CAWT: COM Automation With Tcl

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1 Introduction

CAWT is a high-level Tcl interface for scripting Microsoft Windows® applications having a COM interface. It uses ***Twapi*** for automation via the COM interface.
Currently packages for Microsoft Excel, Word, PowerPoint and Internet Explorer, MathWorks Matlab and Google Earth are available.

CAWT is available at http://www.poSoft.de/html/extCawt.html

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 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. 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.

1.1 Architecture overview

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

CawtCore	Basic 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.
CawtPpt	Automation functionality for Microsoft PowerPoint.
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.

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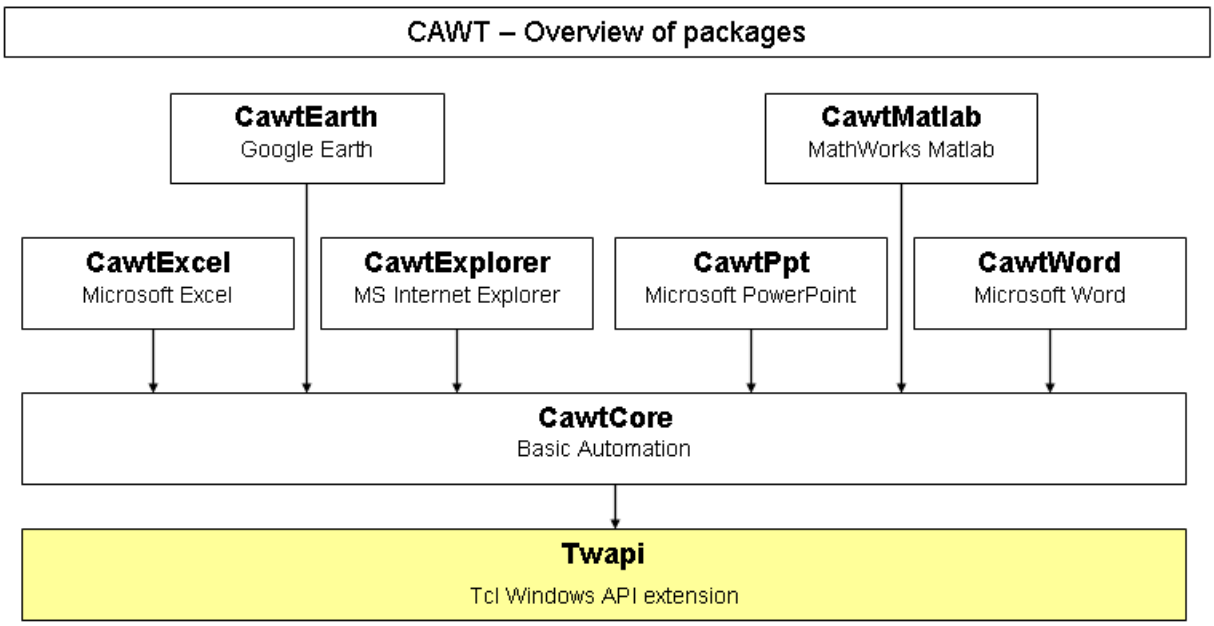

Figure 1: Overview of CAWT packages

1.2 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	>= 4.0	Mandatory: Included in CAWT user distribution.	http://twapi.magicsplat.com/
TkImg	1.4	Optional: Included in CAWT user distribution.	http://sourceforge.net/projects/tkimg/ http://www.poSoft.de/html/extTkImg.html
Tablelist	>= 4	Optional: Included in CAWT user distribution.	http://www.nemethi.de
Libraries needed for generating the CAWT documentation			
Ruff!	0.4	Included in CAWT developer distribution.	http://woof.magicsplat.com/ruff_home
Tcllib		Ruff! needs the textutil module from Tcllib. (textutil included in CAWT developer distribution)	http://sourceforge.net/projects/tcllib/

Note:
Twapi: At the time of writing, the new version 4 of Twapi was not yet officially released, but only available as a developer release. The version included in CAWT is 4.0a16.
TkImg: Needed only for some functionalities (see the CawtExcel package for further details).
Tablelist: Needed only for the excelTablelist module.

