a custom layout object as type parameter.   Extended test suite for changed and new procedures.  New procedures in CawtCore:   * ColorToRgb   New procedures in CawtExcel:   * UseImgTransparency, WorksheetToImg, ImgToWorksheet * SetRowHeight, SetRowsHeight * GetRangeFillColor * SetHyperlinkToFile, SetHyperlinkToCell, SetLinkToCell * SetRangeTooltip   New procedures in CawtPpt:   * MoveSlide, * GetTemplateExtString * GetNumCustomLayouts * GetCustomLayoutName, GetCustomLayoutId |
| 1.1.0 | 2014-08-30 | Compatibility issue:   * Incompatible changes in module CawtWord. * Unified signatures of AddText, AppendText and AddParagraph, AppendParagraph. * Changed handling of text ranges.   New module CawtOutlook to control Microsoft Outlook applications:   * Currently only functionality for creating and sending mails is implemented.   Extended test suite for changed and new procedures.  New procedures in CawtExcel:   * FreezePanes, ScreenUpdate   New procedures in CawtWord:   * SelectRange, GetRangeInformation, CreateRange * SetRangeFontName, SetRangeStyle, SetRangeFontSize * InsertText, AddText, GetNumCharacters * AddPageBreak, ToggleSpellCheck |
| 1.2.0 | 2014-12-14 | Compatibility issue:   * Incompatible changes in module CawtWord. Removed parameter docId from all procedures, which had both docId and rangeId parameters: * SetRangeStartIndex, SetRangeEndIndex, ExtendRange, * AddText, SetHyperlink, AddTable.   CawtExcel:   * Added optional startRow parameter to TablelistToWorksheet.   Extended test suite for changed and new procedures.  New procedures in CawtWord:   * GetDocumentId * SetRangeFontUnderline, CreateRangeAfter * InsertCaption, ConfigureCaption * AddBookmark, GetBookmarkName, SetLinkToBookmark * GetListGalleryId, GetListTemplateId, InsertList |
| 2.0.0 | 2015-03-31 | Ensembled all CAWT namespaces, ex. write "Excel Open" instead of "::Excel::Open".  All Office enumerations are stored in module specific hash tables, ex. write "xlThick" instead of "$::Excel::xlThick".  Updated and extended user manual (automatic insertion of CAWT procedure reference list).  Added new application EnumExplorer.tcl to display Office enumerations.  New module excelHtml.tcl for HTML export of Excel tables.  External packages:   * Updated Twapi to version 4.1.27. * Updated Img (32 and 64 bit) to version 1.4.3. * Updated Tablelist to version 5.13.   CawtExcel:   * New implementation of InsertImage based on Shapes.AddPicture instead of Pictures.Insert   CawtWord:   * Extended procedure UpdateFields to additionally update TablesOfContents and TablesOfFigures of a document.   New procedures in CawtCore:   * GetApplicationVersion, IsApplicationId * PushComObjects, PopComObjects * PrintNumComObjects, CheckComObjects * GetComObjects, GetNumComObjects * Replaced procedure IsValidId with IsComObject   New procedures in CawtExcel:   * GetRangeAsIndex, GetRangeAsString, GetRangeTextColor   New procedures in CawtWord:   * ScaleImage, SetInternalHyperlink, InsertFile, DiffWordFile |
