BAWT - Build Automation With Tcl

1 Introduction

BAWT is a configurable framework written in ***Tcl*** for building ***C/C++*** based software libraries from source code without user interaction. Its main usage is for the ***Windows*** operating system, where heterogeneous build environments and compilers are needed (or wanted) to build these libraries:

- `configure/make` (via MSYS / MinGW)
- `nmake`
- `CMake`
- `Visual Studio Solutions`

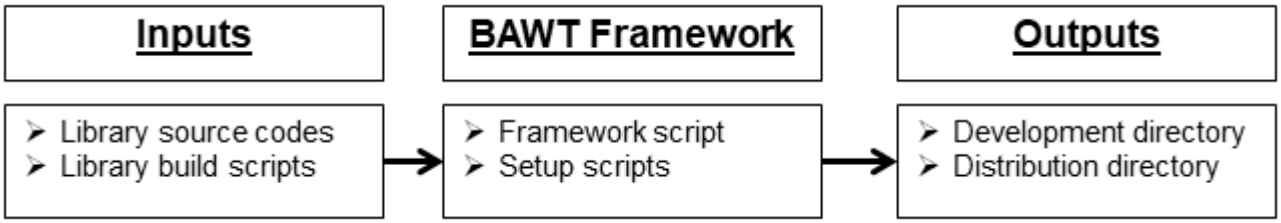
- `gcc` (via MSYS / MinGW)
- `Visual Studio`

Due to the portable nature of ***Tcl*** the framework can be used on ***Linux*** and ***Darwin*** as well using the `configure/make/gcc` build chain.

The libraries currently supported by ***BAWT*** are mainly from the ***Tcl*** and ***OpenSceneGraph*** domain. For these two domains the framework supports creating installation executables on Windows based on ***InnoSetup*** and simple shell-based installation programs for Linux and Darwin.

See chapter *8 Supported Libraries* for a list of currently supported libraries.

The framework itself is just one plain Tcl file *Bawt.tcl*, which reads a *Setup* file containing all the libraries to be built. Each library must have an accompanying *Build* file, which contains the details on how to extract, configure, compile and distribute the library. The library itself is stored as one or more zipped source code files, **which** may contain different versions of the library. The generated shared or static libraries, programs and header files are finally copied into ready-to-use directory structures for use by developers or for software distribution.

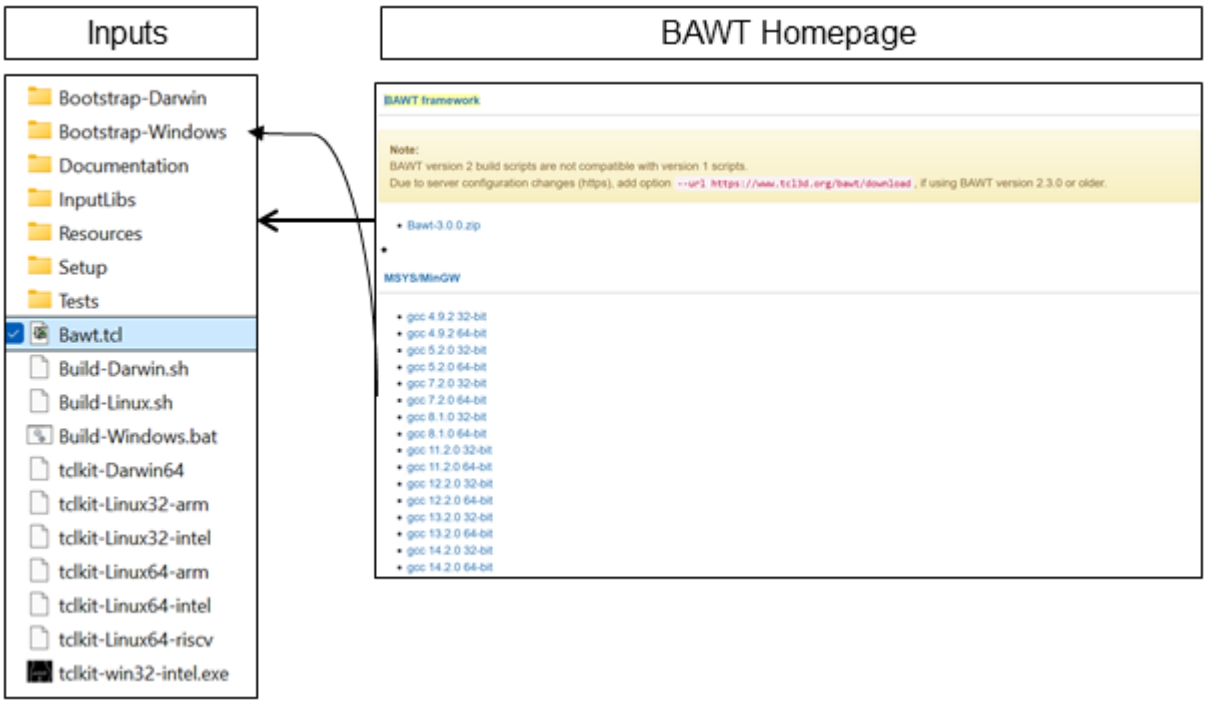


The ***BAWT*** framework (including *Bootstrap* and *Setup* files) as well as the needed MSYS/MinGW files (if running on Windows) must be downloaded manually. You do not need to have Tcl installed to execute the framework. ***BAWT*** comes with Tclkits (single-file Tcl interpreter) for Windows, Linux and Darwin. The library *Build* and source files can be downloaded automatically on demand.

The ***BAWT*** homepage is at https://www.tcl3d.org/bawt.
BAWT is copyrighted by Paul Obermeier and distributed under the 3-clause BSD license.

2 Installation and Usage Examples

This chapter explains the installation of the ***BAWT*** framework and gives first simple use cases.
BAWT related downloads are available at https://www.tcl3d.org/bawt/download.html.



2.1 Installation on Windows

Prerequisites:

- None for building libraries supporting MSYS / MinGW.
- Otherwise, Visual Studio (Express, Community or Professional).
  - Visual Studio Versions 2013, 2015, 2017, 2019 and 2022 are currently supported.
  - If Visual Studio is not installed in the standard location, you have to use procedure `SetVcvarsProg` with the absolute path to batch script *vcvarsall.bat*.

Downloads:

- ***BAWT*** framework *Bawt-3.1.0.zip*
- MSYS / MinGW distribution file(s), ex. *gcc7.2.0_x86_64-w64-mingw32.7z*

Installation:

- Extract ***BAWT*** framework *Bawt-3.1.0.zip* in a directory of choice, ex. *C:\Bawt*
- Copy MSYS / MinGW distribution file(s) into *C:\Bawt\Bawt-3.1.0\Bootstrap-Windows*
- Open command shell window and go into directory *C:\Bawt\Bawt-3.1.0*

Usage examples:

- Create basic Tcl packages for a 32-bit Intel machine (using only MSYS / MinGW):

```
> Build-Windows.bat intel 32 gcc Setup\Tcl_Basic.bawt update
```

- Create basic Tcl packages for a 64-bit Intel machine (using only MSYS / MinGW):

```
> Build-Windows.bat intel 64 gcc Setup\Tcl_Basic.bawt update
```

- Create extended Tcl packages including InnoSetup installation executable for a 64-bit Intel machine (using Visual Studio 2019 to build Tcl packages supporting Visual Studio like *Mpexpr* and *tkdnd*):

```
> Build-Windows.bat intel 64 gcc+vs2019 Setup\Tcl_Distribution.bawt update
```

- Run the test suite of Tcl and Tk:

```
> Build-Windows.bat intel 64 gcc Setup\Tcl_MinimalDist.bawt test Tcl Tk
```

2.2 Installation on Linux

Prerequisites:

- Required: `C/C++` development package, `curl, p7zip`
- Optional: Dependent on the libraries. See below for distribution specific examples.

Downloads:

- ***BAWT*** framework *Bawt-3.1.0.zip*

Installation:

- Extract ***BAWT*** framework *Bawt-3.1.0.zip* in a directory of choice, ex. *~/Bawt*
- Open shell (Terminal window), go into created directory *~/Bawt Bawt-3.1.0* and execute:

```
> chmod u+x Build*.sh
```

```
> chmod u+x tclkit*
```

Usage examples:

- Create basic Tcl packages for a 64-bit Intel machine:

```
> ./Build-Linux.sh intel 64 Setup/Tcl_Basic.bawt update
```

- Create extended Tcl packages including simple shell-based installation script for a 64-bit ARM machine:

```
> ./Build-Linux.sh arm 64 Setup/Tcl_Distribution.bawt update
```

- Create minimal Tcl packages including simple shell based installation script for a 64-bit Risc-V machine:

```
> ./Build-Linux.sh riscv 64 Setup/Tcl_Basic.bawt update
```

- Run the test suite of Tcl and Tk:

```
> ./Build-Linux.sh arm 64 gcc Setup/Tcl_MinimalDist.bawt test Tcl Tk
```

If compiling Tcl3DFull on slow machines like Raspberry or Risc-V, you should add the following BAWT options:

```
--osgversion 3.4.1 --libjobs tcl3dFull 1 --copt tcl3dFull OptOsg=OFF
```

Distribution specific prerequisites:

See chapter *3.2 Setup Files* for a list of available Setup files and the dependencies between Setup files. If you want to build ex. *Tcl_Extended.bawt*, you must not only install the prerequisites of this Setup file, but also the prerequisites of the dependent Setup file *Tcl_Basic.bawt*.

Debian 12.0 Bookworm (gcc 12.2.0)

- Install default Debian 12.0 desktop distribution (ex. *debian-12.0.0-amd64-DVD-1.iso*)
- Use ex. `Synaptic` to install further packages:

Setup file	Debian package	Needed by library
All	`build-essential`	All C/C++ based libraries.
	`curl`	BAWT framework.
	`p7zip`	
	`zip`	
Tcl_Basic.bawt	`libx11-dev`	`Tk`
	`libcups2-dev`	`Tk (printing)`
	`libcairo2-dev`	`tkpath`
	`libglx-dev`	`Canvas3d`
	`libglu1-mesa-dev`	
	`libasound2-dev`	`Snack`
Tcl_Extended.bawt	`libxrandr-dev`	`tcl3dBasic`
	`libpython3.11-dev`	`tclpy`
	`python3-numpy`	
	`libxcursor-dev`	`tkdnd`
	`libudev-dev`	`tcluvc`
	`libjpeg*-turbo-dev`	`tcluvc libgd`
Tcl3D.bawt	`libxi-dev`	`glfw`
	`libxinerama-dev`	
OSG_Extended.bawt	`freeglut3-dev`	`Cal3D`

Raspberry Pi OS (gcc 10.2.1)

- Install default Raspberry Pi OS using the Raspberry Pi Imager.
- Packages `build-essential`, `curl` and `p7zip` are part of the OS installation.
- As Raspberry Pi OS is based on Debian, install additional packages as for Debian.

Ubuntu 23.04 (gcc 12.2.0)

- Install default Ubuntu 23.04 desktop distribution (ex. *ubuntu-23.04-desktop-amd64.iso*)
- Use ex. `Synaptic` to install further packages:

Setup file	Ubuntu package	Needed by library
All	`build-essential`	All C/C++ based libraries.
	`curl`	BAWT framework.
	`p7zip`	
	`zip`	
Tcl_Basic.bawt	`libx11-dev`	`Tk`
	`libcups2-dev`	`Tk (printing)`
	`libcairo2-dev`	`tkpath`
	`libglx-dev`	`Canvas3d`
	`libglu1-mesa-dev`	
	`libasound2-dev`	`Snack`
Tcl_Extended.bawt	`libxrandr-dev`	`tcl3dBasic`
	`libpython3.11-dev`	`tclpy`
	`python3-numpy`	
	`libxcursor-dev`	`tkdnd`
	`libudev-dev`	`tcluvc`
	`libjpeg*-turbo-dev`	`tcluvc libgd`

Tcl3D.bawt	libxi-dev libxinerama-dev	glfw
OSG_Extended.bawt	freeglut3-dev	Cal3D

SUSE 15.5 (gcc 7.5.0)

- Install default SUSE 15.5 desktop distribution (ex. *openSUSE-Leap-15.5-DVD-x86_64-Build491.1-Media.iso*)
- Use `Yast` to install further packages:

Setup file	SUSE schema	Needed by library
All	General development C++ development	All C/C++ based libraries.
Setup file	**SUSE package**	**Needed by library**
Tcl_Basic.bawt	libx11-devel	Tk
	cups-devel	Tk (printing)
	cairo-devel	tkpath
	alsa-devel	Snack
Tcl_Extended.bawt	glu-devel libxrandr-devel	tcl3dBasic
	python3-devel python3-numpy	tclpy
	libxcursor-devel	tkdnd
	systemd-devel	tcluvc
	libjpeg*-devel	tcluvc libgd
Tcl3D.bawt	libxi-devel libxinerama-devel	glfw
OSG_Extended.bawt	freeglut-devel	Cal3D

Fedora 38.1 (gcc 13.1.1)

- Install default Fedora 38.1 workstation distribution (ex. *Fedora-Workstation-Live-x86_64-38-1.6.iso*)
- Use `dnf` to install further packages:

Setup file	dnf groupinstall	Needed by library
All	Development Tools Development Libraries X Software Development	All C/C++ based libraries.
Setup file	**dnf install**	**Needed by library**
Tcl_Basic.bawt	cups-devel	Tk (printing)
	gcc-g++	photoresize
	cairo-devel	tkpath
	alsa-lib-devel	Snack
Tcl_Extended.bawt	mesa-libGLU-devel	tcl3dBasic
	jbigkit-devel liblerc-devel	openjpeg
	libudev-devel	tcluvc
Tcl3D.bawt	libXinerama-devel	glfw

OSG_Extended.bawt	`freeglut-devel`	`Cal3D`

2.3 Installation on Darwin

Prerequisites:

- `XCode`
- `curl` (should be available by default on Darwin)

Downloads:

- ***BAWT*** framework *Bawt-3.1.0.zip*

Installation:

- Extract ***BAWT*** framework *Bawt-3.1.0.zip* in a directory of choice, ex. *~/Bawt*
- Open shell (Terminal window), go into created directory *~/Bawt Bawt-3.1.0* and execute:

```
> chmod u+x Build*.sh
> chmod u+x tclkit*
```

Usage examples:

Note, that Darwin does not support 32-bit programs.

- Create basic Tcl packages as universal binaries:

```
> ./Build-Darwin.sh universal Setup/Tcl_Basic.bawt update
```

- Create extended Tcl packages including simple shell-based installation script as native binaries:

```
> ./Build-Darwin.sh native Setup/Tcl_Distribution.bawt update
```

- Run the test suite of Tcl and Tk:

```
> ./Build-Darwin.sh native Setup/Tcl_MinimalDist.bawt test Tcl Tk
```

2.4 Use of Batch Scripts

As the ***BAWT*** framework is generic and has lots of command line options (see chapter *7 Command Line Options*), a batch or shell script for each supported platform is included in the distribution for ease of usage in the most common use cases:

- `Build-Windows.bat`
- `Build-Linux.sh`
- `Build-Darwin.sh`

These batch scripts have been used in the examples of the previous chapters and may serve as starting point for your own batch scripts suited exactly to your needs.

Batch script *Build-Windows.bat*

```
@echo off
setlocal

rem Default values for some often used options.
set OUTROOTDIR=../BawtBuild
set NUMJOBS=%NUMBER_OF_PROCESSORS%

rem First 5 parameters are mandatory.
```

```
if "%1" == "" goto ERROR
if "%2" == "" goto ERROR
if "%3" == "" goto ERROR
if "%4" == "" goto ERROR
if "%5" == "" goto ERROR

set PROCESSOR=%1
set BITS=%2
set COMPILER=%3
set SETUPFILE=%4
set ACTION=%5
shift
shift
shift
shift
shift

rem If no target is given, use target "all".
if "%1"=="" goto BUILDALL

rem Loop through the rest of the parameter list for targets.
set TARGETS=
:PARAMLOOP
rem There is a trailing space in the next line. It's there for formatting.
set TARGETS=%TARGETS%%1
shift
if not "%1"=="" goto PARAMLOOP
goto BUILD

:BUILDALL
if "%ACTION%"=="clean"    goto WARNING
if "%ACTION%"=="complete" goto WARNING

set TARGETS=all

:BUILD

if "%BITS%"=="32" set ARCH=x86
if "%BITS%"=="64" set ARCH=x64
if "X%ARCH%"=="X" goto ERROR

if "X%TCLKIT%"=="X" set TCLKIT=tclkit-win32-intel.exe

set ACTION=--%ACTION%
set BAWTOPTS=--rootdir %OUTROOTDIR% ^
             --architecture %ARCH% ^
             --compiler %COMPILER% ^
             --numjobs %NUMJOBS% ^
             --logviewer

rem Build all libraries as listed in Setup file.
CALL %TCLKIT% Bawt.tcl %BAWTOPTS% %ACTION% %SETUPFILE% %TARGETS%

goto EOF

:WARNING
echo Warning: This may clean or rebuild everything.
echo Use "clean all" or "complete all" to allow this operation.

:ERROR
echo.
echo Usage: %0 Processor Bits Compiler SetupFile Action [Target1] [TargetN]
echo   Processor       : intel
echo   Bits            : 32 64
echo   Compiler        : gcc vs2013 vs2015 vs2017 vs2019 vs2022
```

```
echo                      gcc+vs20XX vs20XX+gcc
echo   Actions          : list clean extract configure compile distribute
echo                      finalize complete update simulate touch test
echo   Default target   : all
echo.
echo   Output directory: %OUTROOTDIR%
echo.
echo Specify variable TCLKIT on the command line to use a separate bootstrap program.
echo   Example:
echo   set TCLKIT=tclsh ^&^& Build-Windows.bat intel 64 gcc Setup\Tcl_Basic.bawt update
echo.
:EOF
```

See also chapter *5.5 Advanced Batch Scripts* for examples of more complex batch scripts.

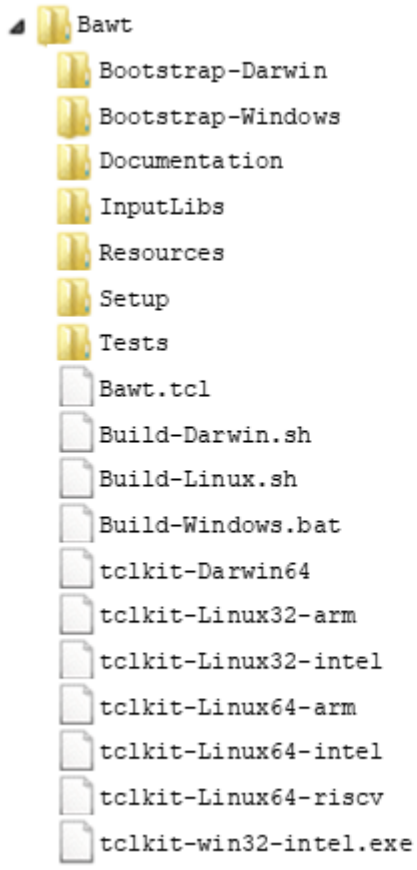
3 Directory and File Structure

This chapter explains the directory structure of the input and output files as well as the contents and structure of the *Setup* and *Build* files.

3.1 Directory Structure

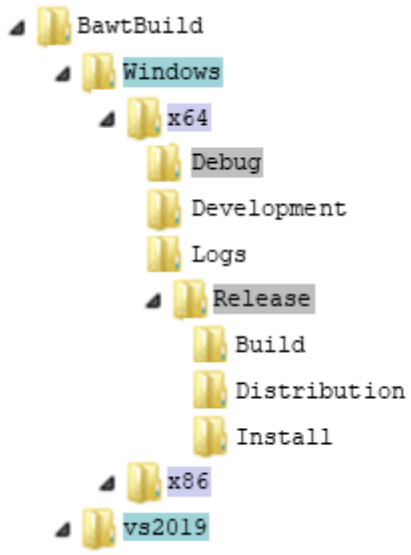
3.1.1 Structure of the input directories

If ***BAWT*** was downloaded and installed according to the instructions in chapter *2 Installation and Usage*, the following directory structure should exist.



The *Bootstrap* directories contain zipped versions of the `7-zip` program for Windows and Darwin and zipped versions of the `zip` program for Windows and Linux.
In directory *Bootstrap-Windows* there should be at least one version of the MSYS/MinGW distributions, which you must have downloaded manually.
Directory *InputLibs* contains the zipped source code versions of the libraries and the associated *Build* files, see chapter *3.3 Build Files* for a detailed description of *Build* files. Note, that this directory is empty after a fresh installation of ***BAWT***, because the corresponding files are downloaded on demand at the first start of a ***BAWT*** build by default. See chapter *5 Build Process* on how to avoid automatic downloads and updates.
The *Setup* files (see chapter *3.2 Setup Files*) supplied with ***BAWT*** are located in directory *Setup*.
Directory *Tests* contains several simple test scripts for checking correct compilation and installation of Tcl related packages.
For each supported platform there is also a Tclkit executable supplied, which is needed to run the ***BAWT*** framework, if no Tcl interpreter is available on your machine (Bootstrapping). A Tclkit is a single-file Tcl interpreter executable.

3.1.2 Structure of the output directories



The root directory of the output files of a ***BAWT*** build (*BawtBuild* in the above example) can be specified with command line option `--rootdir`. In a *Build* script this directory can be queried with Tcl procedure `GetOutputRootDir`.
Beneath the root build directory there can be several directories named according to the build environment used: *Windows*, *Linux*, *Darwin* for builds with *gcc* or *vs2013*, *vs2015, vs2017, vs2019 or vs2022*, if a Visual Studio version was used for building.

Beneath these environment specific directories two directory names can appear, depending on the build architecture: *x86* for 32-bit or *x64* for 64-bit builds.
In these architecture specific directories 3 to 4 subdirectories are contained.

The *Logs* directory contains the overall build log file *_BawtBuild.log* as well as the library specific build log files. See chapter *6 Logging* for an in-depth explanation of ***BAWT*** logging functionality.

The *Development* directory contains all the files needed for a developer using the built libraries.
Depending on the specified build types, directories called *Release* and *Debug* will be created. These directories contain the *Build* and *Install* subdirectories, where the actual sources are extracted and built as well as a *Distribution* subdirectory, which will contain all files needed for a software distribution of the compiled libraries.
The *Distribution* and *Development* directories contain mostly identical content. The *Development* directory typically contains additional library include files and import files (**.lib*). It is the task of the library specific *Build* file to copy the needed files into the *Distribution* and *Development* directories.

3.1.3 Directory access

The next figure shows the input and output directory hierarchy together with the procedures which can be used to get the path to the corresponding directory. The first procedure column (grey boxes) shows the names used in BAWT versions prior to 1.0, the second column (green boxes) shows the names as used by BAWT 1.0 and newer.
The last column shows the available command line options to change the location of a specific input or output directory.