1.3 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:

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```
> tclsh Excel-01_Basic.tcl
```

See also chapter 4 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***, ***TkImg*** 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.

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2 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.

2.1 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, RgbToColor, TclBool`
COM access via Twapi	`GetOrCreateApp, IsValidId, Destroy`
Common Office functionality	`GetApplicationName`
Testing utilities	`CheckString, CheckNumber`

2.2 CawtEarth: Automation for Google Earth

The procedures of package ***CawtEarth*** are implemented in namespace `Earth`.
The name of the controlled application is `GoogleEarth.ApplicationGE`.

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.

2.3 CawtExcel: Automation for Microsoft Excel

The procedures of package ***CawtExcel*** are implemented in namespace `Excel`.
The name of the controlled application is `Excel.Application`.

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`
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`

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The commands are grouped and implemented in the following modules:

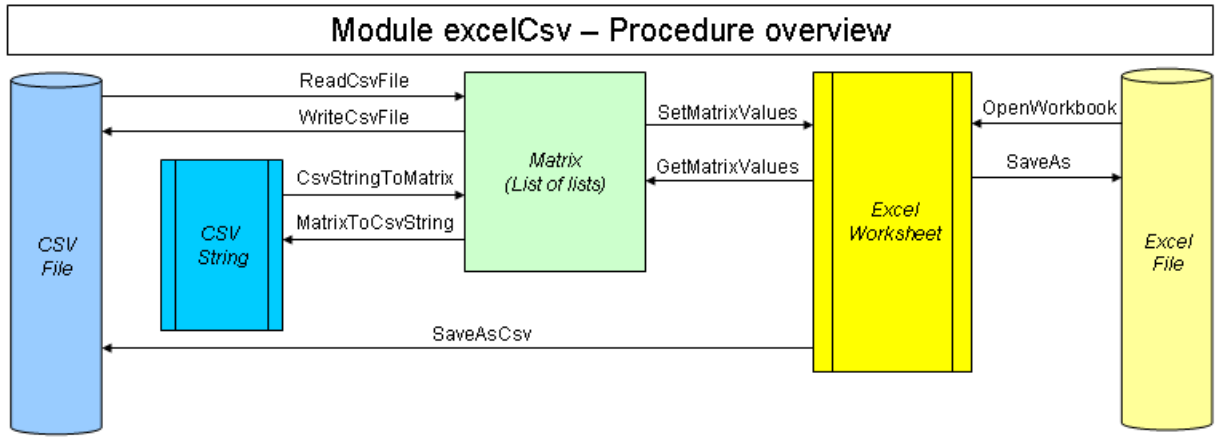
Implementation file	Description
`excelConst.tcl`	All Excel enumeration types.
`excelBasic.tcl`	Basic Excel commands.
`excelUtil.tcl`	Higher-level utility commands.
`excelChart.tcl`	Higher-level commands for chart creation.
`excelCsv.tcl`	Commands for reading/writing CSV files.
`excelTablelist.tcl`	Exchange 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.

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/8.5/img/doc/img-raw.html
MediaWiki: https://meta.wikimedia.org/wiki/Help:Table
Wikit: http://wiki.tcl.tk/14