| 2.1.0 | 2015-09-01 | Updated Twapi to version 4.2.a1, because of new Twapi functionality "tclcast bstr" and bug fix to retrieve document properties.  Added support to generate a CAWT starpack.  CawtExcel:   * Take hidden flag of both Excel and tablelist columns into account in procedures TablelistToWorksheet and WorksheetToTablelist. * Fixed SetCellValue and SetRangeFormat using new TclString procedure.   CawtPpt:   * Extended functionality of ExportPptFile and ExportSlides to take into account slide comments regarding export file names.   New procedures in CawtCore:   * TclString   New procedures in CawtExcel:   * DeleteColumn, DeleteRow * HideColumn, GetHiddenColumns * GetDecimalSeparator (replacing GetFloatSeparator) * GetThousandsSeparator * GetNumberFormat (replacing GetLangNumberFormat)   New procedures in CawtPpt:   * AddTextbox, AddTextboxText, SetTextboxFontSize * GetNumComments, GetComments, GetCommentKeyValue   New procedures in CawtWord:   * AddContentControl * SetContentControlDropdown, SetContentControlText * GetDocumentProperties, GetDocumentProperty * SetDocumentProperty. |
| 2.1.1 | 2015-10-31 | Support for Office 2016.  External packages:   * Updated Tablelist to version 5.14. |
| 2.1.2 | 2015-11-10 | Extended support for Excel page setup.  Changed all Office procedures with size parameters to accept inches, centimeters or points.  CawtExcel:   * Corrected SetWorksheetFitToPages to accept zero as values for wide and tall parameters. Zero indicates automatic determination of number of pages.   New procedures in CawtCore:   * SetPrinterCommunication, * ValueToPoints, PointsToCentiMeters, PointsToInches.   New procedures in CawtExcel:   * SetWorksheetPrintOptions, SetWorksheetPaperSize, * SetWorksheetMargins, SetWorksheetFooter, * SetWorksheetHeader. |
| 2.2.0 | 2015-12-12 | Enhanced functionality in Core and Office modules.  Compatibility issue:   * AddWorksheet now adds the new sheet at the end, as was already written in the documentation. Previous behaviour was to insert before active worksheet.   New module CawtOffice:   * Moved basic Office procedures into namespace Office. * Added aliases in namespace Cawt for backwards compatibility. * Added new enumeration constants file for basic Office types based on type library in mso.dll.   CawtCore:   * Colors can now be specified in hex notation, Tcl color names, RGB or as Office color numbers.   CawtExcel:   * Extended SetLinkToCell to copy number format when linking. * Extended SetRangeFormat to accept Excel style number formats. * Extended SetHyperlinkToFile to accept relative path names. * Corrected hyperlinking to relative file names.   New procedures in CawtCore:   * GetColor, GetColorNames, * IsHexColor, IsNameColor, IsOfficeColor, IsRgbColor * OfficeColorToRgb, RgbToOfficeColor   New procedures in CawtExcel:   * CopyRange, GetCurrencyFormat, GetRangeFormat   New procedures in CawtPpt:   * AddShape, ConfigureShape, * ConnectShapes, ConfigureConnector   New procedures in CawtWord:   * SetHyperlinkToFile |
| 2.3.0 | 2016-08-16 | New module CawtOneNote.  Compatibility issue:   * Excel::GetRangeAsIndex now returns a 2-element (cell) or 4-element (range) list. Previous behaviour was to always return a 4 element list.   CawtOneNote:   * Added basic functionality for Microsoft OneNote. * Added script OneNoteInfo.tcl to retrieve information from OneNote.   New procedures in CawtExcel:   * DuplicateColumn, DuplicateRow * GetHiddenRows, HideRow * InsertColumn, InsertRow * GetColumnNumber, ShowWorksheet * GetRangeWrapText, SetRangeWrapText * SetRangeValues, GetRangeValues, IsWorkbookId * SetNamedRange, GetNamedRange * GetNamedRangeNames   New procedures in CawtOutlook:   * CreateHtmlMail   External packages:   * Updated Tablelist to version 5.15. * Updated Twapi to version 4.2a3. * New package tDOM 0.8.3 (needed for CawtOneNote). |