The library search paths, which can be obtained with procedure `GetInputLibsDirs` are set at BAWT start-up to the following values:

- `file join [GetInputRootDir] "InputLibs"`
- `file join [pwd] "InputLibs"`

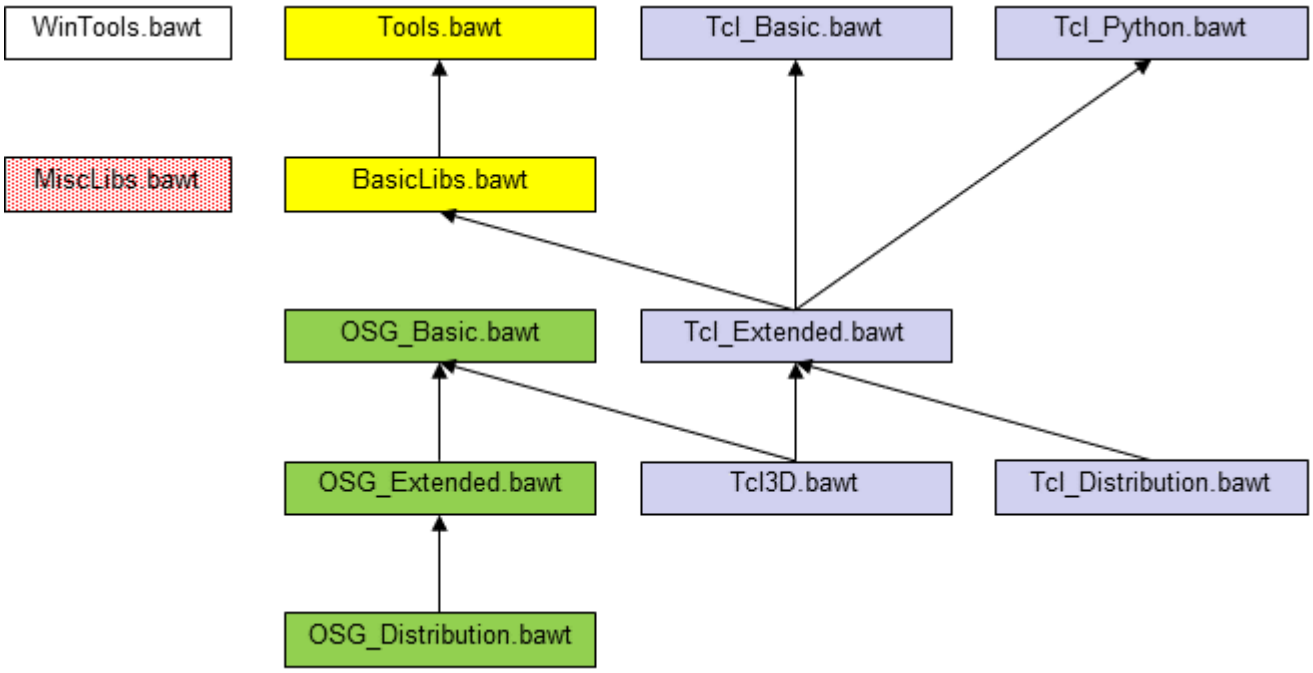
This list can be extended by using command line option --libdir.

If command line option --nosubdirs is specified, procedures `GetOutputArchDir` and `GetOutputRootDir` return the same directory path.

See chapter *4 Build Stages* for an in-depth tour through the directory structure of ***BAWT*** in conjunction with the different build stages.

3.2 Setup Files

The following figure shows all available *Setup* files and their dependencies.



For the ***Tcl*** ecosystem the following *Setup* files are currently supported.

Tcl_MinimalDist.bawt	Builds Tcl, Tk and creates an InnoSetup based setup file on Windows or an installation shell script on Unix.
Tcl_Basic.bawt	Builds Tcl, Tk, Tclkit and Tcl/Tk packages, which do not depend on 3rd party libraries. On Windows all libraries can be compiled with MSYS/MinGW.
Tcl_Python.bawt	Extracts the binary Python distribution on Windows and builds the tclpy package.
Tcl_Extended.bawt	Builds all libraries of *Tcl_Basic.bawt, Tcl_Python.bawt* and Tcl/Tk packages which depend on 3rd party libraries, like SWIG, CMake, libressl or image libraries. On Windows all libraries can be compiled with MSYS/MinGW.
Tcl3D.bawt	Builds all libraries of *Tcl_Extended.bawt* and the extended version of Tcl3D, which depends on 3rd party libraries like OpenSceneGraph, SDL, FTGL.
Tcl_Distribution.bawt	Builds all libraries of *Tcl_Extended.bawt* and creates an InnoSetup based setup file on Windows or an installation shell script on Unix.

For the ***OpenSceneGraph*** ecosystem the following *Setup* files are currently supported.

OSG_Basic.bawt	Builds OpenSceneGraph with basic plugin libraries as needed by Tcl3D. On Windows all libraries can be compiled with MSYS/MinGW.
OSG_Extended.bawt	Builds all libraries of *OSG_Basic.bawt* and builds OpenSceneGraph with extended plugin libraries, as well as libraries depending on OpenSceneGraph like osgEarth.
OSG_Distribution.bawt	Builds all libraries of *OSG_Extended.bawt* and creates an InnoSetup based setup file on Windows or an installation shell script on Unix.

Both the ***OpenSceneGraph*** ecosystem as well as the extended ***Tcl*** versions need special tools for building or basic libraries they depend upon.

Tools.bawt	Builds tools needed for building of libraries, like CMake or SWIG.
BasicLibs.bawt	Builds basic libraries needed by other libraries like several image libraries, zlib, freetype, ffmpeg and libressl.

There are two other *Setup* files not directly related to one of the above-mentioned ecosystems.

WinTools.bawt	Convenience tools for Windows supplied as precompiled binaries like Vim or Doxygen.
MiscLibs.bawt	Builds miscellaneous libraries not directly related to Tcl or OpenSceneGraph like mathematical, geographical or XML libraries. **Note, that the libraries listed in this file are not updated or supported since BAWT version 3.**

See the tables at the end of this chapter for the detailed content of the *Setup* files.

Setup files are standard Tcl script files. They must have one or more calls to the ***BAWT*** `Setup` procedure for each library being built. Optionally one or more calls to the ***BAWT*** `Include` procedure can be specified to add dependent libraries.

The `Setup` procedure has the following signature:

```
proc Setup { libName zipFile buildFile args }
```

The following 3 mandatory parameters must be specified:

- `libName:` Library name.
- `zipFile:` Zipped library source file or library source directory.
- `buildFile:` File containing build script for the library (see next chapter).

The following optional build parameters are currently supported:

Release	Build the Release version of the library. This is the default.
Debug	Build the Debug version of the library. Note, that not all libraries may support Debug mode.
NoTcl8 NoTcl9	Do not build the library with Tcl 8 resp. Tcl 9.
NoTk8 NoTk9	Do not build the library with Tk 8 resp. Tk 9.
NoGccX	Do not build the library with gcc major version X.
NoUniversal	Do not build the library as MacOS universal binary.
NoWindows	Do not build the library on Windows.
NoLinux	Do not build the library on Linux.
NoDarwin	Do not build the library on Darwin.
NoWindows-arm	Do not build the library on ARM based Windows.
NoWindows-intel	Do not build the library on Intel based Windows.
NoLinux-arm	Do not build the library on ARM based Linux.
NoLinux-intel	Do not build the library on Intel based Linux.
NoLinux-riscv	Do not build the library on RISC-V based Linux.
NoDarwin-arm	Do not build the library on ARM based Darwin.
NoDarwin-intel	Do not build the library on Intel based Darwin.
WinCompiler=winCompiler	Specify the Windows compiler to use. Valid Windows compiler names are: `gcc`, `vs`. Note, that the *Build* file must have support for both Visual Studio and MSYS/MinGW instructions.
ForceVS (Deprecated)	Force using Visual Studio instead of using MSYS/MinGW. Note, that the *Build* file must have support for both Visual Studio and MSYS/MinGW instructions.
Version=X.Y.Z	Specify or override a version string for the library. Use this option, if building a library from a directory (ex. your repository

	workspace), which does not have a version number included in the directory name.
MaxParallel=Platform:NumJobs	Specify the number of parallel build jobs for a specific platform. Some build systems do not work correctly with lots of parallel builds. Valid platform names are: `Windows`, `Linux`, `Darwin`. The platform name may be optionally appended by the compiler type `vs` or `gcc`. Example: `MaxParallel=Windows-gcc:2`
NoParallel=Platforms *(Deprecated)*	Specify platforms as comma separated list for which parallel builds should be disabled. Valid platform names are: `Windows`, `Linux`, `Darwin`.
All other strings	Strings not matching any of the above patterns are interpreted as a user configuration string. User configuration strings are either appended to the `CMake` or `configure` commands of the library or can be evaluated by the Build script. See chapter *3.3.2 User configurable build files* for a description of user configuration strings.

The next tables list the contents of the currently available *Setup* files.

Setup file Tools.bawt

```
# Builds tools needed for building of libraries, like CMake or SWIG.

# Setup LibName  ZipFile                 BuildFile        BuildOptions

if { [UseVisualStudio "primary"] && [GetVisualStudioVersion] <= 2010 } {
    Setup CMake  CMake-3.21.4.7z         CMake.bawt
} elseif { [IsDarwin] } {
    # Use newest CMake only on new Darwin systems.
    Setup CMake  CMake-3.31.7.7z         CMake.bawt
} else {
    # Use this CMake version, so that Visual 2013 still works.
    Setup CMake  CMake-3.25.2.7z         CMake.bawt
}
Setup pandoc     pandoc-3.5.7z           pandoc.bawt      NoLinux-riscv
Setup pkgconfig  pkgconfig-0.29.2.7z     pkgconfig.bawt
Setup SWIG       SWIG-4.3.1.7z           SWIG.bawt
Setup yasm       yasm-1.3.0.7z           yasm.bawt
```

Setup file BasicLibs.bawt

```
# Builds basic libraries needed by several other libraries.

Include "Tools.bawt"

# All of the following libraries can be compiled on Linux or Darwin,
# but it is better to use the system provided libraries.

# Setup LibName ZipFile            BuildFile       BuildOptions

# Basic library needed by most other libraries.
Setup ZLib      ZLib-1.3.1.7z      ZLib.bawt       NoLinux NoDarwin
Setup xz        xz-5.4.1.7z        xz.bawt         NoLinux NoDarwin

# Basic Image libraries.
Setup giflib    giflib-5.2.1.7z    giflib.bawt     NoLinux
Setup libwebp   libwebp-1.2.4.7z   libwebp.bawt    NoLinux
Setup JPEG      JPEG-9.f.7z        JPEG.bawt       NoLinux NoDarwin
Setup openjpeg  openjpeg-2.5.3.7z  openjpeg.bawt
Setup PNG       PNG-1.6.48.7z      PNG.bawt        NoLinux MaxParallel=Windows-gcc:1
Setup TIFF      TIFF-4.7.0.7z      TIFF.bawt       NoLinux NoDarwin

Setup ffmpeg    ffmpeg-4.4.4.7z    ffmpeg.bawt     NoLinux32-arm

Setup Freetype  Freetype-2.13.3.7z Freetype.bawt   NoLinux NoDarwin
if { [GetTlsVersion] == 1 } {
```

```
    Setup libressl libressl-2.9.2.7z libressl.bawt
} else {
    Setup openssl  openssl-3.5.1.7z  openssl.bawt
}

if { [UseVisualStudio "primary"] && [GetVisualStudioVersion] <= 2008 } {
    # Visual Studio 2008
    Setup SDL   SDL-2.0.4.7z       SDL.bawt
} elseif { [UseVisualStudio "primary"] && [GetVisualStudioVersion] == 2010 } {
    # Visual Studio 2010
    Setup SDL   SDL-2.0.8.7z       SDL.bawt
} else {
    Setup SDL   SDL-2.26.2.7z      SDL.bawt
}
```

Setup file Tcl_MinimalDist.bawt

```
# Builds just Tcl and Tk and creates a distribution setup file.

# Setup LibName  ZipFile                 BuildFile      BuildOptions

# Tcl and Tk.
Setup Tcl        Tcl-[GetTclVersion].7z  Tcl.bawt
Setup Tk         Tk-[GetTkVersion].7z    Tk.bawt

# Tcl/Tk distribution as InnoSetup installer.
Setup InnoSetup  InnoSetup-6.2.2.7z      InnoSetup.bawt
Setup SetupTcl   SetupTcl.7z             SetupTcl.bawt
```

Setup file Tcl_Basic.bawt

```
# Builds Tcl, Tk, Starkit and Tcl/Tk packages, which do not depend on 3rd party libraries.
# On Windows all libraries can be compiled with MSys/MinGW.

# Setup LibName         ZipFile                         BuildFile           BuildOptions

# Tcl/Tk, stubs and manual.
Setup Tcl               Tcl-[GetTclVersion].7z          Tcl.bawt
Setup TclStubs          Tcl-[GetTclVersion].7z          TclStubs.bawt
Setup Tk                Tk-[GetTkVersion].7z            Tk.bawt
Setup TkStubs           Tk-[GetTkVersion].7z            TkStubs.bawt
Setup TclTkManual       TclTkManual.7z                  TclTkManual.bawt

# Compiled Tcl packages.
Setup critcl            critcl-3.3.7z                   critcl.bawt
Setup expect            expect-5.45.4.1.7z              expect.bawt         NoLinux32-arm NoGcc14
NoGcc16 NoGcc17
Setup DiffUtil          DiffUtil-0.4.3.7z               DiffUtil.bawt
Setup memchan           memchan-2.3.1.7z                memchan.bawt        NoTcl9
Setup Mpexpr            Mpexpr-1.2.1.7z                 Mpexpr.bawt         NoGcc14 NoGcc16 NoGcc17
Setup nacl              nacl-1.1.1.7z                   nacl.bawt
Setup nsf               nsf-2.4.0.7z                    nsf.bawt            NoTcl9
Setup oratcl            oratcl-4.6.1.7z                 oratcl.bawt
Setup parse_args        parse_args-0.5.1.7z             parse_args.bawt
Setup poMemory          poMemory-1.0.0.7z               poMemory.bawt
Setup rl_json           rl_json-0.16.0.7z               rl_json.bawt
Setup tbcload           tbcload-1.7.2.7z                tbcload.bawt        NoTcl9
Setup tclcompiler       tclcompiler-1.7.4.7z            tclcompiler.bawt    NoTcl9
Setup tcldebugger       tcldebugger-2.0.1.7z            tcldebugger.bawt
Setup tclcsv            tclcsv-2.4.3.7z                 tclcsv.bawt
Setup tclparser         tclparser-1.9.7z                tclparser.bawt
Setup tclvfs            tclvfs-1.5.0.7z                 tclvfs.bawt
Setup tclx              tclx-9.0.0.7z                   tclx.bawt
Setup tdom              tdom-0.9.6.7z                   tdom.bawt
Setup trofs             trofs-0.4.9.7z                  trofs.bawt          NoTcl9
Setup tserialport       tserialport-1.1.1.7z            tserialport.bawt    MaxParallel=Windows-gcc:1
Setup udp               udp-1.0.12.7z                   udp.bawt            NoTcl9
Setup vectcl            vectcl-0.2.1.7z                 vectcl.bawt         NoTcl9

# Compiled Tk packages.
Setup Canvas3d          Canvas3d-1.2.3.7z               Canvas3d.bawt       NoTcl9
Setup Img               Img-[GetImgVersion].7z          Img.bawt
Setup imgtools          imgtools-0.3.1.7z               imgtools.bawt
Setup itk               itk-4.2.5.7z                    itk.bawt
Setup iwidgets          iwidgets-4.1.2.7z               iwidgets.bawt
Setup photoresize       photoresize-0.2.1.7z            photoresize.bawt
Setup poImg             poImg-3.0.1.7z                  poImg.bawt
```

```
Setup rtext             rtext-0.1.7z                rtext.bawt          NoTcl8
Setup Snack             Snack-2.2.12.7z             Snack.bawt
Setup Tix               Tix-8.4.4.7z                Tix.bawt            NoDarwin NoTk9
Setup Tkhtml            Tkhtml-3.0.2.7z             Tkhtml.bawt
Setup tkpath            tkpath-0.4.2.7z             tkpath.bawt
Setup tko               tko-0.4.7z                  tko.bawt            NoDarwin
Setup tksvg             tksvg-0.14.7z               tksvg.bawt
Setup Tktable           Tktable-2.12.7z             Tktable.bawt
Setup treectrl          treectrl-2.5.1.7z           treectrl.bawt

# Compiled Tcl and Tk packages. Windows only.
Setup iocp              iocp-2.0.2.7z               iocp.bawt
Setup rbc               rbc-0.2.7z                  rbc.bawt            NoTcl9
Setup shellicon         shellicon-0.1.1.7z          shellicon.bawt
Setup twapi             twapi-5.1.1.7z              twapi.bawt
Setup winhelp           winhelp-1.1.1.7z            winhelp.bawt

# Compiled Tcl packages. Darwin only.
Setup Tcladdressbook    Tcladdressbook-1.2.4.7z     Tcladdressbook.bawt NoTcl9
Setup Tclapplescript    Tclapplescript-2.2.7z       Tclapplescript.bawt NoTcl9
Setup tclAE             tclAE-2.0.7.7z              tclAE.bawt          NoTcl9

# Pure Tcl/Tk packages.
Setup apave             apave-4.4.10.7z             apave.bawt
Setup awthemes          awthemes-10.4.0.7z          awthemes.bawt
Setup BWidget           BWidget-1.10.1.7z           BWidget.bawt
Setup cawt              cawt-3.1.1.7z               cawt.bawt
Setup materialicons     materialicons-0.2.7z        materialicons.bawt
Setup mentry            mentry-4.5.7z               mentry.bawt
Setup mqtt              mqtt-4.0.7z                 mqtt.bawt
Setup ooxml             ooxml-1.10.7z               ooxml.bawt
Setup pdf4tcl           pdf4tcl-0.9.4.7z            pdf4tcl.bawt
Setup pgintcl           pgintcl-3.5.2.7z            pgintcl.bawt
Setup poLibs            poApps-3.1.0.7z             poLibs.bawt
Setup publisher         publisher-2.0.7z            publisher.bawt
Setup puppyicons        puppyicons-0.1.7z           puppyicons.bawt
Setup ruff              ruff-2.5.0.7z               ruff.bawt
Setup scrollutil        scrollutil-2.6.7z           scrollutil.bawt
Setup thtmlview         thtmlview-2.0.0.7z          thtmlview.bawt
Setup tablelist         tablelist-7.7.7z            tablelist.bawt
Setup tcl9migrate       tcl9migrate-1.0.7z          tcl9migrate.bawt
Setup tclargp           tclargp-0.2.7z              tclargp.bawt
Setup tclfpdf           tclfpdf-1.7.1.7z            tclfpdf.bawt
Setup tcllib            tcllib-2.0.7z               tcllib.bawt
Setup tclws             tclws-3.5.0.7z              tclws.bawt
Setup tkcon             tkcon-2.8.7z                tkcon.bawt
Setup tklib             tklib-0.9.7z                tklib.bawt
Setup tsw               tsw-1.2.7z                  tsw.bawt
Setup ukaz              ukaz-2.1.7z                 ukaz.bawt
Setup wcb               wcb-4.2.7z                  wcb.bawt
Setup windetect         windetect-2.0.1.7z          windetect.bawt
Setup tkwintrack        tkwintrack-2.1.1.7z         tkwintrack.bawt

# Tclkits.
Setup vlerq             vlerq-4.1.7z                vlerq.bawt
Setup Tclkit            Tclkit.7z                   Tclkit.bawt

# Tcl programs wrapped as starpacks.
Setup cawtapp           cawt-3.1.1.7z               cawtapp.bawt
Setup jigsaw            jigsaw-2.0.7z               jigsaw.bawt
Setup gorilla           gorilla-1.6.1.7z            gorilla.bawt
Setup tclssg            tclssg-3.0.1.7z             tclssg.bawt
Setup tkchat            tkchat-1.482.7z             tkchat.bawt
Setup tksqlite          tksqlite-0.5.14.7z          tksqlite.bawt
```

Setup file Tcl_Python.bawt

```
# Builds binary Python distribution for Windows and tclpy package.

Include "Tcl_Basic.bawt"

# Setup LibName  ZipFile                    BuildFile        BuildOptions

Setup Python     Python-3.7.7-[GetBits].7z  Python.bawt      Version=3.7.7
Setup tclpy      tclpy-0.4.1.7z             tclpy.bawt
```

Setup file Tcl_Extended.bawt

```
# Builds Tcl/Tk packages which depend on 3rd party libraries,
# like SWIG, CMake, openssl or image libraries.

Include "Tools.bawt"
Include "BasicLibs.bawt"
Include "Tcl_Basic.bawt"
Include "Tcl_Python.bawt"

# Setup LibName           ZipFile                         BuildFile              BuildOptions
Setup   mawt              mawt-0.4.4.7z                   mawt.bawt              NoLinux32-arm
Setup   FTGL              FTGL-2.1.3.7z                   FTGL.bawt              NoDarwin
Setup   tcl3dExtended     tcl3d-1.0.1.7z                  tcl3dExtended.bawt     NoDarwin
Setup   OglInfo           tcl3d-1.0.1.7z                  OglInfo.bawt           NoDarwin

Setup   tkdnd             tkdnd-2.9.5.7z                  tkdnd.bawt
Setup   tkribbon          tkribbon-1.2.7z                 tkribbon.bawt

if { [GetTlsVersion] == 1 } {
    Setup   tcltls        tcltls-1.7.23.7z                tcltls.bawt
} else {
    Setup   tcltls        tcltls-2.0b1.7z                 tcltls2.bawt
}
Setup   Trf               Trf-2.1.4.7z                    Trf.bawt               NoDarwin NoTcl9

Setup   imgjp2            imgjp2-0.1.1.7z                 imgjp2.bawt
Setup   tzint             tzint-1.1.1.7z                  tzint.bawt             NoUniversal

Setup   libgd             libgd-2.3.2.7z                  libgd.bawt
Setup   tclgd             tclgd-1.4.1.7z                  tclgd.bawt             NoUniversal

Setup   tcluvc            tcluvc-0.1.7z                   tcluvc.bawt

Setup   cfitsio           cfitsio-4.1.0.7z                cfitsio.bawt
Setup   fitsTcl           fitsTcl-2.5.1.7z                fitsTcl.bawt
Setup   pawt              pawt-1.2.0.7z                   pawt.bawt

Setup   libffi            libffi-3.4.8.7z                 libffi.bawt            NoUniversal
Setup   cffi              cffi-2.0.3.7z                   cffi.bawt              NoUniversal
Setup   Ffidl             Ffidl-0.9.1.7z                  Ffidl.bawt             NoUniversal

# MuPDF (and therefore dependent libraries tclMuPdf and MuPDFWidget)
# are not available with VisualStudio < 2019.
if { ( [UseVisualStudio "primary"] && [GetVisualStudioVersion] < 2019 ) || \
       ! [IsGccCompilerNewer "4.9.2"] } {
    Setup   mupdf         mupdf-1.18.2.7z                 mupdf.bawt
    Setup   tclMuPdf      tclMuPdf-2.1.1.7z               tclMuPdf.bawt
} else {
    Setup   mupdf         mupdf-1.26.0.7z                 mupdf.bawt
    Setup   tclMuPdf      tclMuPdf-2.5.1.7z               tclMuPdf.bawt
}
Setup   MuPDFWidget       MuPDFWidget-2.4.7z              MuPDFWidget.bawt

Setup   hdc               hdc-0.2.0.1.7z                  hdc.bawt
Setup   gdi               gdi-0.9.9.15.7z                 gdi.bawt
Setup   printer           printer-0.9.6.16.7z             printer.bawt

# Tcl programs wrapped as starpacks.
Setup   BawtLogViewer     BawtLogViewer-[GetVersion].7z   BawtLogViewer.bawt
Setup   poApps            poApps-3.1.0.7z                 poApps.bawt
Setup   poClipboardViewer poApps-3.1.0.7z                 poClipboardViewer.bawt
```

Setup file Tcl3D.bawt

```
# Builds the full version of Tcl3D, which depends on
# 3rd party libraries (OpenSceneGraph, SDL, FTGL).

Include "Tcl_Extended.bawt"
Include "OSG_Basic.bawt"

# Setup LibName  ZipFile         BuildFile       BuildOptions

Setup glfw       glfw-3.3.8.7z   glfw.bawt
Setup tcl3dFull  tcl3d-1.0.1.7z  tcl3dFull.bawt
```

Setup file Tcl_Distribution.bawt

```
# Use this Setup file to create a Tcl/Tk distribution.

# Builds Tcl/Tk with basic package libraries.
# Include "Tcl_Basic.bawt"

# Builds Tcl/Tk with extended package libraries including Tcl3D.
# Include "Tcl3D.bawt"

# Builds Tcl/Tk with extended package libraries.
Include "Tcl_Extended.bawt"

# Setup LibName          ZipFile              BuildFile              BuildOptions

# Tcl/Tk distribution as InnoSetup installer.
Setup InnoSetup          InnoSetup-6.2.2.7z   InnoSetup.bawt
Setup Redistributables   Redistributables.7z  Redistributables.bawt
Setup SetupTcl           SetupTcl.7z          SetupTcl.bawt
Setup SetupPython        SetupPython.7z       SetupPython.bawt
```