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. Note, that procedure names painted in red are not yet implemented, but planned for a future release to make the modules feature-complete.

2.3.1 Module excelCsv



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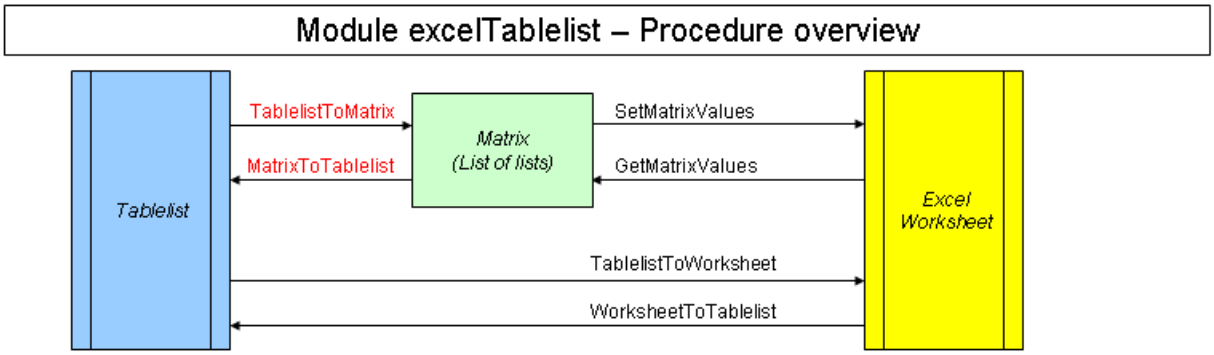
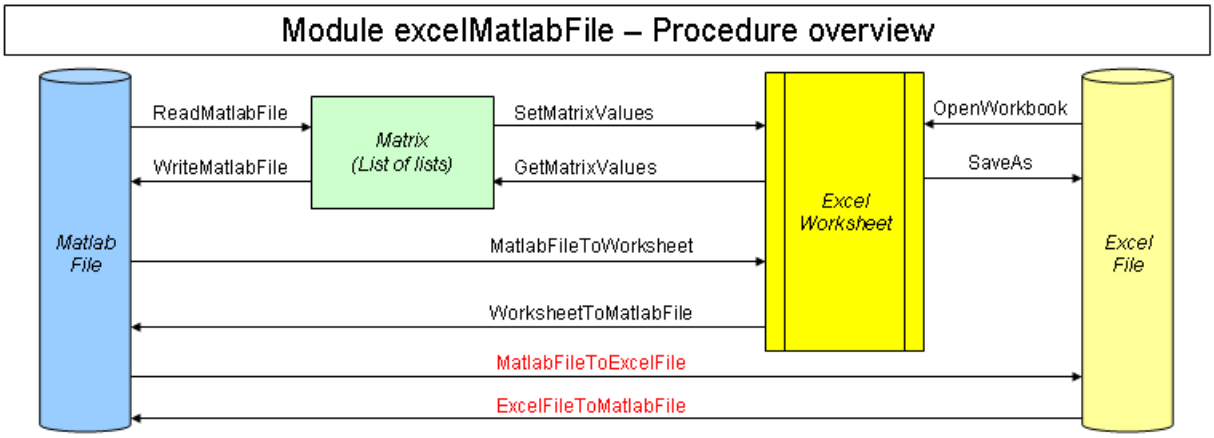
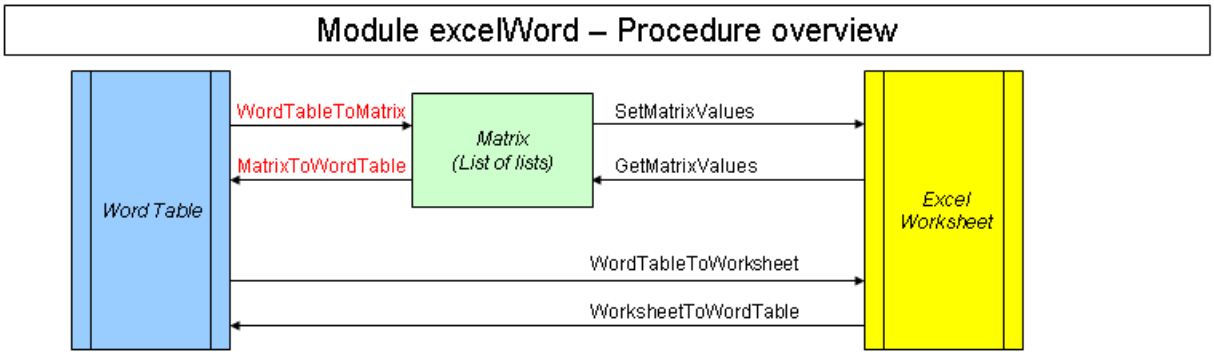
2.3.2 Module excelTablelist



2.3.3 Module excelMatlabFile



2.3.4 Module excelWord



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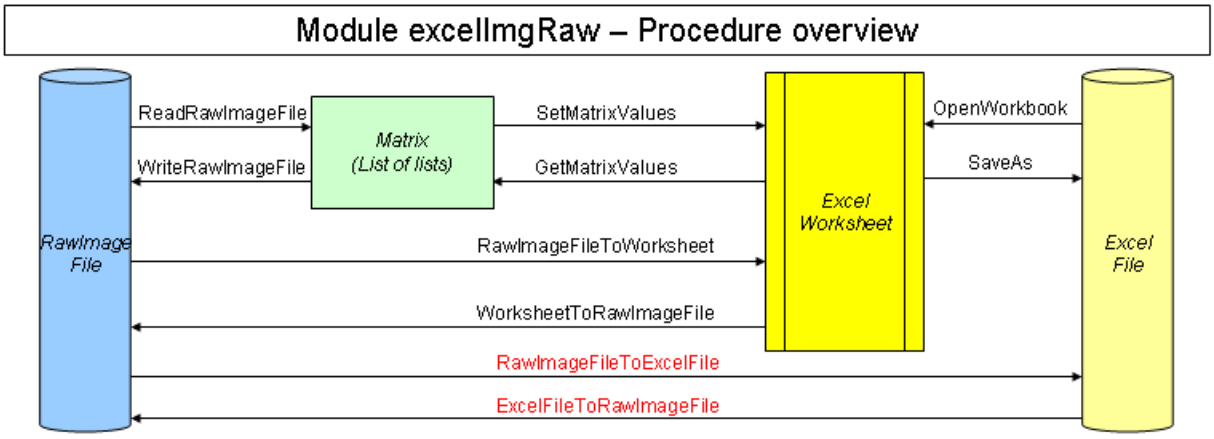
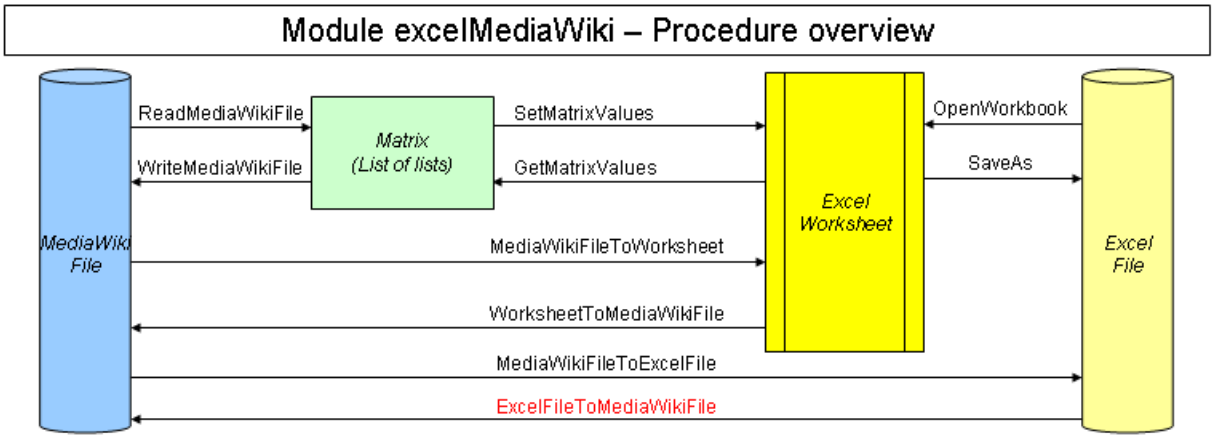
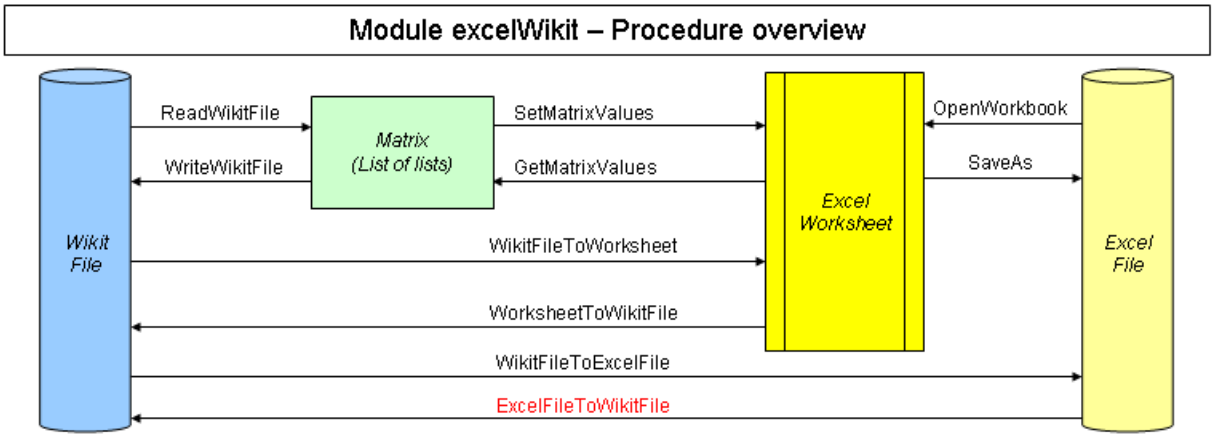
2.3.5 Module excelImgRaw



2.3.6 Module excelMediaWiki



2.3.7 Module excelWikit



2.4 CawtExplorer: Automation for Internet Explorer

The procedures of package ***CawtExplorer*** are implemented in namespace `Explorer`.
The name of the controlled application is `InternetExplorer.Application`.

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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
```