| 2.3.1 | 2016-12-10 | Enhanced functionality in Core and Office modules.  CawtExcel:   * Extended Excel module excelImgRaw to support 16-bit integer images.   New procedures in CawtCore:   * CheckBoolean   New procedures in CawtExcel:   * GetCellComment   New procedures in CawtWord:   * Search SetRangeFontBackgroundColor   External packages:   * Updated Img (32 and 64 bit) to version 1.4.6. * Updated Tablelist to version 5.16. |
| 2.4.0 | 2017-06-18 | New module CawtReader.  Compatibility issue:   * Excel::ExcelFileToHtmlFile has changed signature. * Now uses parameter args for extended options.   CawtReader:   * Added basic functionality for Acrobat Reader (not via COM).   CawtExcel:   * Extended module excelHtml to convert Excel hyperlinks.   New procedures in CawtWord:   * IsValidCell   External packages:   * Updated Tablelist to version 5.17. * Updated Twapi to version 4.2a5. |
| 2.4.1 | 2017-12-30 | Enhanced functionality in Outlook module.  CawtOutlook:   * Added handling of appointments, calendars and categories. * Added ability to read and apply Outlook holiday files.   CawtExcel:   * Added ability to save CSV files in UTF-8 format.   New procedures in CawtExcel:   * CreateRangeString, SetChartTicks   New procedures in CawtWord:   * AddImageTable, GetImageId, GetImageName, * GetNumImages, ReplaceImage, SetImageName, * CountWords   External packages:   * Updated Tablelist to version 6.0. * Updated Twapi to version 4.2.12. * Updated tDOM to version 0.9.0. * Updated Img to version 1.4.7. |
| 2.4.2 | 2018-04-26 | Enhanced functionality in several modules.  CawtPpt:   * Added new configure options for shapes: -beginsite, -endsite * Added new configure option for connectors: -weight   CawtWord:   * Corrected procedure SetDocumentProperty.   New procedures in CawtExcel:   * Import, CopyColumn, SetChartSourceByIndex, * SetChartTitle, GetChartNumSeries, GetChartSeries, * SetSeriesLineWidth   New procedures in CawtPpt:   * SetPresPageSetup, SetHyperlinkToSlide, GetNumSites   New procedures in CawtWord:   * DeleteRow, SetRangeMergeCells |
| 2.4.3 | 2018-12-27 | Support for Office 2019.  CawtOffice:   * Added script DocumentInfo.tcl to retrieve information about Office documents.   CawtWord:   * Extended procedure GetRowRange to use start and end rows. * Extended procedure GetNumImages to consider both InlineShapes as well as Shapes.   New procedure in CawtOffice:   * GetOfficeType   New procedure in CawtExcel:   * AddSeriesTrendLine   New procedures in CawtPpt:   * GetCommentKeyTopPosition, GetNumShapes, * GetPresImages, GetPresVideos, GetShapeId, * GetShapeMediaType, GetShapeName, GetShapeType, * InsertVideo, SetShapeName, SetMediaPlaySettings   New procedures in CawtWord:   * CollapseRange, CopyRange, DeleteTable, GetImageList, * GetPageSetup, GetRowId, GetTableIdByName, * GetTableName, IsVisible, MergeCells, ScreenUpdate, * SetCellVerticalAlignment, SetHeadingFormat, * SetRowHeight, SetTableName   External packages:   * Updated Tablelist to version 6.3. * Updated Img to version 1.4.8. * Updated Twapi to version 4.3.5. * Updated tDOM to version 0.9.1. |
| 2.4.4 | 2019-06-08 | Enhanced functionality in several modules.  CawtCore:   * Added new utility procedures \*OfficeDate\*. Declared old \*OutlookDate\* procedures as obsolete.   CawtExcel:   * Extended procedure GetCellRange to allow specification of a cell range, not only a single cell. * Extended procedure AddSeriesTrendLine with option keys -linewidth and -linecolor.   New procedure in CawtExcel:   * SetSeriesAttributes   New procedures in CawtWord:   * SetTableAlignment, SetTableOptions, * SetTableVerticalAlignment   External packages:   * Updated Tablelist to version 6.5. * Updated Img to version 1.4.9. |