Setup file OSG_Basic.bawt

```
# Builds OpenSceneGraph with basic plugin libraries as needed by Tcl3D.

# Setup LibName           ZipFile                              BuildFile                BuildOptions

# Tools needed for compilation of libraries.
Setup CMake               CMake-3.25.2.7z                      CMake.bawt
Setup yasm                yasm-1.3.0.7z                        yasm.bawt

# The following libraries can be compiled on Linux, but for OpenSceneGraph
# we use the libraries installed by the Linux distribution.
# Basic library needed by most other libraries.
Setup ZLib                ZLib-1.2.13.7z                       ZLib.bawt                NoLinux
Setup xz                  xz-5.4.1.7z                          xz.bawt                  NoLinux NoDarwin

# Image libraries needed by OpenSceneGraph.
Setup giflib              giflib-5.2.1.7z                      giflib.bawt              NoLinux
Setup JPEG                JPEG-9.e.7z                          JPEG.bawt                NoLinux
Setup PNG                 PNG-1.6.39.7z                        PNG.bawt                 NoLinux
Setup TIFF                TIFF-4.5.0.7z                        TIFF.bawt                NoLinux

Setup freeglut            freeglut-3.2.2.7z                    freeglut.bawt            NoLinux NoDarwin
Setup Freetype            Freetype-2.10.4.7z                   Freetype.bawt            NoLinux
Setup SDL                 SDL-2.26.2.7z                        SDL.bawt
Setup ffmpeg              ffmpeg-4.4.4.7z                      ffmpeg.bawt              NoLinux32-arm
Setup openjpeg            openjpeg-2.5.3.7z                    openjpeg.bawt

if { [UseVisualStudio "primary"] && [GetVisualStudioVersion] <= 2010 } {
    Setup jasper          jasper-2.0.14.7z                     jasper.bawt              NoLinux NoDarwin
} else {
    Setup jasper          jasper-2.0.25.7z                     jasper.bawt              NoLinux NoDarwin
}
Setup libressl            libressl-2.9.2.7z                    libressl.bawt

# OpenSceneGraph 3rd party libraries.
if { [IsGccCompilerNewer "13.0.0"] && ! [IsWindows]  } {
    Setup curl            curl-7.88.1.7z                        curl.bawt
} else {
    Setup curl            curl-7.70.0.7z                        curl.bawt
}

# OpenSceneGraph
Setup OpenSceneGraph      OpenSceneGraph-[GetOsgVersion].7z OpenSceneGraph.bawt
Setup OpenSceneGraphData  OpenSceneGraphData-3.4.0.7z       OpenSceneGraphData.bawt
```

Setup file OSG_Extended.bawt

```
# Builds OpenSceneGraph with extended plugin libraries, as
# well as libraries depending on OpenSceneGraph like osgEarth.

Include "OSG_Basic.bawt"

# Setup LibName ZipFile          BuildFile             BuildOptions

# Extended OpenSceneGraph 3rd party libraries.
```

```
Setup Cal3D     Cal3D-0.120.7z   Cal3D.bawt            NoLinux-arm NoLinux-riscv
if { [UseVisualStudio "primary"] && [GetVisualStudioVersion] <= 2013 } {
    Setup gdal  gdal-2.2.0.7z    gdal.bawt
    Setup geos  geos-3.6.3.7z    geos.bawt
} else {
    Setup gdal  gdal-2.4.4.7z    gdal.bawt             NoLinux-riscv
    Setup geos  geos-3.7.2.7z    geos.bawt
}
Setup GLEW      GLEW-2.2.0.7z    GLEW.bawt
Setup Gl2ps     Gl2ps-1.4.2.7z   Gl2ps.bawt

# Libraries based on OpenSceneGraph.
Setup osgcal    osgcal-0.2.1.7z  osgcal.bawt           NoLinux-arm NoLinux-riscv MaxParallel=Linux:1
MaxParallel=Windows-gcc:1

if { [UseVisualStudio "primary"] && [GetVisualStudioVersion] <= 2008 } {
    Setup osgearth  osgearth-2.8.7z     osgearth.bawt
} else {
    Setup osgearth  osgearth-2.10.1.7z  osgearth.bawt  NoLinux-arm NoLinux-riscv
}
```

Setup file OSG_Distribution.bawt

```
# Use this Setup file to create an OpenSceneGraph distribution.

# Builds OpenSceneGraph with basic plugin libraries.
# Include "OSG_Basic.bawt"

# Builds OpenSceneGraph with extended plugin libraries, as
# well as libraries depending on OpenSceneGraph like osgEarth.
Include "OSG_Extended.bawt"

# Setup LibName         ZipFile              BuildFile              BuildOptions

# OpenSceneGraph distribution as InnoSetup installer.
Setup InnoSetup         InnoSetup-6.2.2.7z   InnoSetup.bawt
Setup Redistributables  Redistributables.7z  Redistributables.bawt
Setup SetupOsg          SetupOsg.7z          SetupOsg.bawt
```

Setup file MiscLibs.bawt

```
# Builds miscellaneous libraries not related to Tcl or OpenSceneGraph.
# Note, that the libraries listed in this file are not updated or
# supported anymore.

Include "Tools.bawt"
Include "BasicLibs.bawt"

# Setup LibName          ZipFile                  BuildFile               BuildOptions

if { ( ! [UseVisualStudio "primary"] && [IsWindows] && [IsGccCompilerNewer "12.0.0"] ) || \
     ( [UseVisualStudio "primary"] && [GetVisualStudioVersion] >= 2022 ) } {
    # This boost version can only be compiled with
    # Windows: VS 2022 or newer.
    # Windows: gcc 12.0.0 or newer
    Setup Boost          Boost-1.78.0.7z          Boost.bawt
} elseif { ( [UseVisualStudio "primary"] && [GetVisualStudioVersion] >= 2015 ) || \
     ( ! [UseVisualStudio "primary"] && [IsWindows] ) || \
     ( ! [IsWindows] && [IsGccCompilerNewer "4.9.0"] ) } {
    # This boost version can only be compiled with
    # Windows: VS 2015 or newer.
    # Unix   : gcc 4.9.0 or newer
    Setup Boost          Boost-1.75.0.7z          Boost.bawt
} else {
    # This boost version cannot be compiled with MinGW gcc.
    Setup Boost          Boost-1.58.0.7z          Boost.bawt
}

Setup ccl                ccl-4.0.6.7z             ccl.bawt
Setup Eigen              Eigen-3.3.9.7z           Eigen.bawt
Setup fftw               fftw-3.3.9.7z            fftw.bawt
if { [UseVisualStudio "primary"] && [GetVisualStudioVersion] <= 2013 } {
    Setup GeographicLib  GeographicLib-1.50.1.7z  GeographicLib.bawt
} else {
    Setup GeographicLib  GeographicLib-1.52.7z    GeographicLib.bawt
}
Setup GeographicLibData  GeographicLibData.7z     GeographicLibData.bawt
```

```
Setup KDIS              KDIS-2.9.0.7z           KDIS.bawt
Setup libxml2           libxml2-2.10.3.7z       libxml2.bawt
Setup sqlite3           sqlite3-3.47.1.7z       sqlite3.bawt
Setup tinyxml2          tinyxml2-9.0.0.7z       tinyxml2.bawt
Setup Xerces            Xerces-3.2.4.7z         Xerces.bawt
```

Setup file WinTools.bawt

```
# Builds miscellaneous tools for Windows.

# Setup LibName         ZipFile                 BuildFile       BuildOptions
Setup Blender           Blender-3.0.0.7z        Blender.bawt
Setup DirectXTex        DirectXTex-2021_11.7z   DirectXTex.bawt
Setup Doxygen           Doxygen-1.8.15.7z       Doxygen.bawt
Setup Vim               Vim-9.0.0.7z            Vim.bawt
```

3.3 Build Files

Build files include the logic needed to extract, configure, compile and distribute a library. They must define the following two procedures, where `libName` is replaced with the name of the library as specified as first parameter of the *`Setup`* procedure:

- *`Init_libName  { libName libVersion }`*
- *`Build_libName { libName libVersion buildDir instDir devDir distDir }`*

The parameter values for these procedures are supplied by the ***BAWT*** framework.

`libName`	Library name as supplied with first parameter of procedure *`Setup`*.
`libVersion`	Library version extracted from source file name as supplied with second parameter of procedure *`Setup`*.
`buildDir`	*`[file join [GetOutputBuildDir] $libName]`*
`instDir`	*`[file join [GetOutputInstDir] $libName]`*
`devDir`	*`[GetOutputDevDir]`*
`distDir`	*`[GetOutputDistDir]`*

The logic of a *Build* file will be explained with the following excerpt of the *Build* file of Tcl package ***udp***:

Build file udp.bawt

```
# Copyright: 2016-2025 Paul Obermeier (obermeier@tcl3d.org)
# Distributed under BSD license.
#
# BuildType: MSys / gcc

proc Init_udp { libName libVersion } {
    SetScriptAuthor    $libName "Paul Obermeier" "obermeier@tcl3d.org"
    SetLibHomepage     $libName "https://core.tcl-lang.org/tcludp/"
    SetLibDependencies $libName "Tcl"
    SetPlatforms       $libName "All"
    SetWinCompilers    $libName "gcc"
}

proc Build_udp { libName libVersion buildDir instDir devDir distDir } {
    if { [UseStage "Extract" $libName] } {
        ExtractLibrary $libName $buildDir
    }

    if { [UseStage "Configure" $libName] } {
        set flags  ""
        set cflags ""
        append cflags [GetPermissiveCFlags] " "
        append cflags [GetDarwinCFlags]     " "
        if { [string trim $cflags] ne "" } {
            append flags "CFLAGS='$cflags' "
        }
```

```
        TeaConfig $libName $buildDir $instDir $flags
    }

    if { [UseStage "Compile" $libName] } {
        MSysBuild $libName $buildDir "install-binaries"
    }

    if { [UseStage "Distribute" $libName] } {
        StripLibraries "$instDir"
        LibFileCopy "$instDir"  "$devDir/[GetTclDir]"   "*"  true
        LibFileCopy "$instDir"  "$distDir/[GetTclDir]"  "*"  true
    }
    return true
}
```

The *Init_libName* procedure must call the following ***BAWT*** framework procedures:

SetScriptAuthor	Specify name and mail address of the build script author. This information is used for command line option `--authors`.
SetLibHomepage	Specify the homepage of the library. This information is used for command line option `--homepages`.
SetLibDependencies	Specify the dependencies of the library. If the library has no dependencies, specify *"None"* as parameter. Otherwise, a variable number of library names can be given. This information is used for command line option `--dependencies`.
SetPlatforms	Specify the supported platforms. Valid keywords are: *"Windows" "Linux" "Darwin" "All"*. This information is used for command line option `--platforms`.
SetWinCompilers	Specify the supported compilers on Windows. Optional. The first specified compiler is used as default. Valid keywords are: *"gcc" "vs"*. This information is used for command line option `--wincompilers`.

The *Build_libName* procedure must check, which stage or stages should be executed (using procedure *UseStage*) and supply appropriate Tcl commands for each stage.
The following four stages can be handled in a build file:

- `Extract`
- `Configure`
- `Compile`
- `Distribute`

See chapter *4 Build Stages* for details on these stages and typical commands executed for each stage.

Errors can be indicated by calling the ***BAWT*** procedure *SetErrorMessage* and returning *false*.

Optionally a procedure named *Env_libName* may be specified in a build file. This procedure has the same signature as the *Build_libName* procedure and may be used to specify library specific environment variables (using ***BAWT*** procedure *SetEnvVar*) or to add a value to the system environment variable `Path` (using ***BAWT*** procedure *AddToPathEnv*).

The following excerpt from the `Tcl` build file shows a usage example:

```
proc Env_Tcl { libName libVersion buildDir instDir devDir distDir } {
    SetEnvVar    "TCLLIBPATH" "$devDir/[GetTclDir]/lib"
    AddToPathEnv "$devDir/opt/$libName/bin"
}
```

Another optional procedure named *Test_libName* was introduced in ***BAWT 3.0***. This procedure has the same signature as the *Build_libName* procedure and may be used to execute test scripts.

The following excerpt from the `Tcl` build file shows how to execute the Tcl test suite by calling BAWT procedure `MSysTest`:

```
proc Test_Tcl { libName libVersion buildDir instDir devDir distDir } {
    if { [UseStage "Test" $libName] } {
        MSysTest $libName $buildDir "test"
    }
    return true
}
```

It is also possible to execute a shell test script instead of `MSysTest`:

```
proc Test_poApps { libName libVersion buildDir instDir devDir distDir } {
    if { [UseStage "Test" $libName] } {
        if { [IsUnix] } {
            MSysRun $libName "Test$libName" "$buildDir/TestPrograms" "./RunTests.sh"
        } else {
            DosRun  $libName "Test$libName" "$buildDir/TestPrograms" "RunTests.bat"
        }
    }
    return true
}
```

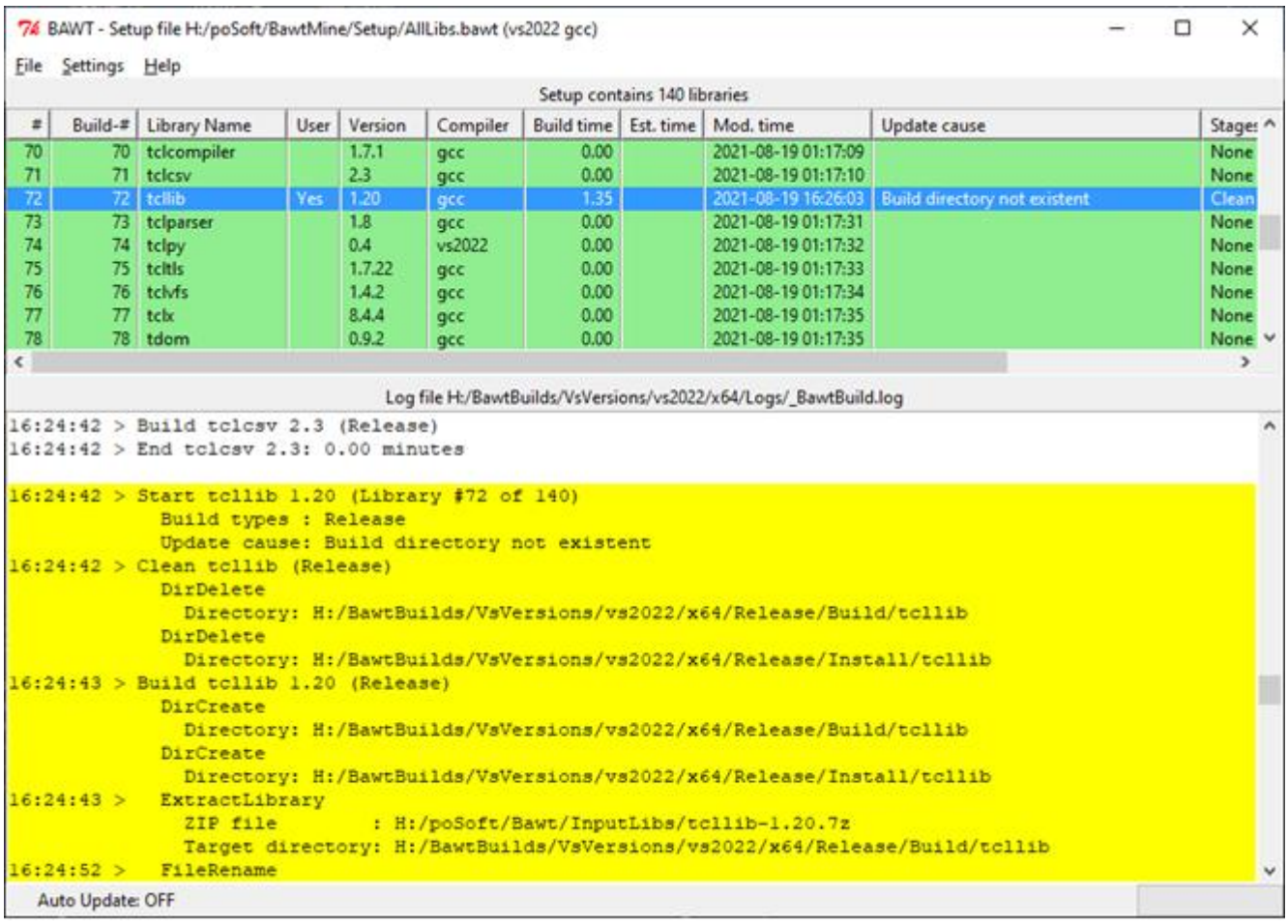
3.3.1 User supplied build files

BAWT version 2.0 introduced the functionality of user supplied build files, which allows to add custom build files for existing libraries without the need to change the default build files.
To create a user supplied build file, make a copy of the build file (ex. *tcllib.bawt*) and give the copied file the name *tcllib_User.bawt*. By appending the string *_User* to the root file name, BAWT automatically detects the file as a user supplied build file and uses this file instead of the original build file.
You can then edit the user supplied build file according to your needs, ex. do not create the `critcl` based modules for `tcllib`.
The user supplied build scripts must be located in directories from the library search paths, see chapter *3.1.3 Directory access.*

Note, that user supplied build scripts are not considered in action `--update`, see chapter *5 Build Process*.

You may also give the user supplied build file any name you like. Then you have to notify BAWT to use that file for a specific library by using command line option `--user`.
If you do not want to use the user supplied files, there is no need to delete or rename them. Specify command line option `--nouserbuilds` to disable all user build files.

If using the graphical log viewer, the application of a user supplied build file is indicated in the corresponding column, see next figure.



3.3.2 User configurable build files

Some of the library build files are already setup to supply user configuration options. These configuration options can be supplied using the following methods:

As command line option `--copt`
As option string of the *`Setup`* procedure, see chapter *3.2 Setup Files*

The following build scripts currently support user configuration options:

Build script	User options
`Tcl.bawt`	Build static `tclsh`: `Static=ON|OFF`. Default: `OFF`.
`Tk.bawt`	Build static `wish`: `Static=ON|OFF`. Default: `OFF`.

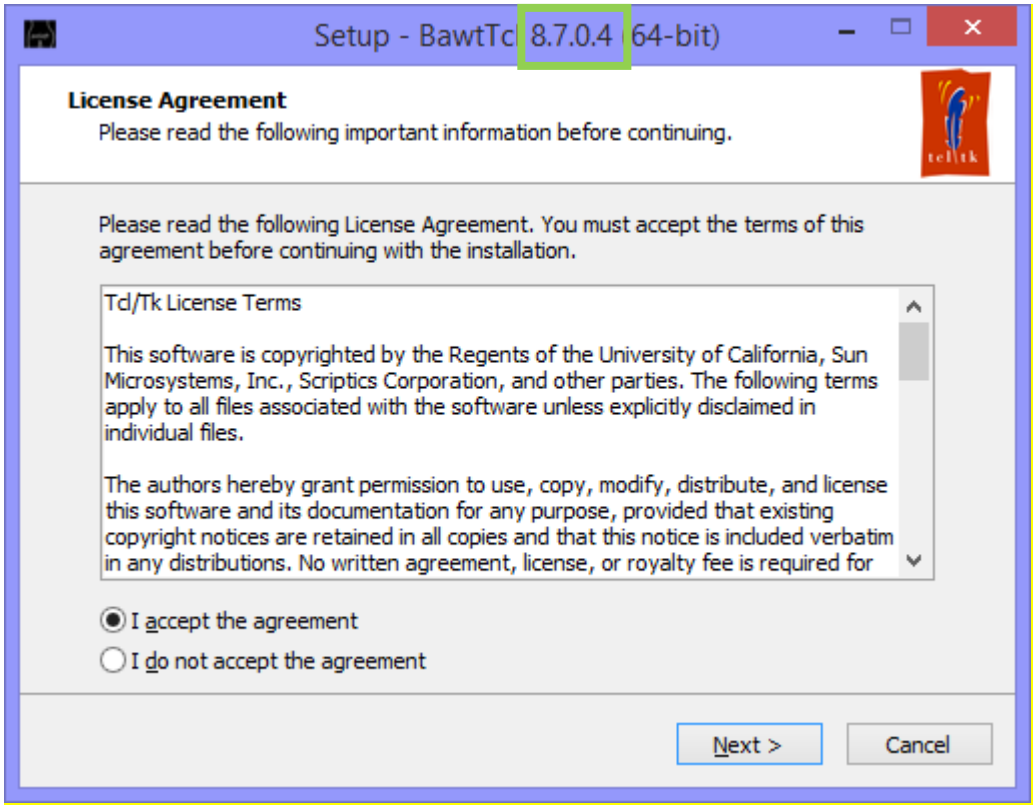
Build script	User options
`SetupOsg.bawt`	Tag string for generated Setup file name: *`Tag=XXX`* Version string used for `InnoSetup`: *`Version=XXX`*
`SetupPython.bawt`	
`SetupTcl.bawt`	

The following example using Tcl version 8.7.a4

```
--copt SetupTcl 'Tag=-BI' --copt SetupTcl 'Version=8.7.0.4'
```

generates an InnoSetup file with the following name:

`SetupTcl-BI-8.7.a4-x64_Bawt-3.0.0.exe`



Build script	User options
`tcl3dFull.bawt`	Use static SDL library: `StaticSDL=ON|OFF`. Default: `OFF`. Currently only supported for Visual Studio builds.

Example:
```
--copt tcl3dFull 'StaticSDL=ON'
```

Build script	User options
`tcllib.bawt`	Toggle `critcl` based compilation: `Critcl=ON|OFF`. Default: `ON`. Build `dtplite` starpack on Windows: `Dtplite=ON|OFF`. Default: `ON`.

Example:
```
--copt tcllib 'Critcl=OFF'
```

Build script	User options
`tcltls.bawt`	Toggle hardening: `Hardening=ON|OFF`. Default: `ON`.

Example:
```
--copt tcltls 'Hardening=OFF'
```

If `tcltls` is compiled with hardening set to ON, it is compiled with option `-fstack-protector-all`, which needs the `libssp-0.dll` library. That library is automatically copied into the *Tcl/bin* directory. Starting with gcc 13, the stack protector library is automatically linked statically.
If hardening is set to OFF, `tcltls` does not need this external dependency.

Build script	User options
`SWIG.bawt`	Add Tcl dependency for SWIG test-suite: `AddTcl=ON|OFF`. Default: `OFF`.

Example:
```
--copt SWIG 'AddTcl=ON'
```

Build script	User options
`OpenSceneGraph.bawt`	Toggle example compilation: `-DBUILD_OSG_EXAMPLES=ON|OFF`. Default: `OFF`. Keep the plugin directory structure: `KeepPluginFolder=ON|OFF`. Default: `OFF`.

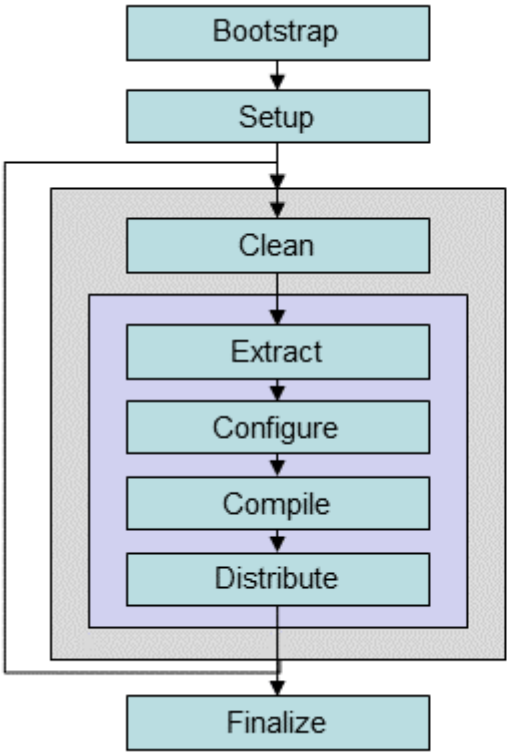
Example:
```
--copt OpenSceneGraph '-DBUILD_OSG_EXAMPLES=ON'
```

Build script	User options
`osgearth.bawt`	Toggle example compilation: `-DBUILD_OSGEARTH_EXAMPLES=ON|OFF`. Default: `OFF`.