2.5 CawtMatlab: Automation for MathWorks Matlab

The procedures of package ***CawtMatlab*** are implemented in namespace `Matlab`.
The name of the controlled application is `Matlab.Application`.

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.

2.6 CawtPpt: Automation for Microsoft PowerPoint

The procedures of package ***CawtPpt*** are implemented in namespace `Ppt`.
The name of the controlled application is `PowerPoint.Application.`

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`

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

2.7 CawtWord: Automation for Microsoft Word

The procedures of package ***CawtWord*** are implemented in namespace `Word`.
The name of the controlled application is `Word.Application`.

They provide functionality for the following domains:

Domain	Examples
Application handling	`Open, Quit, GetVersion`

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Document handling	`OpenDocument, AddDocument, SaveAs, Close`
Table handling	`AddTable, GetNumRows, SetCellValue, GetCellValue`
Text handling	`AddParagraph, AppendText,`
Range handling	`GetStartRange, GetRangeStartIndex, ExtendRange`
Search/Replace functionality	`FindString, ReplaceString, ReplaceByProc`
Formatting functionality	`SetRangeFontBold, SetRangeBackgroundColor`

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

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3 Miscellaneous CAWT information

This chapter contains miscellaneous information about ***CAWT***.

3.1 License information

The CAWT package is copyrighted by Paul Obermeier and distributed under the BSD license. CAWT relies on several other Tcl packages. See the table in chapter 1.2 for links to these packages to get their license information.

3.2 Known bugs

There is an issue with the differing floating-point separators used in languages like German, where the comma is the character used as the “decimal point”.

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4 Test programs

4.1 Test overview

The following test and demonstration programs are currently available:

Test Program	Description
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 createa Tk GUI with buttons corresponding to these positions.Clicking onto one of these buttons triggers Google Earth to fly to that position.
Excel-01_Basic.tcl	Test basic functionality of the CawtExcel package.
Excel-02_Misc.tcl	Test miscellaneous CawtExcel procedures like setting colors, fonts and column width,inserting formulas, hyperlinks and images, searching and page setup.
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-08_Tablelist.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 orRAW image files.
Excel-11_RawImage.tcl	Test CawtExcel procedures to exchange data between Excel and RAW photo 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.
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.
Matlab-01_Basic.tcl	Test basic functionality of the CawtMatlab package.
Matlab-02_MFile.tcl	Test CawtMatlab procedures for executing Matlab commands.
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 slidesas image files.
Ppt-03_Add.tcl	Test CawtPpt procedures for adding and copying slides.

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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.
Word-01_Basic.tcl	Test basic functionality of the CawtWord package.
Word-02_Table.tcl	Test CawtWord procedures related to Word table management.
Word-03_Text.tcl	Test CawtWord procedures for handling text.
Word-04_Find.tcl	Test CawtWord procedures related to search and replace functionality.

Table 1: 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 XP, Windows 7	6.2
CawtExcel	Windows XP, Windows 7	2003, 2007, 2010
CawtExplorer	Windows XP, Windows 7 (*)	IE 8, IE 9
CawtMatlab	Windows XP	R2007b
CawtPpt	Windows XP, Windows 7	2003, 2007, 2010
CawtWord	Windows XP, Windows 7	2003, 2007, 2010

(*) See chapter 2.4 for known issues with Internet Explorer on Windows 7.

4.2 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 an optional parameter CoverageOnly. If this parameter is set to 1, only the code coverage tests are executed.
If called without any parameters, the script issues a help message onto standard output.

```
Usage: RunTest.tcl Namespace [CoverageOnly]

Perform the tests and check code coverage for specified namespace.
Namespaces available: Earth, Excel, Explorer, Ppt, Matlab, Word
If CoverageOnly is set to 1, only coverage checks are performed.
```


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5 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. 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 the enumeration values of the Office applications Excel, PowerPoint and Word (*excelConst.tcl, pptConst.tcl, wordConst.tcl*) are automatically generated with script *createConstFile.tcl*.
The enumeration values of the current CAWT distribution are based on Microsoft Office 2010. 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. Note also, that the enumeration files are created in the CAWT root directory, so you have to copy them into the appropriate sub-folders by hand (but check and compare the differences to the existing files first).

Create or update CAWT documentation

The CAWT documentation comes in 2 parts, the user manual 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 files, 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 creates the reference manual by calling Ruff!, and the user manual by exporting the slides of the presentation and inserting them into the Word template document. The final documents are then written into folder *Documents/Final*.
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.

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6 Release history

The following table gives an overview of the release history of ***CAWT*** and it's 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.

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