| 2.4.5 | 2019-08-13 | Enhanced functionality in Word module.  CawtWord:   * Corrected procedures FindString and Search, when called with a docId.   New procedures in CawtWord:   * GetFooterText, GetHeaderText, * DeleteSubdocumentLinks, ExpandSubdocuments, * GetNumSubdocuments, GetSubdocumentPath   External packages:   * Updated Tablelist to version 6.6. * Updated Twapi to version 4.3.7. |
| 2.4.6 | 2019-10-12 | Enhanced reference documentation.  CawtCore:   * Extended test suite for complete test coverage. * Fixed bug in procedure GetColorNames.   Office modules:   * Added procedures for each enumeration type.   CawtPpt:   * Added new option "-fit" to proc InsertImage.   New procedures in CawtPpt:   * CheckCreateVideoStatus, CreateVideo, * SetSlideShowTransition, * GetPresPageHeight, GetPresPageWidth   External packages:   * Updated Ruff! to version 1.0b3. |
| 2.4.7 | 2019-11-03 | Enhanced functionality in Ppt and Word modules.  CawtPpt:   * Extended InsertImage to support both image file names as well as photo images. * Corrected procedure ExportPptFile. * Added additional "-check" option to proc CreateVideo to specify the check interval.   New procedures in CawtPpt:   * GetPptImageFormat, GetSupportedImageFormats, * GetCreateVideoStatus, IsImageFormatSupported   New procedures in CawtWord:   * SetPageSetup, * GetCrossReferenceItems, GetHeadingRanges, * GetRangeText, SetRangeFontColor, * GetRangeFont, SetRangeFont |
| 2.4.8 | 2020-03-08 | Support for Office macro execution.  CawtExcel:   * Fixed bugs in DiffExcelFiles.   CawtWord:   * Fixed COM object leak in IsValidCell.   New procedures in CawtCore:   * GetTmpDir   New procedures in CawtOffice:   * AddMacro, RunMacro   New procedures in CawtExcel:   * GetCellValueA1   New procedures in CawtWord:   * GetRangeScreenPos |
| 2.4.9 | 2020-06-09 | Enhanced functionality in Excel module  All modules:   * Compare procedure options with -nocase.   CawtExcel:   * Fixed bug when reading CSV files with Unix line endings.   New procedures in CawtExcel:   * SetRangeFontAttributes, GetRangeFontAttributes |
| 2.5.0 | 2020-07-24 | Enhanced functionality for handling Office document properties.  CawtOffice:   * Extended to support all types of document properties: bool, int, float, date and string.   New procedures in CawtOffice:   * AddProperty, DeleteProperty, GetProperty, * GetPropertyName, GetPropertyType, GetPropertyValue, * SetPropertyValue |
| 2.6.0 | 2021-01-06 | New module CawtSapi adding support for Microsoft Speech API.  New procedures in CawtCore:   * SetEventCallback   External packages:   * Updated Twapi to version 4.5.2. * Updated Tablelist to version 6.11. * Updated tDOM to version 0.9.2. * Updated Img to version 1.4.12. |
| 2.7.0 | 2021-02-27 | Enhanced functionality for handling Outlook contacts.  CawtCore:   * Extended procedure CountWords to additionally sort by increasing or decreasing counts.   CawtExcel:   * Changes in procedure WorksheetToTablelist:   Improved speed when handling worksheets with large number of columns.  Tablelist column headers are labeled like in Excel: A, B, C.  Added options -header, -rownumber, -maxrows, -maxcols.  CawtWord:   * Extended GetHyperlinksAsDict to be used as a coroutine.   New procedures in CawtOutlook:   * AddContact, AddContactFolder, DeleteContactByIndex, * DeleteContactFolder, GetContactByIndex, * GetContactFolderId, GetContactFolderNames, * GetContactProperties, GetNumContactFolders, * GetContactReadOnlyPropertyNames, * GetContactReadWritePropertyNames, * GetNumContacts, HaveContactFolder, * SetContactProperties   New procedures in CawtPpt:   * GetNumSlideImages, GetNumSlideVideos, * GetSlideIdByName, GetSlideImages, GetSlideName, * GetSlideVideos, SetSlideName   New procedures in CawtWord:   * GetBookmarkNames, GetHyperlinksAsDict, * PrintHyperlinkDict, GetNumHyperlinks   External packages:   * Updated Tablelist to version 6.12. * Updated Ruff! to version 1.1. |