Example:
```
--copt osgearth '-DBUILD_OSGEARTH_EXAMPLES=ON'
```

4 Build Stages

This chapter describes the stages used in the ***BAWT*** framework to build the libraries specified in a *Setup* file.



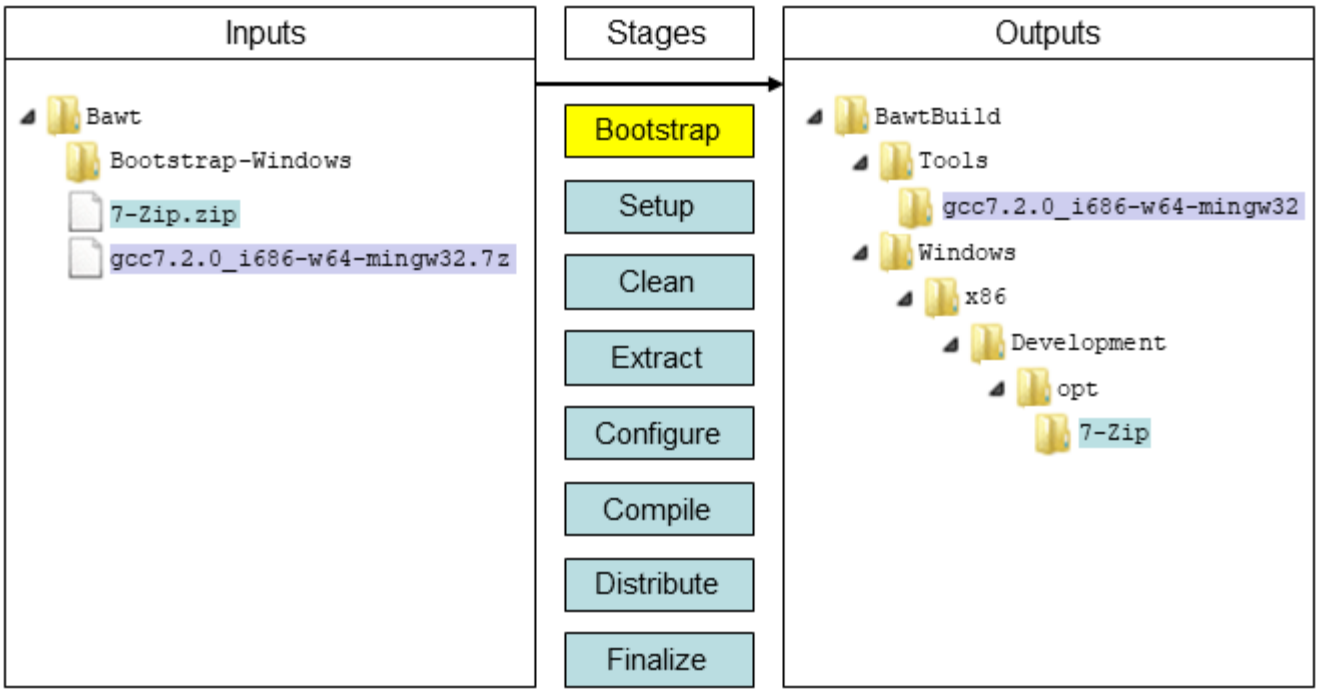
The stages are grouped into global and library specific ones. The global stages `Bootstrap`, `Setup` and `Finalize` are called only once per ***BAWT*** execution, the library specific stages are called once for each library.
Four of the library specific stages (`Extract`, `Configure`, `Compile`, `Distribute`) are user configurable. Actions for these stages must be specified in the library *Build* files.

4.1 Stage Bootstrap

Extract and copy bootstrap tools.
This stage is executed automatically on each invocation of *Bawt.tcl*.
It is not executed, if command line option `--list` is specified.

BAWT needs the ***7-Zip*** program to extract the library source distributions. For Windows and Darwin, a version of the ***7-Zip*** program is included in the ***BAWT*** framework. On Linux ***7-Zip*** is typically already available with the operating system or can be installed as Linux package p7zip or p7zip-full.

On Windows lots of the libraries are built with the MSYS/MinGW suite. Different versions of MSYS/MinGW are available on the ***BAWT*** download site.



Command line options influencing this stage:
`--gccversion`
`--architecture`
`--toolsdir`

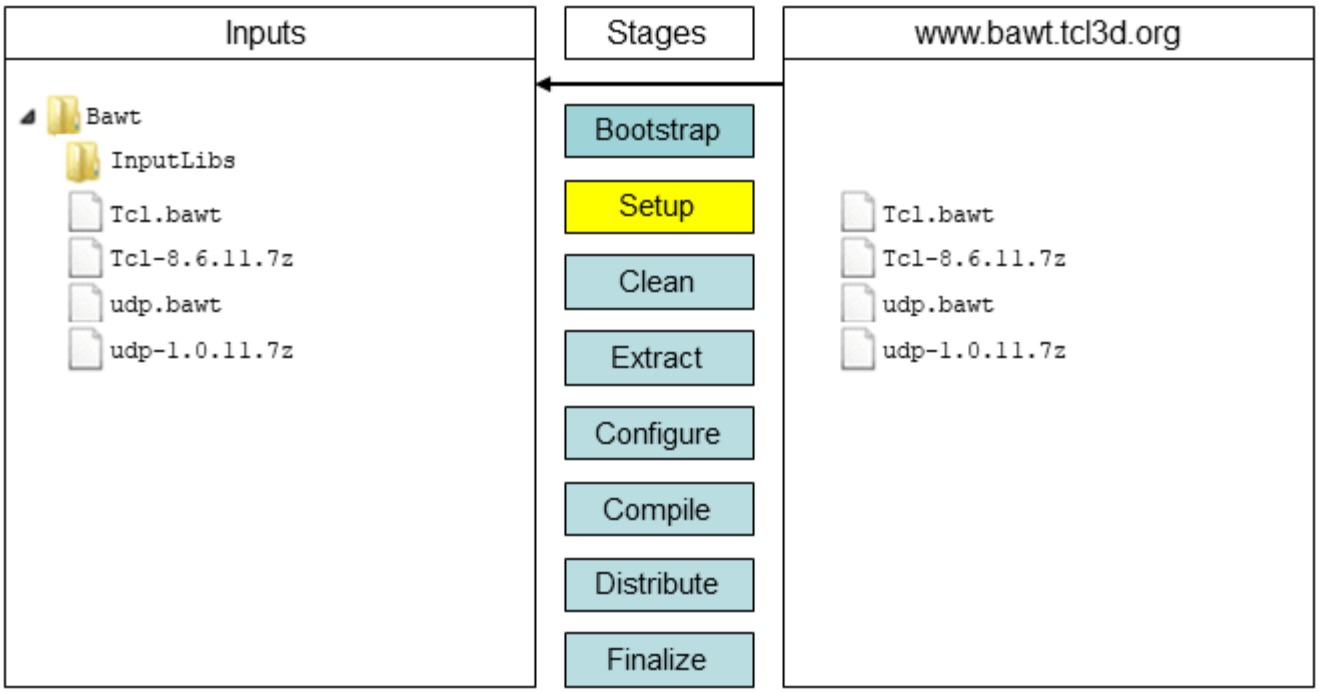
The 7-Zip distribution itself must be compressed with standard ZIP, so that it can be extracted with the vfs::zip package contained in the tclkit. All other tools and libraries are compressed in 7-Zip format because of better compression rates (Example: MSYS/MinGW is 2 times smaller with 7z).

4.2 Stage Setup

Read and execute the specified *Setup* file.
This stage is executed automatically on each invocation of *Bawt.tcl*.

Check for existence of the library source code (either as a 7z file or directory) as well as the according *Build* file. If these do not exist in the library directory *InputLibs* of the current working directory (additional directories can be added with command line option `--libdir`) or are older than those available on the ***BAWT*** website, they are downloaded from the ***BAWT*** website.
If this fails, a fatal error is thrown and the build process is stopped.
The version number of the library is extracted from the file or directory name of the library.
If build action is set to `Update`, the necessary build stages are determined according to the existence of the library source and *Build* files as well as to the modification times of the corresponding build and install directories.

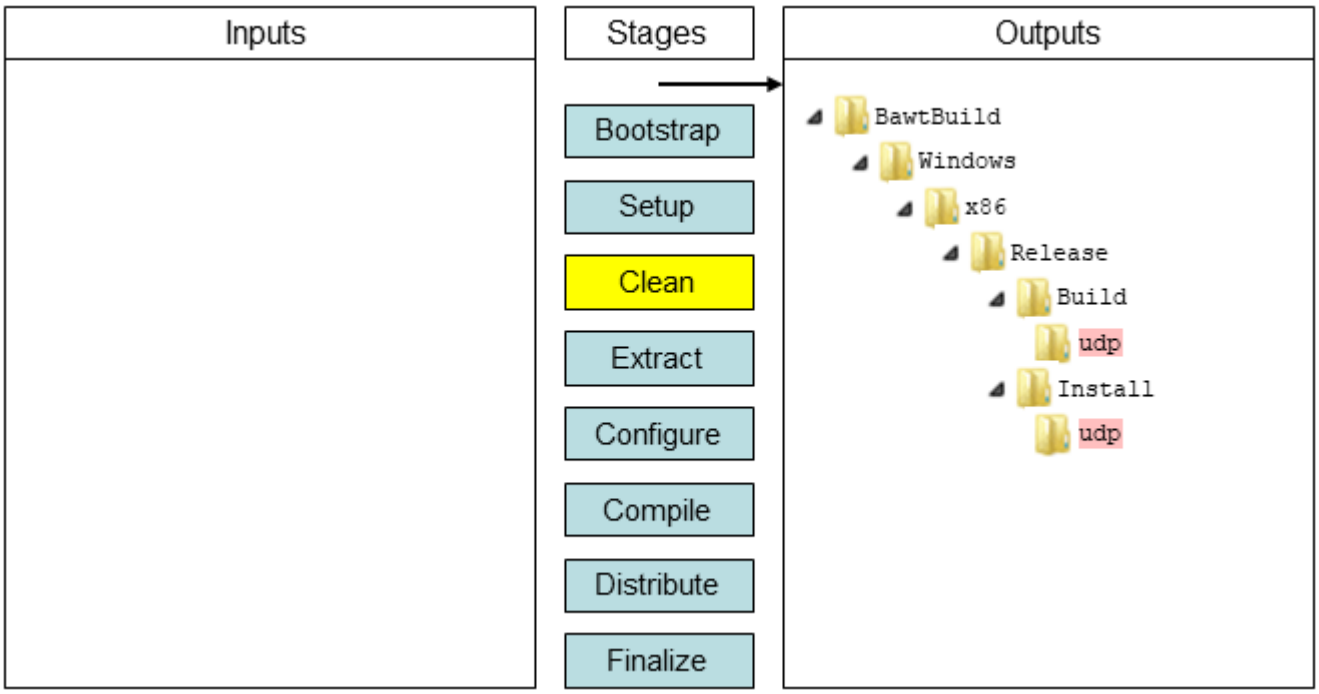
Checking for newer versions and automatic downloading may be skipped by specifying command line option `--noonline`.



Command line options influencing this stage:
`--noonline`
`--norecursive`
`--sort`
`--url`

4.3 Stage Clean

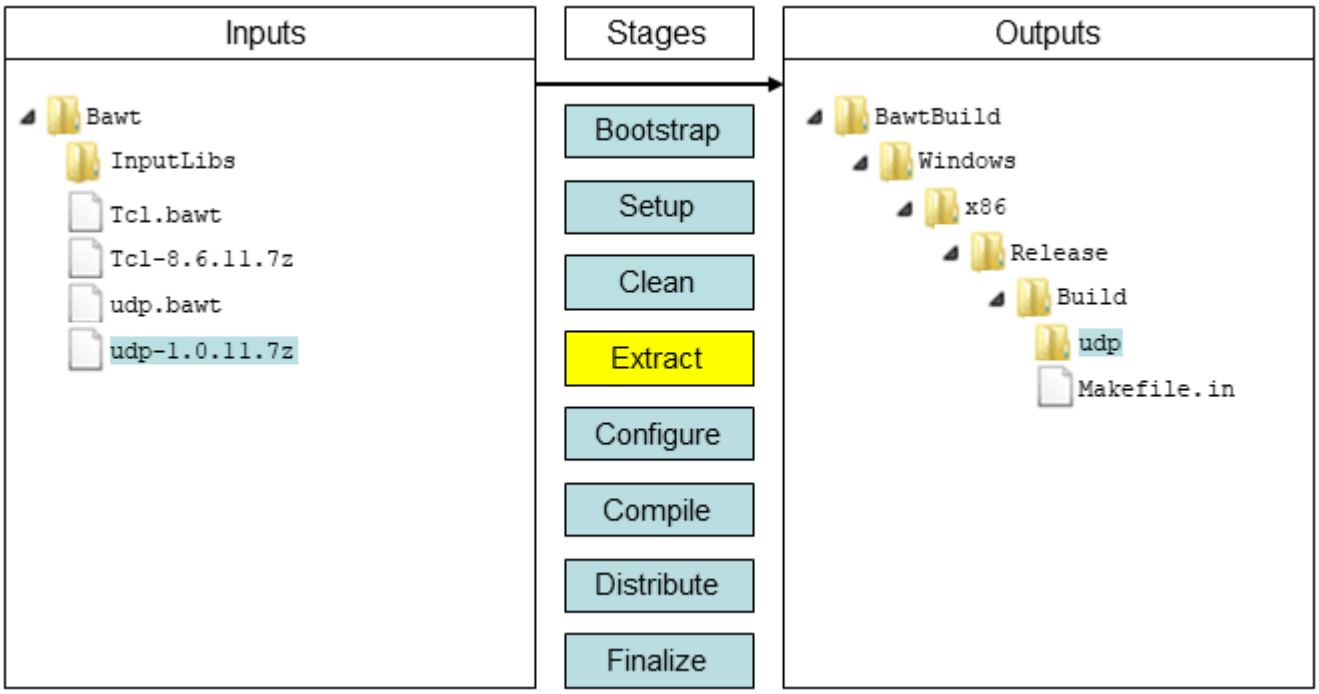
Remove library specific build and install directory.



Command line options influencing this stage:
`--clean`
`--timeout`

4.4 Stage Extract

Extract library source code into build directory.



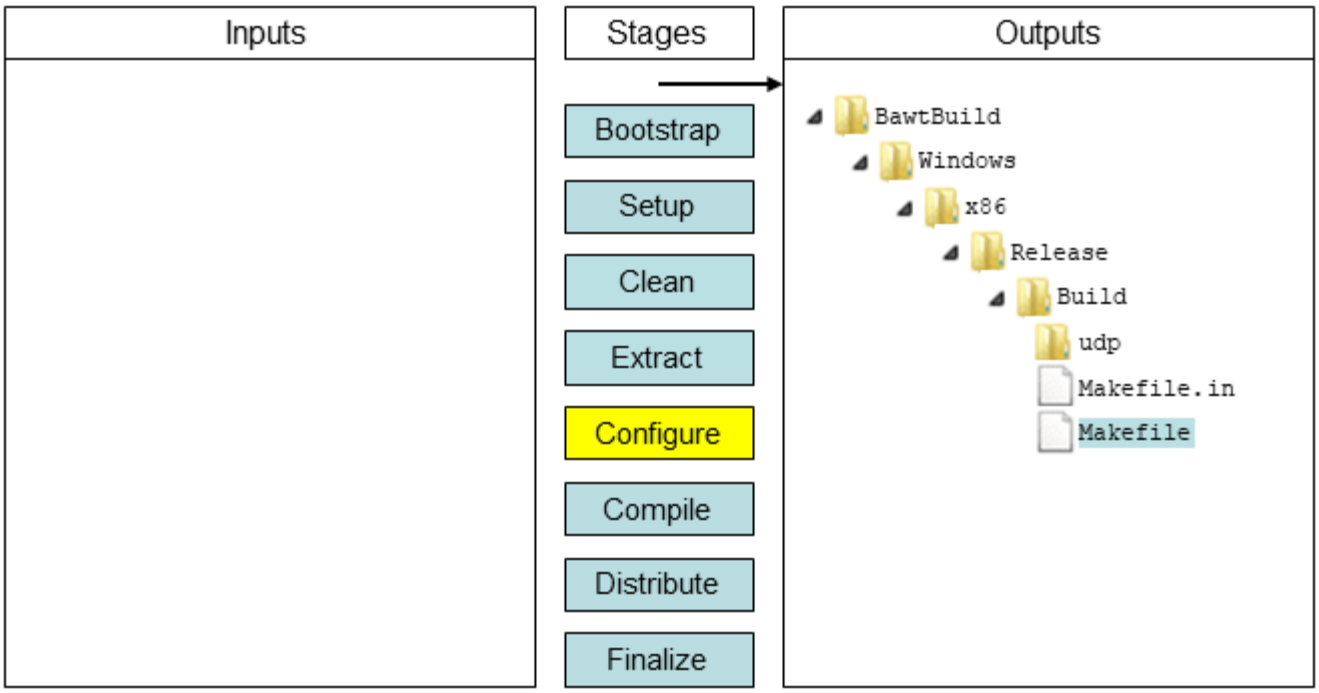
In stage `Extract` the library source code will be extracted and copied into the build directory. This is achieved by calling the ***BAWT*** procedure *`ExtractLibrary`*, which cares about having either a source directory or a compressed source file.
Ideally the source code can be compiled without any changes. If changes have to be done, it is preferred not to edit the source code manually, but make the changes in the build script after extraction.
BAWT has two utility procedures for this purpose:

- *`ReplaceLine`*
- *`ReplaceKeywords`*

Command line options influencing this stage:
`--extract`

4.5 Stage Configure

Configure library for compilation.



In stage `Configure` the library will be configured, which generates the appropriate make files for the chosen compiler and platform.
The following high-level ***BAWT*** procedures are available for configuration tasks:

- *`CMakeConfig`* when using the CMake build infrastructure.
- *`MSysConfig`* when using a configure script with “standard” options.
- *`TeaConfig`* when using the Tcl Extension Architecture for Tcl packages.

See the source code of *Bawt.tcl* to get the default options set by these procedures.

If the build infrastructure does not fit any of the mentioned one above, the configuration command must be built up as a Tcl string and executed with the generic ***BAWT*** procedure *`MSysRun`*.
See the miscellaneous build scripts for usage examples.

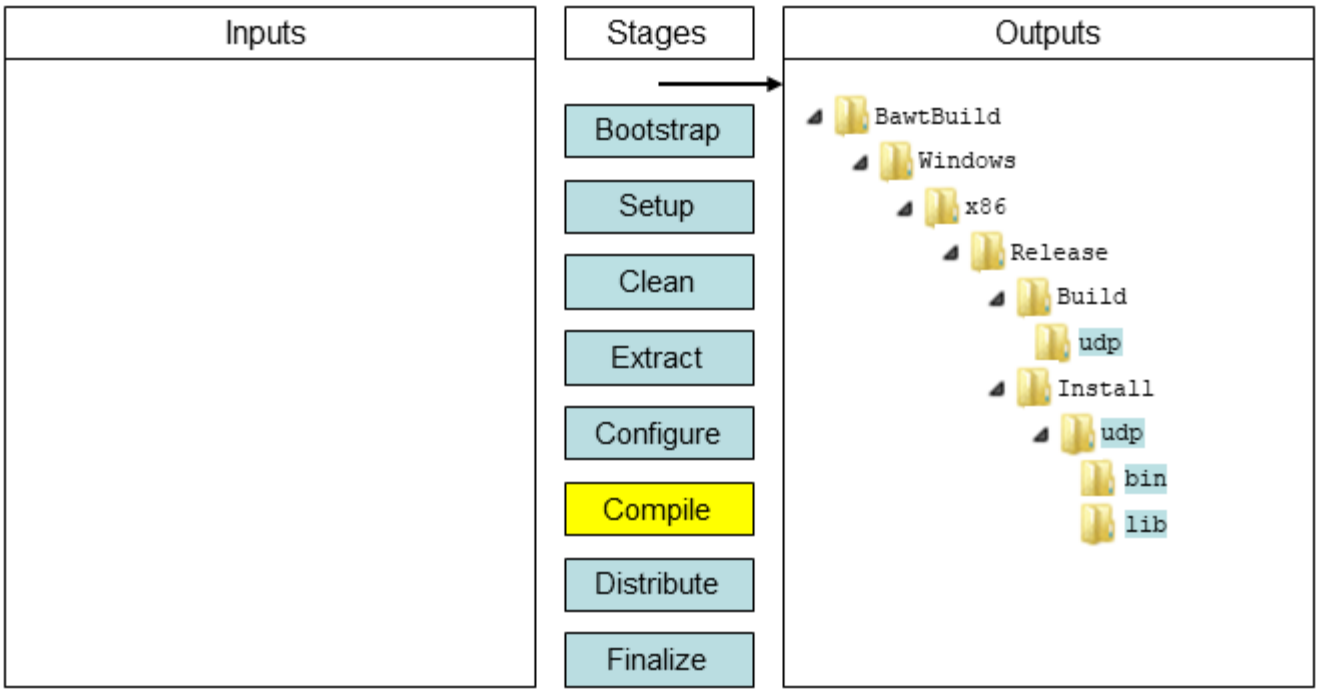
The following ***BAWT*** procedures are typically used for configuration tasks:

- *`IsIntel`*
- *`IsArm`*
- *`IsRiscV`*
- *`IsDebugBuild`*
- *`IsReleaseBuild`*
- *`IsWindows`*
- *`IsLinux`*
- *`IsDarwin`*
- *`IsUnix`*

Command line options influencing this stage:
`--configure`
`--architecture`
`--compiler`
`--gccversion`
`--buildtype`
`--copt`

4.6 Stage Compile

Compile and install library.



In stage `Compile` the library will be compiled and installed.
The following high-level ***BAWT*** procedures are available for compilation tasks:

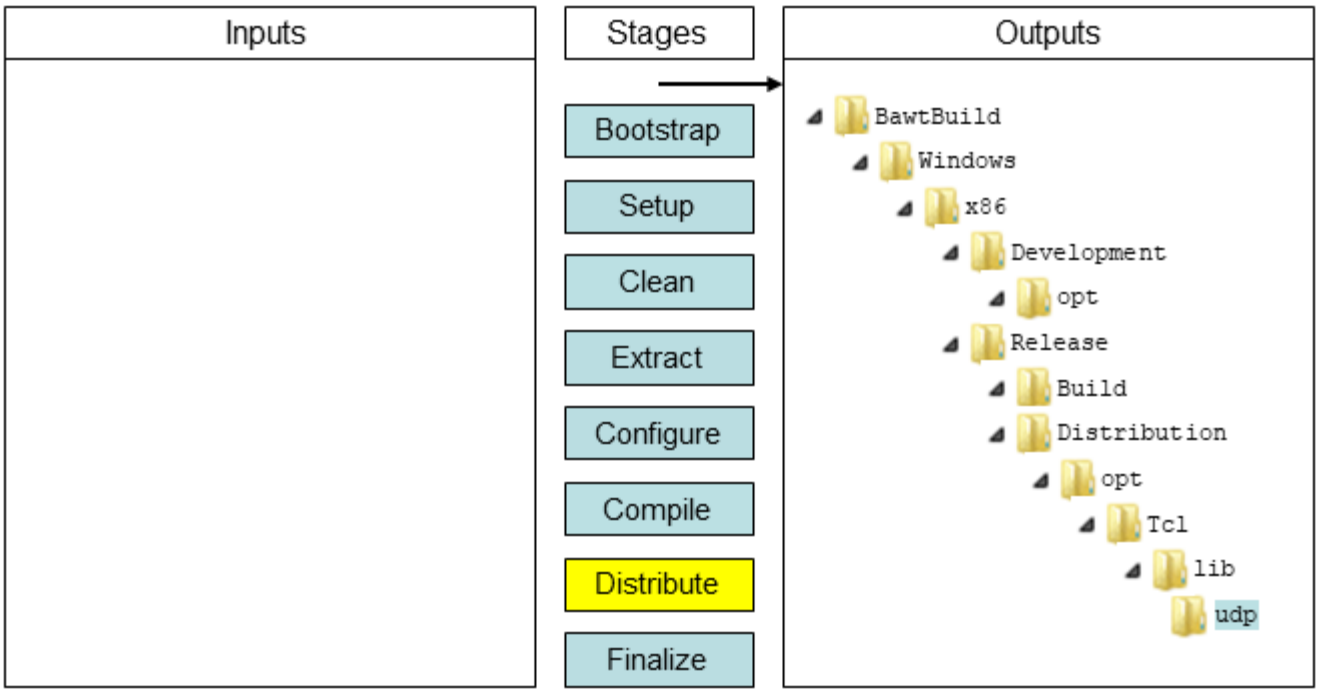
- *`CMakeBuild`* when using the CMake build infrastructure.
- *`MSysBuild`* when using the Tcl Extension Architecture for Tcl packages.

If the build infrastructure does not fit any of the two mentioned above, the compilation command must be built up as a Tcl string and executed with either ***BAWT*** procedure *`MSysRun`* or *`DosRun`*.

Command line options influencing this stage:
`--compile`
`--numjobs`
`--nostrip`
`--noimportlibs`

4.7 Stage Distribute

Copy relevant files into developer and user distribution directories.



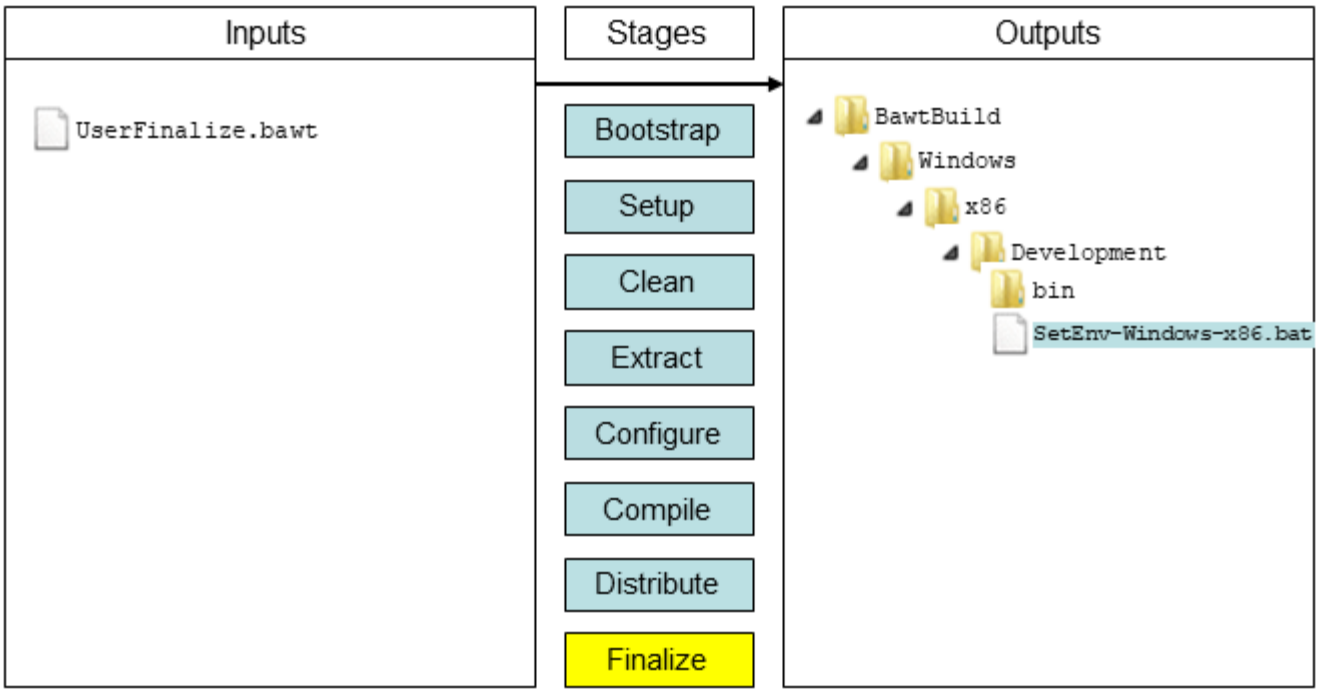
In stage `Distribute` the library will be copied into the distribution and development directories. The following ***BAWT*** procedures are typically used for distribution tasks:

- *`SingleFileCopy`*
- *`MultiFileCopy`*
- *`LibFileCopy`*
- *`FileRename`*
- *`UseTclPkgVersion`*
- *`IsDebugBuild`*
- *`IsReleaseBuild`*
- *`IsWindows`*
- *`IsLinux`*
- *`IsDarwin`*
- *`IsUnix`*
- *`ErrorAppend`*

Command line options influencing this stage:
`--distribute`
`--noversion`

4.8 Stage Finalize

Perform final actions, optionally call user supplied *`Finalize`* procedure and print summary.



The Finalize stage is performed automatically at the end of the build process or can be manually selected with command line option `--finalize`.

The Finalize stage creates an environment file in the *Development/bin* directory called *SetEnv-*.bat* or *SetEnv-*.sh*. It contains all the environment variables set by the `Env_libName` procedures of the libraries.

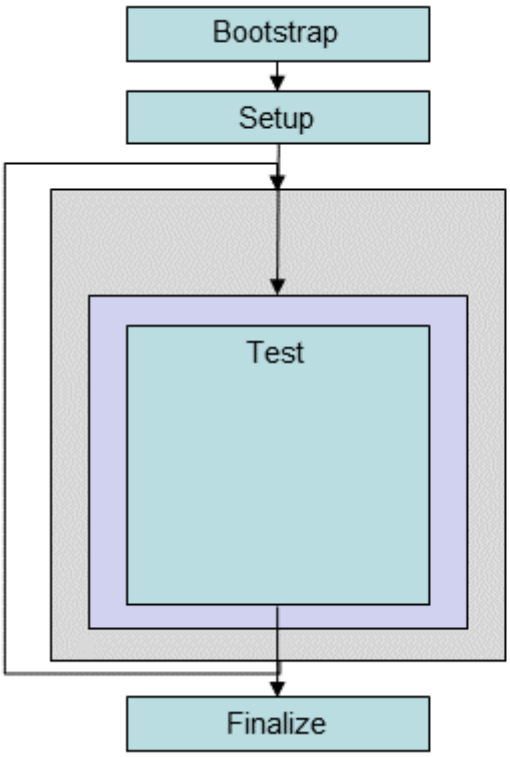
If running on Windows with Visual Studio it also copies the appropriate Visual Studio runtime libraries into the *Development/bin* directory. If you do not want to copy these runtime libraries, use command line option `--noruntimelibs`.

To supply a user defined finalize action to ***BAWT***, create a file containing a procedure named `Finalize`. See the file *UserFinalize.tcl* in ***BAWT*** directory *Setup* as an example.
You can use any standard Tcl procedure or one of the ***BAWT*** procedures like `Log` or `MultiFileCopy` in the `Finalize` procedure.
To make the file containing your Finalize procedure available for the ***BAWT*** build process, use command line option `--finalizefile`.

Command line options influencing this stage:
`--finalize`
`--finalizefile`
`--noruntimelibs`

4.9 Stage Test

Perform test scripts as specified in procedure `Test_libName`.



The Test stage must be manually selected with command line option `--test`.

5 Build Process

This chapter gives insight into the BAWT build process from the perspective of a user of BAWT as well as from the perspective of a developer, who wants to extend BAWT with new libraries.

5.1 User Perspective

As described in the previous chapter a specific stage can be executed with one of the following command line action options. These specific action options are typically only used when integrating a new library into BAWT.

```
--clean     : Clean library specific build and install directories.
--extract   : Extract library source from a ZIP file or a directory.
--configure : Perform the configure stage of the build process.
--compile   : Perform the compile stage of the build process.
--distribute: Perform the distribution stage of the build process.
--finalize  : Generate environment file and call user supplied Finalize procedure.
```

The following global command line action options are typically used for building or updating the BAWT libraries.

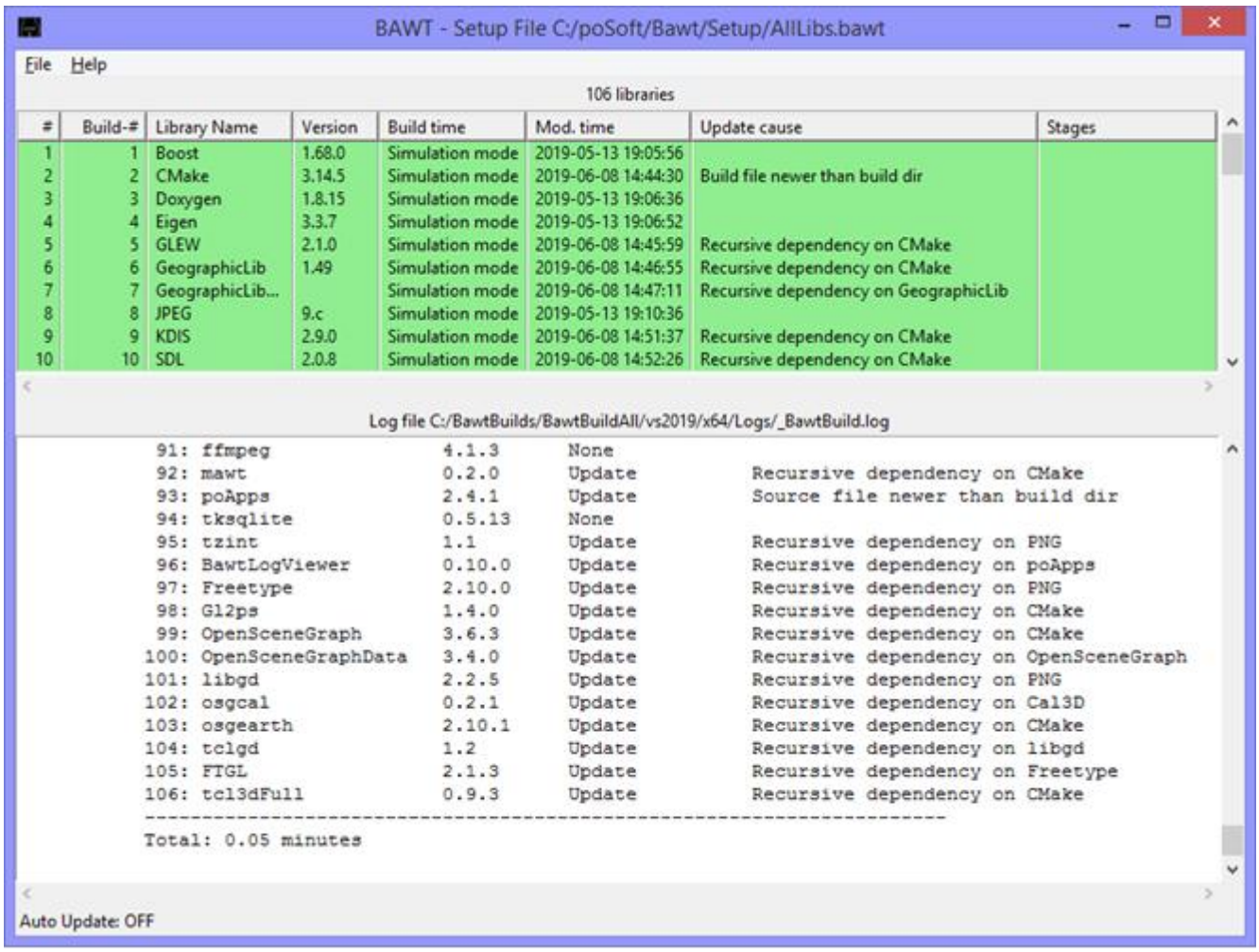
```
--complete  : Perform the following stages in order:
              clean, extract, configure, compile, distribute, finalize.
--update    : Perform necessary stages depending on modification times.
              Note: Global stage finalize is always executed.
--simulate  : Simulate update action without actually building libraries.
--touch     : Set modification times of library build directories to current time.
```

Option `--complete` makes a complete rebuild of the specified libraries, while `--update` checks, which libraries have to be rebuilt.
The necessary build stages are determined according to the existence of the library source and *Build* files as well as to the modification times of the corresponding build directories.
It is also checked, if the build of a library has been cancelled or stopped by checking for the existence of a so-called *Progress File*, which is created in the *Logs* directory at the start of a library build and deleted after a successful library build.
Additionally, a check is performed, if a library is dependent of another library, which has been rebuilt. This recursive dependency checking can be switched off with command line option `--norecursive`.

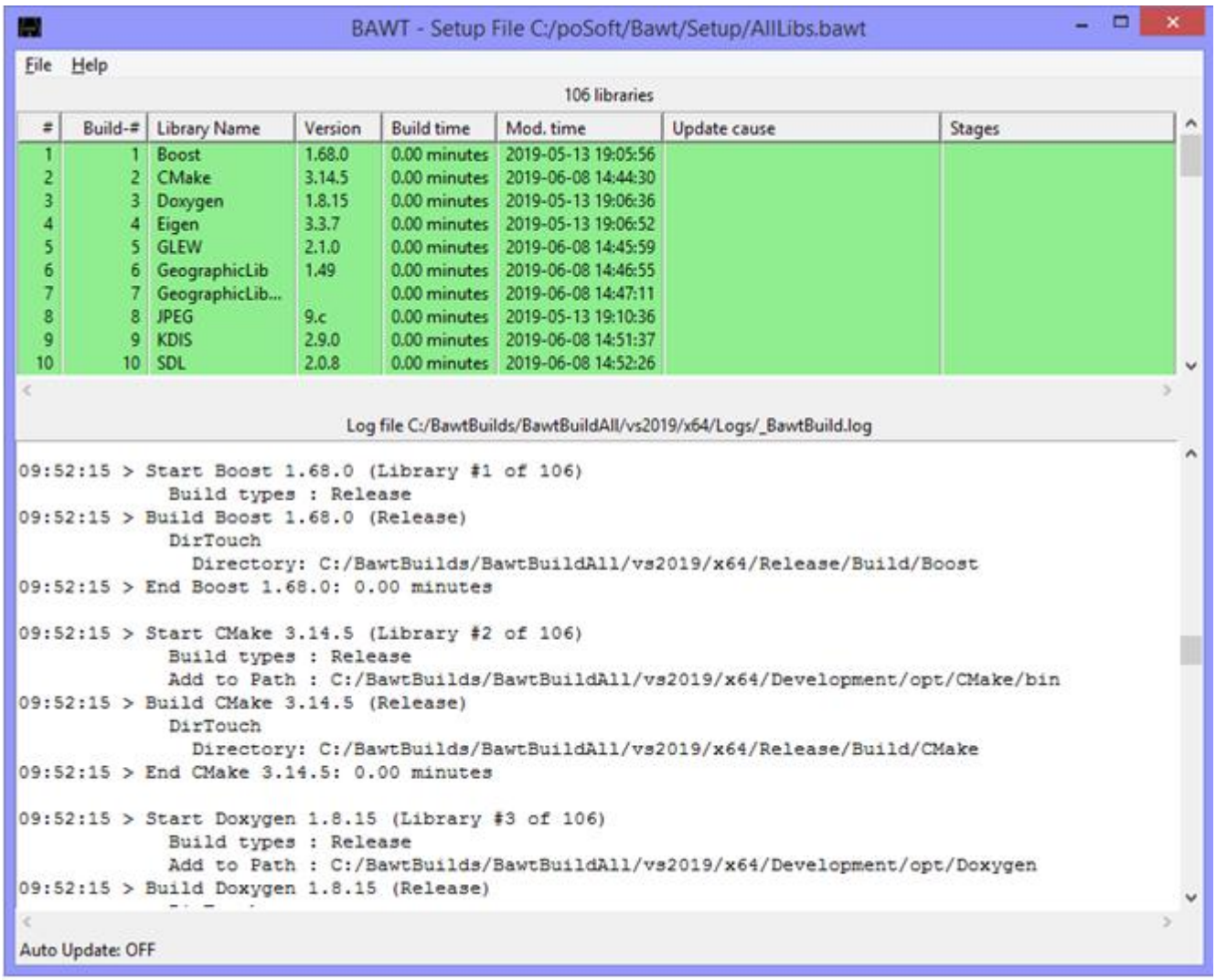
The `--simulate` option performs the same actions as the `--update` option, but does not build anything. It just prints out, which libraries would be rebuilt, if you would execute the `--update` command line option.
It often happens, that only cosmetic changes are done to a Build file, which would cause this library (and all dependent libraries) to be rebuilt. To avoid rebuilding of these libraries, specify the option `--touch`, which sets the modification times of the build directories to the current date and time.

5.1.1 Use Case: Cosmetic change of Build file CMake.bawt

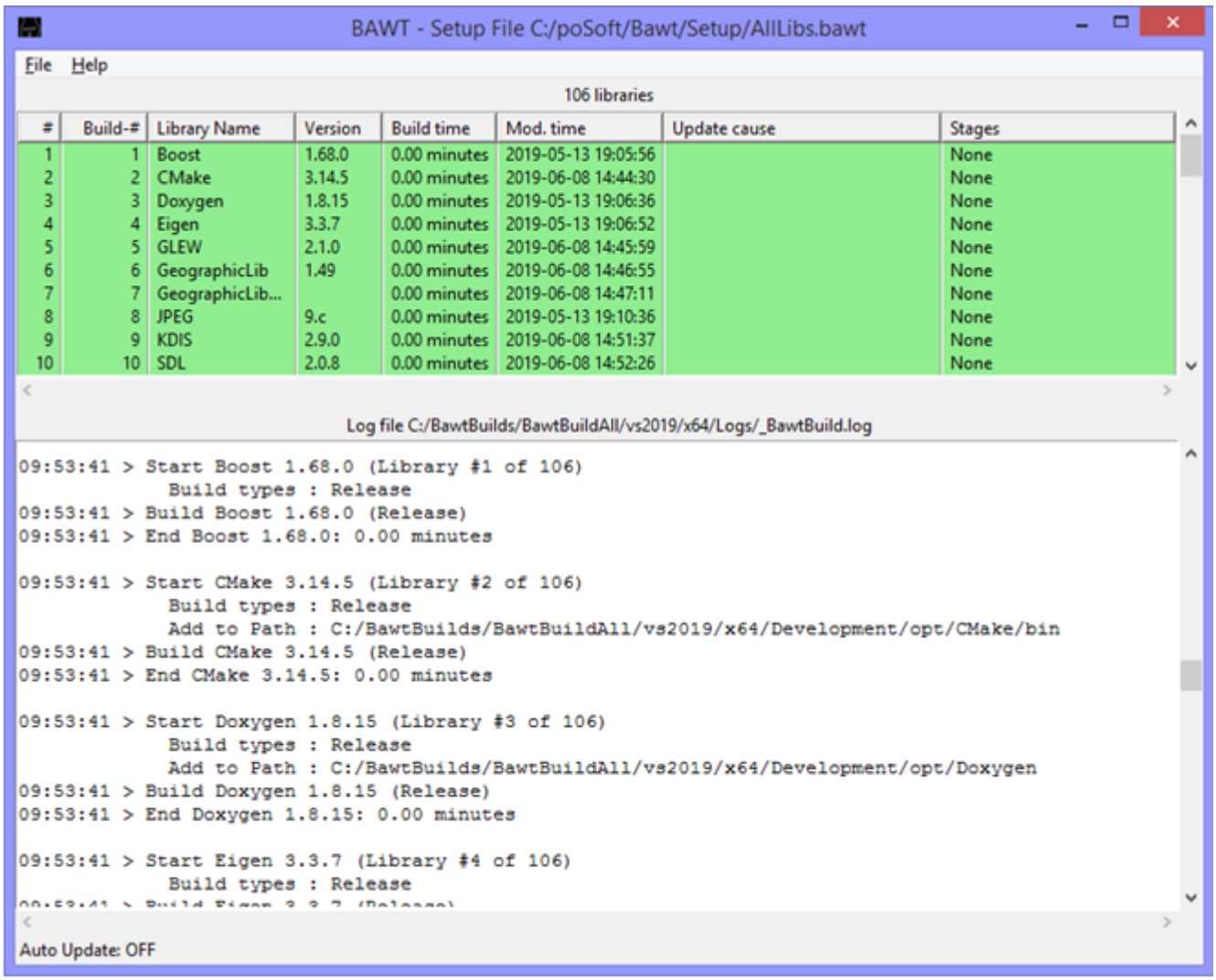
Due to the number of dependencies, a change of Build file *CMake.bawt* would cause a lot of libraries to be rebuilt, as the next screenshot of the ***BawtLogViewer*** shows, when executing a `--simulate` run.



To avoid the rebuild of all of these libraries, which may take a lot of time, we execute a `--touch` run. Note the execution of the *`DirTouch`* procedure of the BAWT framework shown in the text widget in the lower half of the window.



If we now perform an `--update` run, none of the libraries are rebuilt.



5.1.2 Compiler selection on Windows

On Linux and Darwin only the gcc compiler suite is supported.
On Windows gcc and Visual Studio are supported. Some packages can be compiled only with gcc or only with Visual Studio. More and more libraries can be compiled with either gcc or Visual Studio.

Starting with version 2.0, ***BAWT*** supports the notion of primary and secondary compilers on Windows. Which compilers are supported by a build script is indicated with BAWT procedure *`SetWinCompilers`*.

```
proc Init_tkdnd { libName libVersion } {
    SetScriptAuthor    $libName "Paul Obermeier" "obermeier@tcl3d.org"
    SetLibHomepage     $libName "https://github.com/petasis/tkdnd"
    SetLibDependencies $libName "CMake" "Tk"
    SetPlatforms       $libName "All"
    SetWinCompilers    $libName "gcc" "vs"
}
```

The above call of *`SetWinCompilers`* indicates, that the library can be compiled by both Visual Studio and gcc.
To see, which Windows compilers are supported, use the `--wincompilers` command line option or look for that information in the corresponding build files.

To determine, which compiler should be used in an actual compilation, there is the possibility to specify the compiler using command line option `--compiler`.

This option has been extended to not only accept `gcc` or `vs20XX` as arguments, but also a combination of both using a plus sign as separator, ex. `gcc+vs2019`.

If a library does not support the Windows compiler selected when calling BAWT, then that library is excluded from the build. The log file contains a message like the following:

```
15:02:30 > Start Boost 1.58.0 (Library #2 of 137)
             Build types : Release
15:02:30 > End Boost: Excluded from build (Compiler gcc not supported)
```

Behaviour before BAWT version 2.0:

If the chosen Windows compiler is Visual Studio, but the package only supports gcc, the gcc compiler was automatically chosen as secondary compiler, as the MSYS/MinGW suite is part of BAWT and therefore always available. The other way is not supported, as a Visual Studio compiler may not be available.
The following 3 options of choosing a compiler on Windows were available up to BAWT version 1.3.0.

BAWT 1.3.0	Command line option --compiler	SetWinCompilers		
		gcc	vs	gcc vs
Option 1	`Not specified`	gcc	Excluded	gcc
Option 2	`--compiler gcc`	gcc	Excluded	gcc
Option 3	`--compiler vs20XX`	gcc	vs	vs

Behaviour since BAWT version 2.0:

With BAWT 2.0 two new options have been added, which specify the primary and secondary compiler.