| 2.8.0 | 2021-06-27 | Added functionality for embedding applications.  CawtExcel:   * Extended procedure OpenWorkbook to embed the application into a Tk frame.   CawtPpt:   * Extended procedure OpenPres to embed the application into a Tk frame.   CawtReader:   * Extended procedure Open to embed the application into a Tk frame.   CawtWord:   * Extended procedure OpenDocument to embed the application into a Tk frame.   New procedures in CawtCore:   * EmbedApp   New procedures in CawtExcel:   * GetNumStyles, GetStyleId   New procedures in CawtWord:   * GetNumPages, SetViewParameters   External packages:   * Updated Tablelist to version 6.14. * Updated Ruff! to version 1.2. |
| 2.8.1 | 2021-07-22 | Maintenance release.  CawtExcel:   * Added automatic mapping of worksheet names to Excel constraints regarding invalid characters and maximum length.   CawtWord:   * Corrected behaviour of GetHyperlinksAsDict, if link points to an invalid domain. |
| 2.8.2 | 2021-08-20 | Maintenance release.  CawtWord:   * Corrected behaviour of GetHyperlinksAsDict, if link points to an URL with spaces. * Extended SetTableOptions with new option -width. * Extended SetColumnWidth to specify width in percent. |
| 2.9.0 | 2021-12-19 | Added functionality for interpolation curves.  CawtCore:   * Added oo:class to interpolate between control points.   CawtWord:   * GetHyperlinksAsDict:   + Improved speed of URL validity check.   + Added support for URL's with subaddress (ex. www.tcl3d.org/doc.html#Index).   New procedures in CawtCore:   * IsValidUrlAddress, SetClipboardWaitTime, * WaitClipboardReady   New procedures in CawtPpt:   * IsValidPresId, GetCurrentSlideIndex   External packages:   * Updated Ruff! to version 2.0. * Updated Tablelist to version 6.16. * Updated Twapi to version 4.6.0. |
| 2.9.1 | 2022-04-09 | Maintenance release.  CawtExcel:   * Added option "-selection" to procedure WorksheetToTablelist to transfer the selected Excel cell range. * Corrected regexp in procedures GetRangeAsIndex and GetCellValueA1.   CawtOutlook:   * Improved GetFoldersRecursive.   New procedures in CawtWord:   * GetHeadingsAsDict, PrintHeadingDict |

# Tables

This chapter contains lists of figures, tables and terms and abbreviations.

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## Table of Terms and Abbreviations

| Term / Abbreviation | Meaning |
| --- | --- |
| API | Application Program Interface |
| BAWT | Build Automation With Tcl |
| BSD | Berkeley Software Distribution |
| CAWT | COM Automation With Tcl |
| COM | Component Object Model |
| CSV | Comma Separated Values |
| DOM | Document Object Model |
| GUI | Graphical User Interface |
| HTML | Hypertext Markup Language |
| ISO | International Organization for Standardization |
| OCR | Optical Character Recognition |
| PDF | Portable Document Format |
| RGB | Red-Green-Blue |
| SAPI | Speech Application Programming Interface |
| Tcl | Tool Command Language |
| Tk | Toolkit |
| URL | Uniform Resource Locator |
| UTF | Unicode Transformation Format |
| XML | Extensible Markup Language |