BAWT 2.0.0	Command line option --compiler	SetWinCompilers		
		gcc	vs	gcc vs
Option 1	`Not specified`	gcc	Excluded	gcc
Option 2	`--compiler gcc`	gcc	Excluded	gcc
Option 3	`--compiler vs20XX`	Excluded	vs	vs
Option 4	`--compiler gcc+vs20XX`	gcc	vs	gcc
Option 5	`--compiler vs20XX+gcc`	gcc	vs	vs

Options 1 and 2 work the same way as they did in BAWT versions before 2.0. Option 3 now does not compile packages supporting only gcc. This behaviour can now be achieved by specifying Option 4 (vs20XX+gcc).

To support this new functionality, several incompatible changes had to be implemented:

New procedures	Removed procedures
SetCompilerVersions	*GetVSCompilerVersionNumber*
GetCompilerVersions	*IsVSCompilerNewer*
UseVisualStudio	*IsVSCompiler*
GetVisualStudioVersion	*SetForceVSCompiler*
NeedDll2Lib	*ForceVSCompiler*

Procedure *GetCompilerVersion* now has a changed and extended signature.

Compilation of ***Tcl/Tk*** and all supported Tcl packages (everything included in *Setup* files *Tcl_Basic.bawt* and *Tcl_Extended.bawt*) is possible without using Visual Studio with the exception of building Visual

Studio compatible Tcl and Tk stub libraries. Those stub libraries can only be compiled using Visual Studio.

To generate Visual Studio compatible Tcl and Tk import libraries (*.lib) the ***BAWT*** procedure `Dll2Lib` is used. It creates the import library from the DLL by using the ***link.exe*** program, which is part of Visual Studio.

If Visual Studio is not available, a warning message like the following is issued:

```
Warning > Dll2Lib tk86.lib: Creating import libraries needs VisualStudio
```

To avoid these warnings, add command line option `--noimportlibs`, if Visual Studio is not available or import libraries are not needed.

5.1.3 Online updates of libraries

If using the online update functionality, it is recommended that the local BAWT version is identical to the remote version on the BAWT server. If the local major or minor version is older than the remote version, a fatal error is generated:

```
FATAL > Remote major version 2.0.0 different to major local version 1.3.0
```

If only the patch version differs, a warning is issued.

You are able to download with different local and remote versions by specifying the `--noexit` command line option, but this is not recommended.

To have a consistent set of library versions or if using ***BAWT*** on a computer without internet connection, use the command line option `--noonline` to avoid checking for updates and automatic downloading of new libraries.

5.1.4 Use the generated libraries

To use the generated libraries, the following possibilities exist:

- Manually copy the appropriate directory.
- Use the `Finalize` procedure.
- Create a software distribution setup file

Manually copy the appropriate directories

Copy the appropriate directories from either the *Distribution* or *Development* directory to a suitable location on your computer.
For example, after executing the Setup file *Tcl_Basic.bawt* to generate a ***Tcl*** distribution for Windows, copy output directory *Development\opt\Tcl* to *C:\Tcl* and set the environment variables `PATH` and `TCLLIBPATH`.

Note, that the entries of the `PATH` variable on Windows are separated by semicolons (;). The entries of variable `TCLLIBPATH` are separated by spaces and directory paths must use slashes (/) instead of backslashes (\).

On Unix the environment variables are typically set in the shell resource file, ex. .bashrc:

Use the Finalize procedure

Instead of doing the copy manually, it is easier and faster to do the copying in the Finalize stage. The ***BAWT*** framework contains a template Finalize file *Setup/UserFinalize.bawt*, which is shown below.

Adapt the installation paths according to your local needs.

```
# Example script for user supplied Finalize procedure.
#
# The procedure copies the generated Tcl distribution
# from the Development folder into a folder specified
# in your Path environment variable.
#
# You have to adapt the installation paths (tclRootDir)
# according to your needs.
#
# To execute the Finalize procedure, the name of this file
# must be specified on the BAWT command line with option
# "--finalizefile".

proc Finalize {} {
    Log "Finalize (User defined)"

    # For safety reasons this is just a dummy mode.
    # Remove the next lines to enable functionality.
    if { 1 } {
        Log "Finalize Dummy mode" 2 false
        return
    }

    if { [IsWindows] } {
        set tclRootDir "C:/opt"
    } elseif { [IsLinux] } {
        set tclRootDir "~/opt"
    } elseif { [IsDarwin] } {
        set tclRootDir "~/opt"
    } else {
        ErrorAppend "Finalize: Cannot determine operating system" "FATAL"
    }

    set tclInstDir [file join $tclRootDir "Tcl"]

    Log "Installing Tcl into $tclInstDir" 2 false
    DirDelete $tclInstDir

    MultiFileCopy [file join [GetOutputDevDir] [GetTclDir]] $tclInstDir "*" true
}
```

Create a software distribution setup file

There are currently two *Build* files to create software distribution setup files:

- *SetupTcl.bawt* to create a ***Tcl*** Batteries-Included software distribution
- *SetupOsg.bawt* to create an ***OpenSceneGraph*** software distribution

These scripts take all contents of the *Release/Distribution* directory and create a software distribution setup file. This setup file is created with ***InnoSetup*** for Windows platforms and as a simple, self-extracting shell script for Unix platforms.

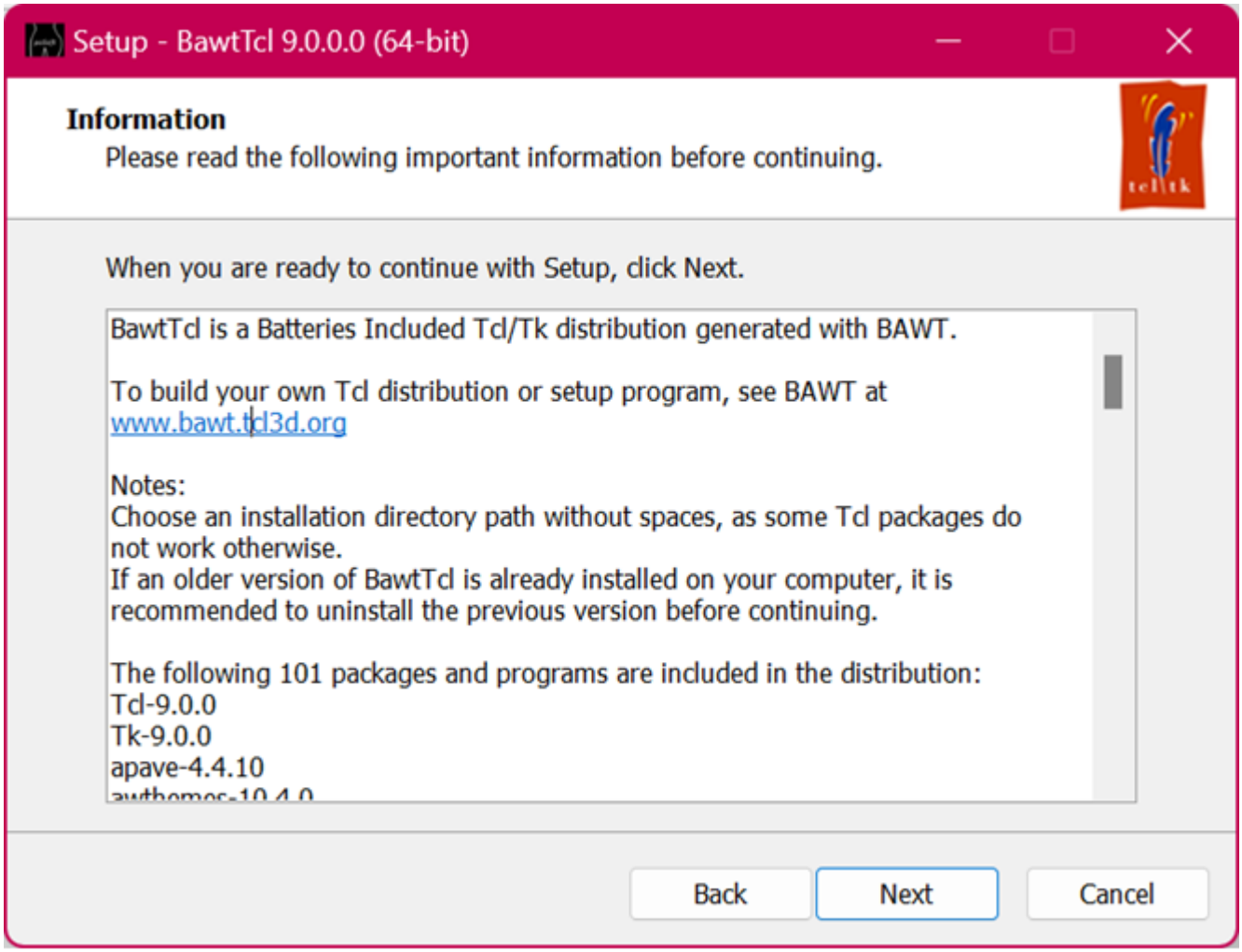
The software distribution setup file itself is generated in the *Release/Distribution* directory.

The software distribution setup file name for ***Tcl/Tk*** has the Tcl version, the architecture and the BAWT version used to build the distribution encoded into the file name.
Example: `SetupTcl-BI-8.6.17-x64_Bawt-3.1.0.exe`

The software distribution setup file name for ***OpenSceneGraph*** has the OSG version, the compiler version, the architecture and the BAWT version used to build the distribution encoded into the file name. Example: `SetupOsg-3.4.1-vs2013-x64_Bawt-3.1.0.exe`

In the same directory as the distribution setup files, text files named *SetupTcl-8.6.17.txt* resp. *SetupOsg-3.4.1.txt* are created, which list the contents of the software distribution setup file.

This list is used to display the contents of the ***InnoSetup*** based distribution setup file, see the following screenshot for an example.



For Unix (Linux and Darwin) a simple shell script-based distribution setup file is generated. If called without arguments, a simple usage message is displayed.

```
> ./SetupTcl-BI-8.6.17-x64_Bawt-3.1.0.sh

Usage: SetupTcl-BI-8.6.17-x64_Bawt-3.1.0.sh InstallationDirectory
Install folder Tcl into specified installation directory
```

If called with a not existing installation directory path, an error message is printed onto standard output.

```
> ./SetupTcl-BI-8.6.17-x64_Bawt-3.1.0.sh asdf

Installation directory asdf does not exist.
Check name or create manually.
```

If called with a valid installation directory, the contents are extracted into that directory and a message on how to set the needed environment variables is printed onto standard output.

```
> ./SetupTcl-BI-8.6.17-x64_Bawt-3.1.0.sh ~/bin
Extracting Tcl into /home/obermeier/bin ...

Add the following lines to your shell resource file (ex. ~/.bashrc):
export PATH="/home/obermeier/bin/Tcl/bin:$PATH"
export TCLLIBPATH="/home/obermeier/bin/Tcl/lib $TCLLIBPATH"
```

5.1.5 Change icons of executables

To change the icon of the generated `tclkits` and `starpacks` as well as the information shown about an executable on Windows (Resource), two command line options exist in the ***BAWT*** framework:

- `--iconfile`
- `--resourcefile`

The user supplied icon and resource files can be either located in the Resources *directory. Then it is sufficient to just specify the name of the files. If the files are located at other places, the path name of the files must be absolute.*

Use the icon file *poSoft.ico* and resource file *poSoft.rc* supplied by ***BAWT*** in directory *Resources* as starting point for your adapted ones.

If specifying your own resource file, do not change the name of the icon file in the following line of your resource file:

```
tk ICON DISCARDABLE "tclkit.ico"
```

The name must always be *tclkit.ico*.

If specifying a user supplied icon file with command line option `--iconfile`, the icon file will be copied into the build directory *Tclkit/kbskit/win* and renamed to *tclkit.ico*, so that it is possible to only specify an icon file without specifying a resource file.

Changes to the used icon and resource file are not considered by the BAWT update check process, so if using these options, it is necessary to at least rebuild package tclkit and its dependencies.

5.1.6 Parallel builds

All build environments used by BAWT support parallel compilation. The number of parallel build jobs can be specified globally for all libraries with command line option `--numjobs.`
Alternatively, the number of parallel build jobs can be restricted for specific libraries as additional parameter `MaxParallel` in the Setup procedure. See chapter *3.2 Setup Files* for a description of the Setup procedure and its parameters.

The following libraries consistently produce deadlocks when executed in parallel, so the number of parallel jobs is already limited in the corresponding BAWT Setup files by specifying option `MaxParallel=Windows-gcc:1.`

- `CERTI`
- `PNG`
- `osgcal`
- `tserialport`

Other libraries which occasionally tend to deadlock are the following:

- freeglut
- gdal
- geos
- openjpeg
- OpenSceneGraph
- osgearth
- SDL

Deadlocks have occurred until now only on Windows using the gcc compiler.

As reference point, the next table shows typical build times on my laptop for libraries needing 2 minutes or more. The laptop is equipped with an Intel QuadCore i7-4700 2.4Ghz with HyperThreading. 8 parallel compile jobs have been used.

Estimated build time	Libraries
~ 2 minutes	ccl libgd libwebp SetupTcl xz
~ 3 minutes	geos kdis TIFF
~ 4 minutes	SWIG tcltls tcl3dFull
~ 5 minutes	gdal Tclkit Xerces
~ 6 minutes	curl gdal libressl Tcl
~ 7 minutes	boost ffmpeg Img
~ 9 minutes	fftw
~ 25 minutes	osgearth
~ 35 minutes	OpenSceneGraph

5.2 Developer Perspective

5.2.1 Upgrade a library

If you want to use a new version of a library already supported by ***BAWT***, chances are high, that the existing build scripts still work with the new version.
So just pack the sources of the new version into a 7z file and edit the corresponding entry in the *Setup* file. Also check the comments of the library build script regarding manual changes to the source code.

If the library is a ***Tcl*** package, you might get warnings from the ***Starpack*** build scripts. This indicates, that you will have 2 different versions in the ***Tcl*** library directory, which might lead to troubles.
The following warnings are issued, when upgrading library tablelist 6.20 to tablelist 6.22:

```
MakeStarpack: Found more than 1 package with prefix tablelist*:
  TclBasic-8.6.17/vs2019/x64/Development/opt/Tcl/lib/tablelist6.20
  TclBasic-8.6.17/vs2019/x64/Development/opt/Tcl/lib/tablelist6.22
```

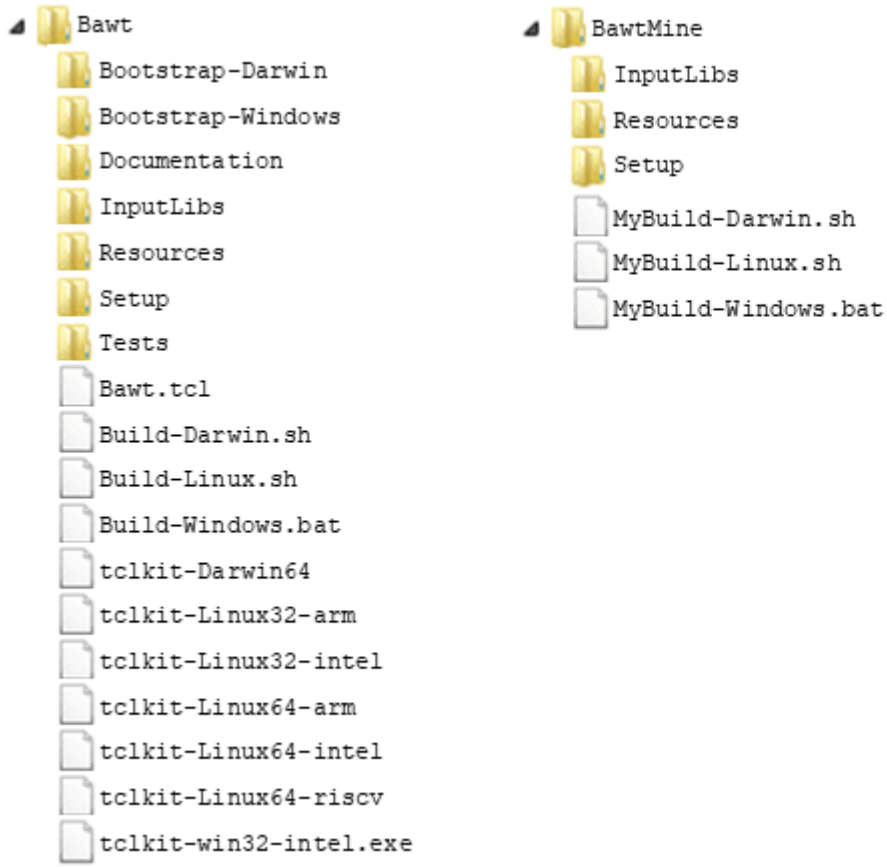
So, when upgrading one or more libraries, you should either remove the development and distribution directories and do a fresh rebuild. The other possibility is to search for the directories of the old version (*tablelist6.10* in the above example) and just remove these directories from the development and distribution directory.
Another option is to use command line option --noversion, which strips the version number from the names of Tcl package directories.

5.2.2 Add a library

Library sources should be specified either as a directory named *$libName-$libVersion* or as a compressed file named *$libName-$libVersion.7z*.

> *libName must not contain a "-" character, because this character is used to separate the library name from the version string.*

It is easily possible to extend the libraries compiled by ***BAWT*** with COTS software, ex. company specific libraries. One possibility is to just add these libraries into the *InputLibs* directory of the standard ***BAWT*** distribution. The better solution is to create a separate directory (ex. *BawtMine*), which holds your libraries in a similar structure like ***BAWT*** does. In this directory you create adapted versions of the batch scripts (ex. *MyBuild-Windows.bat*) and add *Setup* files, which reference your libraries as well as libraries of the standard BAWT distribution.



If you want to use a library, which is currently under development, it is possible to add the directory containing the local checkout of the library.

The following example shows the *Setup* file *mawtSvn.bawt* used to compile the current version of ***MAWT*** from my local SVN checkout.

```
Include "Tools.bawt"
Include "BasicLibs.bawt"
Include "Tcl_Basic.bawt"

if { [IsWindows] } {
    set dirName C:/poSoft/Mawt
} elseif { [IsLinux] } {
    set dirName /home/obermeier/poSoft/Mawt
```

```
} else {
    set dirName /Users/obermeier/poSoft/Mawt
}
Setup mawt $dirName mawt.bawt Version=0.4.0
```

Note, that the checkout directory typically has no version number in it, so the version number is specified as optional argument of the Setup procedure.

5.2.3 Add a Tcl program

Adding a Tcl program is similar to adding a library, i.e. the sources must be supplied as a compressed file as well as a corresponding *Build* script.
The Tcl program will be created as as starpack, i.e. a standalone executable containing the Tcl interpreter (tclkit), the program scripts as well as needed Tcl packages.

To ease the generation of starpacks, the BAWT framework offers procedures `MakeStarpackTcl` and `MakeStarpackTk` for this purpose. Use `MakeStarpackTcl`, if you want to create a console program, and `MakeStarpackTk`, if you want to create a program with a graphical Tk user interface.

```
proc MakeStarpackTcl { appScript appName starpackName buildDir args }
```

appScript	Full path to the startup script of the Tcl program.
appName	The name of the application. Typically `$libName`.
starpackName	The name of the starpack executable. Typically `$libName[GetExeSuffix]`.
buildDir	The name of the output directory. Typically `$instDir`.
args	A list of files and directories to be included in the starpack. The path names of the files and directories must be absolute pathes. The files of the Tcl program are typically located in `$buildDir`. Needed Tcl packages are located in `[GetDevTclLibDir]`.

Example Build files using these procedures are:

- *BawtLogViewer.bawt*
- *gorilla.bawt*
- *poApps.bawt*
- *tclssg.bawt*
- *tksqlite.bawt*

The signature of procedure `MakeStarpackTk` is identical to procedure `MakeStarpackTcl`.

A starpack on Darwin is a directory using the extension .app.

5.2.4 Manually compile a library

To configure and compile a library, the ***BAWT*** framework uses shell (**.sh*) or batch files (**.bat*). These batch files are created in the `Configure` and `Compile` phases and stored in the *Build* directory (or a suitable subdirectory like eg. *win*) of the library.

You can use these batch files to configure or compile a library manually. This is especially useful while developing the build file for a new ***BAWT*** library.

Before running one of the shell or batch files on the command line, you have to remove the last line of the script containing the `exit` command or replace the `exit` command with an `echo` command.

You can easily open a library specific DOS or MSys shell window via the context menu of the BawtLogViewer, see chapter 6.1 Graphical Log Viewer.

The first part of the file name defines the configure and compile environment and corresponds to the general ***BAWT*** procedures for executing commands with the same name:

_Bawt_DosRun:

- The commands will be executed in a standard Windows command line environment.
- If running the command manually on Windows, it must be executed from a DOS command shell.
- Example: `> _Bawt_DosRun_CMakeBuild.bat`

_Bawt_MSysRun:

- The commands will be executed in the MSYS/MinGW environment or a standard shell environment on Unix systems.
- If running the command manually on Windows, it must be executed from a MSYS/MinGW shell.
- Note, that on Unix systems all files are prefixed with *_Bawt_MSys*.
- Example: `> sh _Bawt_MSysRun_MSysBuild.bat`

The second part specifies the caller of the *DosRun* or *MSysRun* command. This is typically one of the following standard BAWT procedures:

- `NMakeBuild`
- `MsBuild`
- `CMakeConfig`
- `CMakeBuild`
- `MSysConfig`
- `TeaConfig`
- `MSysBuild`

For libraries, which cannot be built with one of the above standard procedures, it is common usage to specify the caller in the form:

- `_Bawt_LibName_Configure`
- `_Bawt_LibName_Compile`

One example is the Boost library, which has special configure and compile commands:

- `_Bawt_DosRun_Boost_Configure.bat`
- `_Bawt_DosRun_Boost_Compile.bat`

When using `NMakeBuild` or `MsBuild`, there is no need to specify commands for the configuration phase.

- `_Bawt_DosRun_MsBuild.bat`
- `_Bawt_DosRun_NMakeBuild.bat`

All other commands typically come in pairs, so you will see the following combination of configure and compile batch scripts:

- `_Bawt_DosRun_CMakeConfig.bat`
- `_Bawt_DosRun_CMakeBuild.bat`

- `_Bawt_MSysRun_TeaConfig.bat`
- `_Bawt_MSysRun_MSysBuild.bat`

- `_Bawt_MSysRun_MSysConfig.bat`
- `_Bawt_MSysRun_MSysBuild.bat`

- `_Bawt_MSysRun_CMakeBuild.bat`
- `_Bawt_MSysRun_CMakeConfig.bat`

5.3 Known issues

5.3.1 Build deadlock

Problem:
The build process does not continue with specific libraries.

Workaround or solution:
This is due to errors in the build infrastructure of the corresponding library in conjunction with parallel builds. See chapter *5.1.6 Parallel builds* for details.

5.3.2 BawtLogViewer shows incorrect build time

Problem:
If the build of a library starts before midnight and extends over midnight, the build time of this package will be negative in the BawtLogViewer table display, as the log file only stores time values as HH:MM:SS.

Workaround or solution:
None.

5.3.3 Package SWIG

Problem:
SWIG build fails occasionally on Windows due to problems renaming files.
This behavior was noticed on systems running Sophos AntiVirus only.

Workaround or solution:
No real solution, other than retrying the build until it succeeds.

5.3.4 Package Trf

Problem:
The CRC module of Tcl package `Trf` crashes when compiled in x86 mode on Windows.

Workaround or solution:
None.

5.3.5 Package tcllib/crc32

Problem:
The crc32 module of Tcl package `tcllib` crashes when compiled in x86 mode on Windows.

Workaround or solution:
The crash is not the fault of module crc32 itself, but of the CRC module of package `Trf`, which gets called, if the `Trf` extension is available.

Either remove package `Trf` or remove loading of accelerator `trf` in file *crc32.tcl*

```
foreach e {trf critcl} {
    if {[LoadAccelerator $e]} break
}
```

5.4 Tips and Tricks

5.4.1 Tips for Windows

Check generated library

To check the architecture of a generated dynamic library, execute the following command in a Visual Studio developer command prompt:

```
> dumpbin /headers XXX.dll | more
```

The architecture of the library is contained in the file header section of the output:

```
FILE HEADER VALUES
        machine (x64)
```

5.4.2 Tips for Linux

Check generated library

To check, if a library has been stripped, the commands `nm` or `file` can be used. To check the architecture of a generated library, the command `file` can be used.

A library built for Release should have no symbols and thus should generate the following outputs:

```
> nm libjpeg.so.9.1.0
nm: libjpeg.so.9.1.0: no symbols

> file libjpeg.so.9.1.0
libjpeg.so.9.1.0: ELF 32-bit LSB shared object, Intel 80386, version 1 (SYSV),
dynamically linked, stripped
```

A Debug build should have symbols and thus should generate the following outputs:

```
> nm libjpeg.so.9.1.0 | more
0002ffa0 r aanscalefactor.4133
0002fa60 r aanscalefactor.4178
0002ffe0 r aanscales.4125

> file libjpeg.so.9.1.0
libjpeg.so.9.1.0: ELF 32-bit LSB shared object, Intel 80386, version 1 (SYSV),
dynamically linked, not stripped
```

5.5 Advanced Batch Scripts

This section contains the batch scripts, which are used to generate the ***Tcl-Pure*** (minimal Tcl/Tk distribution) as well as the ***Tcl-BI*** (Batteries Included Tcl/Tk distribution) distributions.

5.5.1 Build Tcl-Pure distributions

The following batch scripts are used to create the ***Tcl-Pure*** distributions for all supported Tcl versions. A separate directory (*C:/BawtBuilds/TclMinimal/TclMinimal-%TCLVERS%-%TkVERS%-%LINKTYPE%*) is created for each Tcl version containing both the x86 and x64 versions.
The needed MSYS/MinGW versions are located in directory *C:/BawtBuildTools* (using option `--toolsdir`) to avoid extracting these for each Tcl version.

Batch script *UpdateTclMinimal.bat*

```
@echo off
setlocal

rem Architecture, TclVersion, TkVersion, TclString, LinkType and Finalize flag are
mandatory parameters
if "%1" == "" goto ERROR
if "%2" == "" goto ERROR
if "%3" == "" goto ERROR
if "%4" == "" goto ERROR
if "%5" == "" goto ERROR
if "%6" == "" goto ERROR

set ARCH=%1
set TCLVERS=%2
set TKVERS=%3
set TCLSTRING=%4
set LINKTYPE=%5
set FINALIZE=%6
shift
shift
shift
shift
shift
shift

rem If no target is given, use target "all".
if "%1"=="" goto BUILDALL

rem Loop through the rest of the parameter list for targets.
set TARGETS=
:PARAMLOOP
rem There is a trailing space in the next line. It's there for formatting.
set TARGETS=%TARGETS%%1
shift
if not "%1"=="" goto PARAMLOOP
goto BUILD

:BUILDALL
set TARGETS=all

:BUILD

set LINKTYPEOPT=
if "%LINKTYPE%"=="Dynamic" goto NOSTATIC
set LINKTYPEOPT=--copt Tcl Static=ON --copt Tk Static=ON
:NOSTATIC

set BAWTROOT=..\Bawt
set SETUPFILE=%BAWTROOT%\Setup\Tcl_MinimalDist.bawt
set FINALIZEFILE=Setup\UserFinalize.bawt
set OUTROOTDIR=C:/BawtBuilds/TclMinimal/TclMinimal-%TCLVERS%-%TKVERS%-%LINKTYPE%
set TOOLSDIR=C:/BawtBuildTools
set TCLKIT=%BAWTROOT%\tclkit-win32-intel.exe
set NUMJOBS=%NUMBER_OF_PROCESSORS%
set ACTION=--update

set BAWTOPTS=--rootdir %OUTROOTDIR% ^
             --toolsdir %TOOLSDIR% ^
             --architecture %ARCH% ^
             --compiler gcc+vs2022 ^
             --numjobs %NUMJOBS% ^
             --noonline ^
             --nouserbuilds ^
             --iconfile poSoft.ico ^
```

```
            --resourcefile poSoft.rc ^
            --certfile poSoft.cer ^
            --tclversion %TCLVERS% ^
            --tkversion %TKVERS% ^
            --copt SetupTcl "Version=%TCLSTRING%"

set FINALIZEOPT=--logviewer
if "%FINALIZE%"=="0" goto NOFINALIZE
set FINALIZEOPT=--finalizefile %FINALIZEFILE%
:NOFINALIZE

rem Build all libraries as listed in build configuration file.
CALL %TCLKIT% %BAWTROOT%\Bawt.tcl %BAWTOPTS% %LINKTYPEOPT% %FINALIZEOPT% %ACTION%
%SETUPFILE% %TARGETS%

goto EOF

:ERROR
echo.
echo Usage: %0 Architecture TclVersion TkVersion TclString UseFinalizeScript [Target1]
[TargetN]
echo   Architecture     : x86 x64
echo   TclVersion       : 8.6.17   9.0.2
echo   TkVersion        : 8.6.17   9.0.2
echo   TclString        : 8.6.17.0 9.0.2.0
echo   LinkType         : Static Dynamic
echo   UseFinalizeScript: 0 1
echo   Default target   : all
echo.

:EOF
```

You might need to adapt the pathes specified in `OUTROOTDIR` and `TOOLSDIR` as well as the used Visual Studio version specified in command line option `--compiler`.

Batch script *UpdateTclMinimals.bat*

```
@echo off
setlocal

REM  Architecture TclVersion TkVersion TclString LinkType UseFinalizeScript

CALL UpdateTclMinimal x64 8.6.17 8.6.17 8.6.17.0 Dynamic  0
CALL UpdateTclMinimal x64 9.0.2  9.0.2  9.0.2.0  Dynamic  0

CALL UpdateTclMinimal x86 8.6.17 8.6.17 8.6.17.0 Dynamic  0
CALL UpdateTclMinimal x86 9.0.2  9.0.2  9.0.2.0  Dynamic  0

CALL UpdateTclMinimal x64 9.0.2  9.0.2  9.0.2.0  Static   0
CALL UpdateTclMinimal x86 9.0.2  9.0.2  9.0.2.0  Static   0
```

5.5.2 Build Tcl-BI distributions

The following batch scripts are used to create the ***Tcl-BI*** distributions for all supported Tcl versions. A separate directory (*C:/BawtBuilds/TclDistribution/TclDistribution-%TCLVERS%*) is created for each Tcl version containing both the x86 and x64 versions.
The needed MSYS/MinGW versions are located in directory *C:/BawtBuildTools* (using option `--toolsdir`) to avoid extracting these for each Tcl version.

Batch script *UpdateTclDistribution.bat*

```
@echo off
setlocal
```

```
rem Architecture, TclVersion, TkVersion, TclString, ImgVersion, Action and Finalize flag
are mandatory parameters
if "%1" == "" goto ERROR
if "%2" == "" goto ERROR
if "%3" == "" goto ERROR
if "%4" == "" goto ERROR
if "%5" == "" goto ERROR
if "%6" == "" goto ERROR
if "%7" == "" goto ERROR

set ARCH=%1
set TCLVERS=%2
set TKVERS=%3
set TCLSTRING=%4
set IMGVERS=%5
set ACTION=%6
set FINALIZE=%7
shift
shift
shift
shift
shift
shift
shift

rem If no target is given, use target "all".
if "%1"=="" goto BUILDALL

rem Loop through the rest of the parameter list for targets.
set TARGETS=
:PARAMLOOP
rem There is a trailing space in the next line. It's there for formatting.
set TARGETS=%TARGETS%%1
shift
if not "%1"=="" goto PARAMLOOP
goto BUILD

:BUILDALL
set TARGETS=all

:BUILD

set BAWTROOT=..\Bawt
set SETUPFILE=%BAWTROOT%\Setup\Tcl_Distribution.bawt
set FINALIZEFILE=Setup\UserFinalize.bawt
set OUTROOTDIR=C:/BawtBuilds/TclDistribution/TclDistribution-%TCLVERS%-%TKVERS%
set TOOLSDIR=C:/BawtBuildTools
set TCLKIT=%BAWTROOT%\tclkit-win32-intel.exe
set NUMJOBS=%NUMBER_OF_PROCESSORS%
set ACTION=--%ACTION%

set BAWTOPTS=--rootdir %OUTROOTDIR% ^
             --toolsdir %TOOLSDIR% ^
             --architecture %ARCH% ^
             --compiler gcc+vs2022 ^
             --numjobs %NUMJOBS% ^
             --noonline ^
             --nouserbuilds ^
             --iconfile poSoft.ico ^
             --resourcefile poSoft.rc ^
             --certfile poSoft.cer ^
             --tclversion %TCLVERS% ^
             --tkversion %TKVERS% ^
             --imgversion %IMGVERS% ^
```

```
              --copt SWIG "AddTcl=ON" ^
              --copt SetupTcl "Tag=-BI" ^
              --copt SetupTcl "Version=%TCLSTRING%"

set FINALIZEOPT=--logviewer
if "%FINALIZE%"=="0" goto NOFINALIZE
set FINALIZEOPT=--finalizefile %FINALIZEFILE%
:NOFINALIZE

rem Build all libraries as listed in build configuration file.
CALL %TCLKIT% %BAWTROOT%\Bawt.tcl %BAWTOPTS% %FINALIZEOPT% %ACTION% %SETUPFILE%
%TARGETS%

goto EOF

:ERROR
echo.
echo Usage: %0 Architecture TclVersion TkVersion TclString ImgVersion Action
UseFinalizeScript [Target1] [TargetN]
echo   Architecture     : x86 x64
echo   TclVersion       : 8.6.17   9.0.2
echo   TkVersion        : 8.6.17   9.0.2
echo   TclString        : 8.6.17.0 9.0.2.0
echo   ImgVersion       : 1.4.17 2.1.0
echo   Action           : update test
echo   UseFinalizeScript: 0 1
echo   Default target   : all
echo.

:EOF
```

You might need to adapt the pathes specified in `OUTROOTDIR` and `TOOLSDIR` as well as the used Visual Studio version specified in command line option `--compiler`.

Batch script *UpdateTclDistributions.bat*

```
@echo off
setlocal

REM  Architecture TclVersion TkVersion TclString ImgVersion Action UseFinalizeScript

CALL UpdateTclDistribution x64 8.6.17 8.6.17 8.6.17.0  2.1.0  update  0
CALL UpdateTclDistribution x86 8.6.17 8.6.17 8.6.17.0  2.1.0  update  0

CALL UpdateTclDistribution x64 9.0.2  9.0.2  9.0.2.0   2.1.0  update  0
CALL UpdateTclDistribution x86 9.0.2  9.0.2  9.0.2.0   2.1.0  update  0
```

6 Logging

The *Logs* output directory contains the overall build log file *_BawtBuild.log* as well as the library specific build log files.
Library specific log files contain the output of the configuration and compile process. They also contain the error messages, if the build of a library does not succeed.
The overall log file contains the messages, which are printed onto standard output during the BAWT build process. The amount of log messages can be set by specifying the log level with command line option `--loglevel`. Level 0 does not produce any log messages, while level 4 produces lots of log messages. The default value for the log level is 3.
Each stage or executed command is prefixed with a time code like shown in the next line:

```
21:35:30 > Build tclcompiler 1.7.1 (Release)
```

If log files of different configurations should be compared, these time codes may be disturbing. BAWT therefore allows to remove the time codes from the log messages by specifying command line option --nologtime.

When rerunning a build, existing log files are renamed by appending *.bak* to the corresponding files before creating the new log files.

To view the build process online in a graphical window, the command line option --logviewer can be specified. See the next chapter for a detailed description of the graphical log file viewer ***BawtLogViewe***r.

Logging functionality is realized in namespace `BawtLog`. The most important procedure is `Log`, which may be used in build scripts, too.

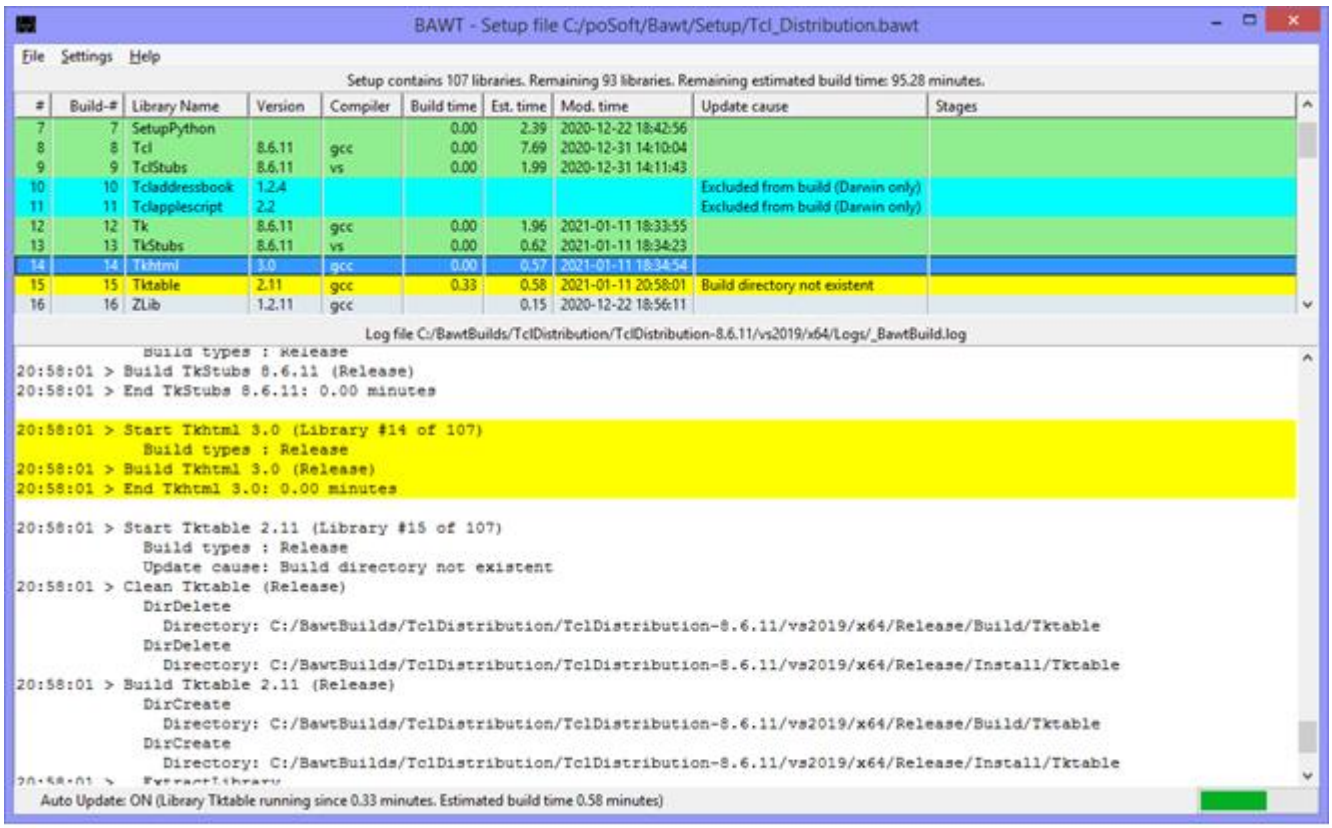
Command line options influencing logging:
--loglevel
--nologtime
--logviewer

6.1 Graphical Log Viewer

The ***BawtLogViewer*** is a separate program to view and analyse the log output of BAWT. It is a Tcl script, which is wrapped as a Starpack and is included as a Windows executable in directory *Bootstrap-Windows*. For other platforms it can be built with BAWT.

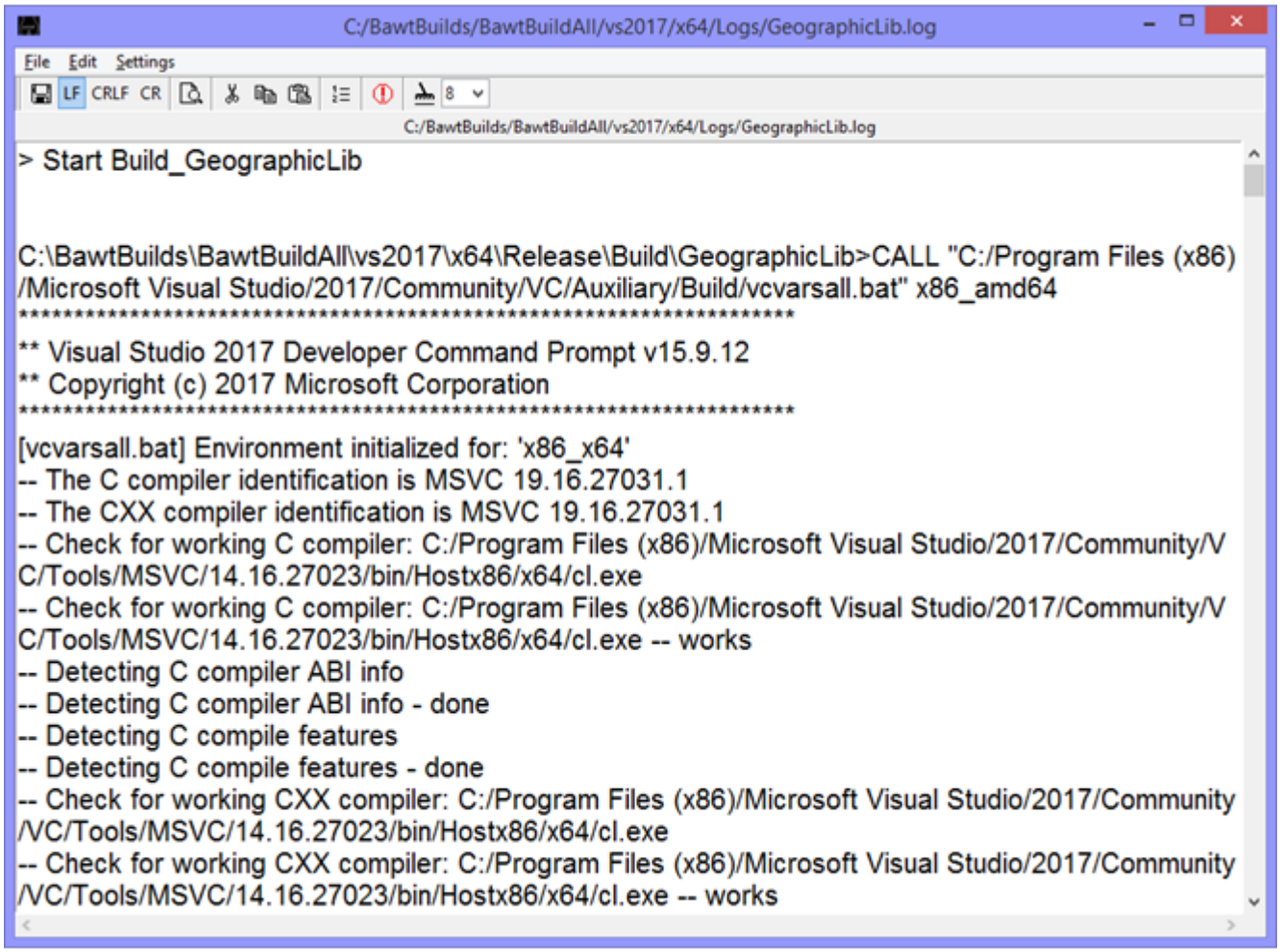
The graphical log viewer can either be used to analyse log files after a build process has finished (offline mode) or it can be used to interactively view the build process (online mode). Viewing the log messages online can be done by either using command line option --logviewer when starting the BAWT build process or by opening the log file *_BawtBuild.log* anytime during the build process.
Log files can be opened by using the `File` menu or by dragging and dropping the icon of the log file onto the ***BawtLogViewer*** window.

The following figure shows the layout of the log viewer window, which has 2 main parts. In the upper part all libraries of the Setup file are listed in a scrollable table, while in the lower part the log messages of the build process are displayed in a scrollable text widget.



Different row background colors indicate the build status of a library. A green background indicates a successful build of a library, a blue background indicates an excluded library, a yellow background shows the library currently under build and an orange background indicates a library, where the current build time is greater than the estimated build time. See below for an explanation of estimated build times for deadlock detection.
A red text color is displayed for libraries which issued a warning during the build process.

The table can be sorted by any of the columns except the first one, which just shows the row number. For example, you may want to view the libraries sorted by library names instead of the build number.
Selecting a table row scrolls to the beginning of the corresponding section in the text widget. The section is also marked with a yellow background.
By double clicking onto a table row, a simple editor window is opened showing the contents of the library specific build log file, see next figure for an example. Your favourite editor may be specified by setting the environment variable `EDITOR`.



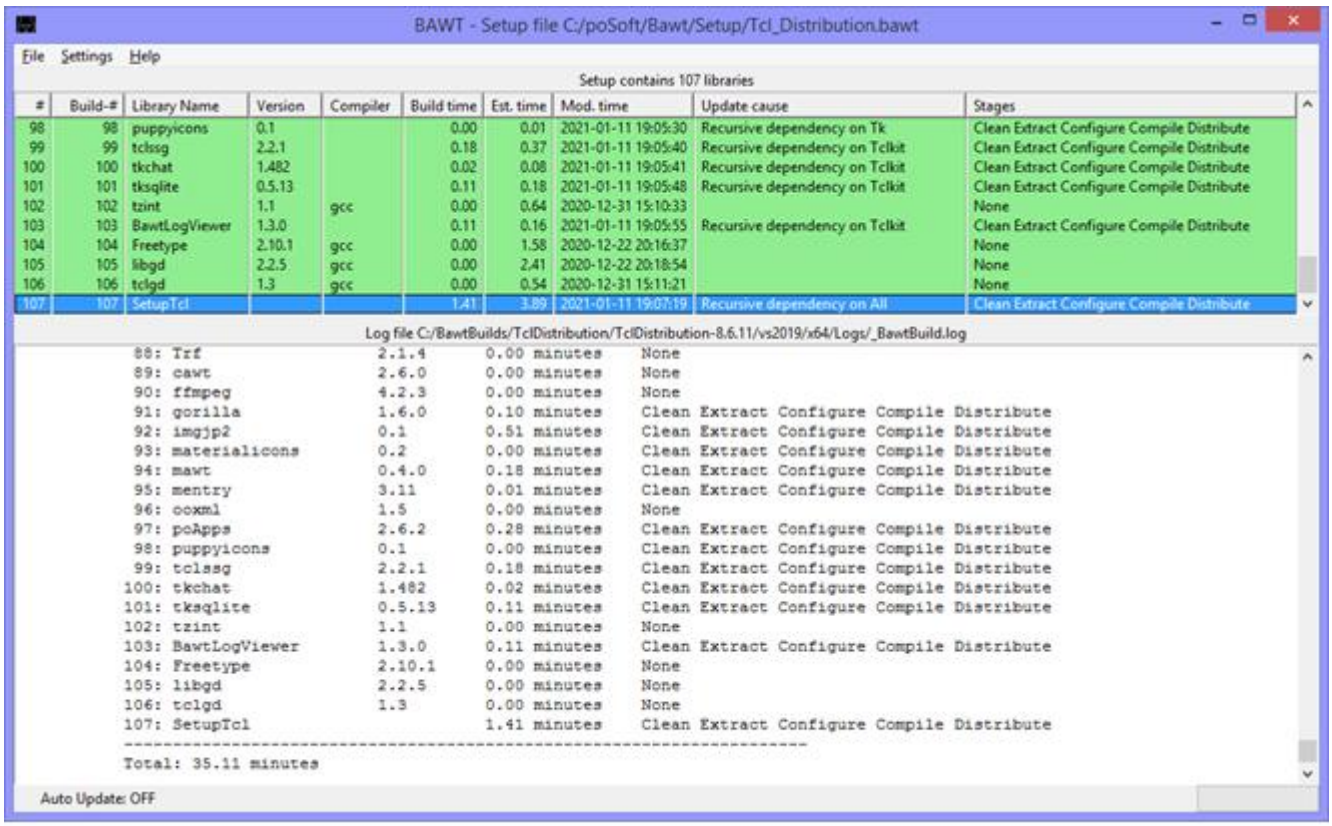
Pressing the right mouse button opens a context menu with the following functionalities:

- Open library specific directories in an Explorer window.
- Open library specific Log, Setup or Build file.
- Open library specific DOS or MSYS shell window.

Pressing a key while the table has focus, selects the next library, which has this key as its first letter. Pressing other keys within the `Key Repeat Time` extends the search string similar to the behaviour of the Windows Explorer. The `Key Repeat Time` can be specified in the `Settings` menu.
Pressing the Return key selects the library currently under build.

Note the following features, which are only available in online mode:

- ***BawtLogViewer*** starts in `Auto Update` mode, where it reloads the log file every 3 seconds. The `Auto Update` mode is automatically switched off when the end of the build process is detected in the log file or it can be switched on or off by selecting the appropriate entry in the `File` menu.
- When reloading the log file, the table row order is always reset to the library build order.
- The accumulated time of the library currently being built is displayed in the status bar of the viewer window and in the corresponding table cell.
- Column Stages is not filled before the end of the build process, see next figure.



The program can be used to detect library build deadlocks by comparing the current build time against an estimated build time. To generate estimated build times, at least one BAWT build has to be performed. After loading the corresponding log files, the build times of this run can be saved in the settings file by selecting `File` menu entry `Save build times`.
These build times are then used as estimated build times in future BAWT builds to compare the current build time of a library against these estimated build times. If the current build time exceeds the estimated time by a specific threshold value (which can be specified in the `Settings` menu), both a visual warning (corresponding row background is set to orange) as well as an acoustic warning (beep) is issued. The acoustic warning can be disabled in the `Settings` menu.

Estimated build times, deadlock parameters and other values like window size and position are stored in the settings files *~/.BawtLogViewer/BawtLogViewer.cfg*.

7 Command Line Options

Calling the ***BAWT*** framework script with command line option `--help` prints the following help message:

```
Usage: Bawt.tcl [Options] SetupFile LibraryName [LibraryNameN]

Start the BAWT automatic library build process.
When using "all" as library name, all libraries specified
in the setup file are built.
It is also possible to specify the numbers of the libraries as printed
by option "--list" or specify a range of numbers (ex: 2-5).
Note, that at least either a list or build action option must be specified.
```

7.1 General Options

Option	Description
`--help`	Print this help message and exit.
`--version`	Print BAWT version and copyright and exit. Use in combination with `--loglevel 0` to just print the version number.
`--procs`	Print all available procedures and exit.
`--proc <str>`	Print documentation of specified procedure and exit.
`--loglevel <int>`	Specify log message verbosity. Choices: 0 - 4. Default: 3.
`--nologtime`	Do not write time strings with log messages. Default: Write time strings. Use this option when comparing log files to have less differences.
`--logviewer`	Start graphical log viewer program ***BawtLogViewer***. Only working, if log level is greater than 1. Default: No.

7.2 List Action Options

Option	Description
`--list`	Print all available library names and versions and exit.
`--platforms`	Print library names, versions and supported platforms.
`--wincompilers`	Print library names, versions and supported Windows compilers.
`--authors`	Print library names, versions and script authors.
`--homepages`	Print library names, versions and homepages.
`--excludes`	Print library names, versions and platform specific excluded libraries.
`--options`	Print library names, versions and library build options.
`--havetest`	Print library names, versions and test procedure availability.
`--dependencies`	Print library names, versions and dependencies.
`--dependency`	Print dependencies of specified target libraries.

The list action options may be accumulated to print several library informations at once.

7.3 Build Action Options

Option	Description
`--clean`	Clean library specific build and install directories.
`--extract`	Extract library source from a ZIP file or a directory.
`--configure`	Perform the configure stage of the build process.
`--compile`	Perform the compile stage of the build process.

`--distribute`	Perform the distribution stage of the build process.
`--finalize`	Generate environment file and call user supplied Finalize procedure.
`--complete`	Perform the following stages in order: clean, extract, configure, compile, distribute, finalize.
`--update`	Perform necessary stages depending on modification times. Note: Global stage finalize is always executed.
`--simulate`	Simulate update action without actually building libraries.
`--touch`	Set modification times of library build directories to current time.
`--test`	Perform library specific test scripts.

7.4 Build Configuration Options

Option	Description
`--architecture <str>`	Build for specified processor architecture. Choices: x86 for 32-bit, x64 for 64-bit. Default: Architecture of the calling tclkit or tclsh.
`--compiler <str>`	Build with specified compiler version. Choices: gcc vs2013 vs2015 vs2017 vs2019 vs2022. Specify primary and secondary compiler by adding a plus sign in between. Example: gcc+vs2022. Default: gcc.
`--gccversion <str>`	Build with specified MinGW gcc version. Windows only. Choices: 7.2.0 8.1.0 11.2.0 12.2.0 13.2.0 14.2.0. Default: 7.2.0.
`--msysversion <str>`	Build with specified MSYS version. Windows only. Choices: 1 2. Default: Version 2 if available, otherwise version 1.
`--tclversion <str>`	Build Tcl, Tk and Tclkit for specified version. Choices: 8.6.7 - 8.6.17, 9.0.1 - 9.0.2. Default: 8.6.17.
`--tkversion <str>`	Build Tk and Tclkit for specified version. Choices: 8.6.7 - 8.6.17, 9.0.1 - 9.0.2. Default: 8.6.17.
`--imgversion <str>`	Build Img for specified version. Choices: 1.4.13 - 1.4.17, 2.0.1 – 2.1.0. Default: 2.1.0.
`--tlsversion <str>`	Build tcltls for specified version. Choices: 1 2. Default: Version 1.
`--osgversion <str>`	Build OpenSceneGraph for specified version. Choices: 3.4.1 3.6.5. Default: 3.6.5.
`--libversion <lib> <str>`	Build library for specified version. Overwrites values specified in Setup file. Default: As specified in Setup file.
`--zipfile <lib> <str>`	Build library from specified file or directory. Overwrites values specified in Setup file. Default: As specified in Setup file.
`--buildtype <str>`	Use specified build type. Choices: Release Debug. Default: Release or as specified in setup file.
`--universal`	Enable universal binary builds.

	Available for Darwin only. Default: Not enabled.
`--mindarwin <str>`	Specify Darwin minimum version to build for. Default: 11.0 (Big Sur).
`--sanitizer`	Enable Address Sanitizer libasan. Only valid with build type Debug. Default: Not enabled.
`--exclude <lib>`	Force exclusion of build for specified library name.
`--wincc <lib> <str>`	Use specified Windows compiler, if supported by build script. Choices: gcc vs.
`--sdk <lib> <str>`	Use specified Microsoft SDK version. To use the SDK version for all libraries, specify "all" as library name.
`--copt <lib> <str>`	Specify library specific user configuration option.
`--user <lib> <str>`	Specify library specific user build file.
`--url <str>`	Specify BAWT download server. Default: https://www.tcl3d.org/bawt/download
`--cacert <str>`	Use specified certificate file as parameter to curl calls. Default: None.
`--toolsdir <str>`	Specify directory containing MSYS/MinGW. Default: [GetOutputToolsDir]
`--rootdir <str>`	Specify build output root directory. Default: [GetOutputRootDir]
`--libdir <str>`	Add a directory containing library source and build files. This option can be called multiple times and adds the new directory to the beginning of the directory list. Default search list: [file join [pwd] “InputLibs”] [file join [GetInputRootDir] “InputLibs”]
`--distdir <str>`	Specify distribution root directory. Default: [file join [GetOutputTypeDir] "Distribution"]
`--finalizefile <str>`	Specify file with user supplied Finalize procedure. Default: None.
`--sort <str>`	Sort libraries according to specified sorting mode. Choices: dependencies dictionary none. Default: dependencies
`--noversion`	Do not use version number for Tcl package directories. Default: Library name and version number.
`--noexit`	Do not exit build process after fatal error, but try to continue. Default: Exit build process after a fatal error.
`--nosetupwarning`	Do not print warnings regarding multiple versions in Setup files. Default: Print warnings.
`--noimportlibs`	Do not create import libraries on Windows. Default: Create import libraries. Needs VisualStudio.
`--noruntimelibs`	Do not copy VisualStudio runtime libraries. Default: Copy runtime libraries. Needs VisualStudio.
`--nostrip`	Do not strip libraries in distribution directory. Default: Strip libraries.
`--noonline`	Do not check or download from online repository. Default: Use https://www.tcl3d.org/bawt/download
`--norecursive`	Do not check recursive dependencies. Default: Use recursive dependencies.

`--nosubdirs`	Do not create compiler and architecture sub directories. Default: Create compiler and architecture sub directories.
`--nouserbuilds`	Do not consider user build files. Default: Consider user build files named *LibraryName_User.bawt*.
`--iconfile <str>`	Use specified icon file for tclkits and starpacks. Default: Standard tclkit icon. Windows only.
`--resourcefile <str>`	Use specified resource file for tclkits and starpacks. Default: Standard tclkit resource file. Windows only.
`--certfile <str>`	Use specified certification file for code signing starpacks. Default: No code signing. Windows only.
`--timestampurl <str>`	Use specified timestamp server for code signing starpacks. Default: http://timestamp.digicert.com. Use empty string to add no timestamp. Windows only.
`--numjobs <int>`	Number of parallel compile jobs. Default: 1
`--libjobs <lib> <int>`	Number of parallel compile jobs for specified library. Default: 1
`--timeout <float>`	Number of seconds to try renaming or deleting directories. Default: 30.0

8 Supported Libraries

List of all libraries (using command line option `--platforms`)

#:	Name	Version	Platforms
1:	apave	4.4.10	Windows Linux Darwin
2:	awthemes	10.4.0	Windows Linux Darwin
3:	BawtLogViewer	3.1.0	Windows Linux Darwin
4:	Blender	3.0.0	Windows
5:	Boost	1.75.0	Windows Linux Darwin
6:	BWidget	1.10.1	Windows Linux Darwin
7:	Cal3D	0.120	Windows Linux
8:	Canvas3d	1.2.3	Windows Linux
9:	cawt	3.1.1	Windows
10:	cawtapp	3.1.1	Windows
11:	ccl	4.0.6	Windows Linux
12:	cffi	2.0.3	Windows Linux Darwin
13:	cfitsio	4.1.0	Windows Linux Darwin
14:	CMake	3.25.2	Windows Linux Darwin
15:	critcl	3.3	Windows Linux Darwin
16:	curl	7.70.0	Windows Linux Darwin
17:	DiffUtil	0.4.3	Windows Linux Darwin
18:	DirectXTex	2021_11	Windows
19:	Doxygen	1.8.15	Windows
20:	Eigen	3.3.9	Windows Linux Darwin
21:	expect	5.45.4.1	Linux Darwin
22:	Ffidl	0.9.1	Windows Linux Darwin
23:	ffmpeg	4.4.4	Windows Linux Darwin
24:	fftw	3.3.9	Windows Linux Darwin
25:	fitsTcl	2.5.1	Windows Linux Darwin
26:	freeglut	3.2.2	Windows Linux Darwin
27:	Freetype	2.13.3	Windows Linux Darwin
28:	FTGL	2.1.3	Windows Linux Darwin
29:	gdal	2.4.4	Windows Linux Darwin
30:	gdi	0.9.9.15	Windows
31:	GeographicLib	1.52	Windows Linux Darwin
32:	GeographicLibData		Windows Linux Darwin
33:	geos	3.7.2	Windows Linux Darwin
34:	giflib	5.2.1	Windows Linux Darwin
35:	Gl2ps	1.4.2	Windows Linux Darwin
36:	GLEW	2.2.0	Windows Linux Darwin
37:	glfw	3.3.8	Windows Linux Darwin
38:	gorilla	1.6.1	Windows Linux Darwin
39:	hdc	0.2.0.1	Windows
40:	Img	2.1.0	Windows Linux Darwin
41:	imgjp2	0.1.1	Windows Linux Darwin
42:	imgtools	0.3.1	Windows Linux Darwin
43:	InnoSetup	6.2.2	Windows
44:	iocp	2.0.2	Windows
45:	itk	4.2.5	Windows Linux Darwin
46:	iwidgets	4.1.2	Windows Linux Darwin
47:	jasper	2.0.25	Windows Linux Darwin
48:	jigsaw	2.0	Windows Linux Darwin
49:	JPEG	9.f	Windows Linux Darwin
50:	KDIS	2.9.0	Windows Linux Darwin
51:	libffi	3.4.8	Windows Linux Darwin
52:	libgd	2.3.2	Windows Linux Darwin
53:	libressl	2.9.2	Windows Linux Darwin
54:	libwebp	1.2.4	Windows Linux Darwin
55:	libxml2	2.10.3	Windows Linux Darwin
56:	materialicons	0.2	Windows Linux Darwin
57:	mawt	0.4.4	Windows Linux Darwin
58:	memchan	2.3.1	Windows Linux Darwin
59:	mentry	4.5	Windows Linux Darwin
60:	Mpexpr	1.2.1	Windows Linux Darwin
61:	mqtt	4.0	Windows Linux Darwin
62:	mupdf	1.26.0	Windows Linux Darwin
63:	MuPDFWidget	2.4	Windows Linux Darwin

```
 64: nacl                1.1.1    Windows Linux Darwin
 65: nsf                 2.4.0    Windows Linux Darwin
 66: OglInfo             1.0.1    Windows Linux Darwin
 67: ooxml               1.10     Windows Linux Darwin
 68: openjpeg            2.5.3    Windows Linux Darwin
 69: OpenSceneGraph      3.6.5    Windows Linux Darwin
 70: OpenSceneGraphData  3.4.0    Windows Linux Darwin
 71: oratcl              4.6.1    Windows Linux Darwin
 72: osgcal              0.2.1    Windows Linux
 73: osgearth            2.10.1   Windows Linux Darwin
 74: pandoc              3.5      Windows Linux Darwin
 75: parse_args          0.5.1    Windows Linux Darwin
 76: pawt                1.2.0    Windows Linux Darwin
 77: pdf4tcl             0.9.4    Windows Linux Darwin
 78: pgintcl             3.5.2    Windows Linux Darwin
 79: photoresize         0.2.1    Windows Linux Darwin
 80: pkgconfig           0.29.2   Darwin
 81: PNG                 1.6.48   Windows Linux Darwin
 82: poApps              3.1.0    Windows Linux Darwin
 83: poClipboardViewer   3.1.0    Windows
 84: poImg               3.0.1    Windows Linux Darwin
 85: poLibs              3.1.0    Windows Linux Darwin
 86: poMemory            1.0.0    Windows Linux Darwin
 87: printer             0.9.6.16 Windows
 88: publisher           2.0      Windows Linux Darwin
 89: puppyicons          0.1      Windows Linux Darwin
 90: Python              3.7.7    Windows
 91: rbc                 0.2      Windows Linux
 92: Redistributables             Windows
 93: rl_json             0.16.0   Windows Linux Darwin
 94: rtext               0.1      Windows Linux Darwin
 95: ruff                2.5.0    Windows Linux Darwin
 96: scrollutil          2.6      Windows Linux Darwin
 97: SDL                 2.26.2   Windows Linux Darwin
 98: SetupPython                  Windows
 99: SetupTcl                     Windows Linux Darwin
100: shellicon           0.1.1    Windows
101: Snack               2.2.12   Windows Linux
102: sqlite3             3.47.1   Windows Linux Darwin
103: SWIG                4.3.1    Windows Linux Darwin
104: tablelist           7.7      Windows Linux Darwin
105: tbcload             1.7.2    Windows Linux Darwin
106: Tcl                 8.6.17   Windows Linux Darwin
107: tcl3dExtended       1.0.1    Windows Linux Darwin
108: tcl3dFull           1.0.1    Windows Linux Darwin
109: tcl9migrate         1.0      Windows Linux Darwin
110: Tcladdressbook      1.2.4    Darwin
111: tclAE               2.0.7    Darwin
112: Tclapplescript      2.2      Darwin
113: tclargp             0.2      Windows Linux Darwin
114: tclcompiler         1.7.4    Windows Linux Darwin
115: tclcsv              2.4.3    Windows Linux Darwin
116: tcldebugger         2.0.1    Windows Linux Darwin
117: tclfpdf             1.7.1    Windows Linux Darwin
118: tclgd               1.4.1    Windows Linux Darwin
119: Tclkit                       Windows Linux Darwin
120: tcllib              2.0      Windows Linux Darwin
121: tclMuPdf            2.5.1    Windows Linux Darwin
122: tclparser           1.9      Windows Linux Darwin
123: tclpy               0.4.1    Windows Linux
124: tclssg              3.0.1    Windows Linux Darwin
125: TclStubs            8.6.17   Windows
126: TclTkManual                  Windows Linux Darwin
127: tcltls              1.7.23   Windows Linux Darwin
128: tcluvc              0.1      Linux
129: tclvfs              1.5.0    Windows Linux Darwin
130: tclws               3.5.0    Windows Linux Darwin
131: tclx                9.0.0    Windows Linux Darwin
132: tdom                0.9.6    Windows Linux Darwin
133: thtmlview           2.0.0    Windows Linux Darwin
134: TIFF                4.7.0    Windows Linux Darwin
```

```
135: tinyxml2            9.0.0    Windows Linux Darwin
136: Tix                 8.4.4    Windows Linux Darwin
137: Tk                  8.6.17   Windows Linux Darwin
138: tkchat              1.482    Windows Linux Darwin
139: tkcon               2.8      Windows Linux Darwin
140: tkdnd               2.9.5    Windows Linux Darwin
141: Tkhtml              3.0.2    Windows Linux Darwin
142: tklib               0.9      Windows Linux Darwin
143: tko                 0.4      Windows Linux Darwin
144: tkpath              0.4.2    Windows Linux Darwin
145: tkribbon            1.2      Windows
146: tksqlite            0.5.14   Windows Linux Darwin
147: TkStubs             8.6.17   Windows
148: tksvg               0.14     Windows Linux Darwin
149: Tktable             2.12     Windows Linux Darwin
150: tkwintrack          2.1.1    Windows Linux
151: treectrl            2.5.1    Windows Linux Darwin
152: Trf                 2.1.4    Windows Linux Darwin
153: trofs               0.4.9    Windows Linux Darwin
154: tserialport         1.1.1    Windows Linux Darwin
155: tsw                 1.2      Windows Linux Darwin
156: twapi               5.1.1    Windows
157: tzint               1.1.1    Windows Linux Darwin
158: udp                 1.0.12   Windows Linux Darwin
159: ukaz                2.1      Windows Linux Darwin
160: vectcl              0.2.1    Windows Linux Darwin
161: Vim                 9.0.0    Windows
162: vlerq               4.1      Windows Linux Darwin
163: wcb                 4.2      Windows Linux Darwin
164: windetect           2.0.1    Windows Linux
165: winhelp             1.1.1    Windows
166: Xerces              3.2.4    Windows Linux Darwin
167: xz                  5.4.1    Windows Linux Darwin
168: yasm                1.3.0    Windows
169: ZLib                1.3.1    Windows Linux Darwin
```

List of all libraries (using command line option `--dependencies`)

```
  #: Name               Version  Dependencies
-------------------------------------------------------------------------------------------------------
-------------------------------------------------
  1: apave              4.4.10   Tk
  2: awthemes           10.4.0   Tk
  3: BawtLogViewer      3.1.0    Tclkit tablelist tkdnd poLibs scrollutil Img rtext
  4: Blender            3.0.0
  5: Boost              1.75.0
  6: BWidget            1.10.1   Tk
  7: Cal3D              0.120    CMake freeglut
  8: Canvas3d           1.2.3    Tk
  9: cawt               3.1.1    Tcl twapi tdom Img tablelist
 10: cawtapp            3.1.1    Tclkit cawt Img tablelist tdom twapi
 11: ccl                4.0.6    CMake
 12: cffi               2.0.3    Tcl libffi
 13: cfitsio            4.1.0
 14: CMake              3.25.2
 15: critcl             3.3      Tcl
 16: curl               7.70.0   libressl
 17: DiffUtil           0.4.3    Tcl
 18: DirectXTex         2021_11
 19: Doxygen            1.8.15
 20: Eigen              3.3.9
 21: expect             5.45.4.1 Tcl
 22: Ffidl              0.9.1    Tcl libffi
 23: ffmpeg             4.4.4    yasm SDL
 24: fftw               3.3.9
 25: fitsTcl            2.5.1    Tcl cfitsio
 26: freeglut           3.2.2    CMake
 27: Freetype           2.13.3   PNG
 28: FTGL               2.1.3    Freetype
 29: gdal               2.4.4    openjpeg
 30: gdi                0.9.9.15 Tk TkStubs
 31: GeographicLib      1.52     CMake
```

```
 32: GeographicLibData           GeographicLib
 33: geos                3.7.2   CMake
 34: giflib              5.2.1
 35: Gl2ps               1.4.2   CMake freeglut PNG ZLib
 36: GLEW                2.2.0   CMake
 37: glfw                3.3.8   CMake
 38: gorilla             1.6.1   Tcl Tclkit
 39: hdc                 0.2.0.1 Tk TkStubs
 40: Img                 2.1.0   Tk TkStubs tcllib
 41: imgjp2              0.1.1   Tk openjpeg
 42: imgtools            0.3.1   Tcl Tk
 43: InnoSetup           6.2.2
 44: iocp                2.0.2   Tcl
 45: itk                 4.2.5   Tk
 46: iwidgets            4.1.2   Tk itk
 47: jasper              2.0.25  CMake JPEG
 48: jigsaw              2.0     Tclkit puppyicons tcllib tklib Img
 49: JPEG                9.f
 50: KDIS                2.9.0   CMake
 51: libffi              3.4.8
 52: libgd               2.3.2   ZLib TIFF JPEG PNG libwebp Freetype
 53: libressl            2.9.2
 54: libwebp             1.2.4
 55: libxml2             2.10.3  CMake Zlib
 56: materialicons       0.2     Tk tdom tksvg
 57: mawt                0.4.4   Tk TkStubs SWIG CMake Img ffmpeg
 58: memchan             2.3.1   Tcl
 59: mentry              4.5     Tk wcb
 60: Mpexpr              1.2.1   Tcl
 61: mqtt                4.0     Tcl
 62: mupdf               1.26.0
 63: MuPDFWidget         2.4     Tk tclMuPdf
 64: nacl                1.1.1   Tcl
 65: nsf                 2.4.0   Tcl
 66: OglInfo             1.0.1   Tclkit tcl3dExtended
 67: ooxml               1.10    Tcl tclvfs tdom
 68: openjpeg            2.5.3   CMake
 69: OpenSceneGraph      3.6.5   CMake ZLib TIFF JPEG jasper giflib PNG curl Freetype ffmpeg
 70: OpenSceneGraphData  3.4.0   OpenSceneGraph
 71: oratcl              4.6.1   Tcl
 72: osgcal              0.2.1   Cal3D OpenSceneGraph
 73: osgearth            2.10.1  CMake curl gdal geos OpenSceneGraph
 74: pandoc              3.5
 75: parse_args          0.5.1   Tcl
 76: pawt                1.2.0   Tcl fitstcl Img
 77: pdf4tcl             0.9.4   Tk
 78: pgintcl             3.5.2   Tcl
 79: photoresize         0.2.1   Tcl Tk
 80: pkgconfig           0.29.2
 81: PNG                 1.6.48  CMake ZLib
 82: poApps              3.1.0   Tclkit tcllib tablelist Img tdom publisher tclMuPdf fitsTcl poImg
poMemory cawt pawt twapi tkdnd tksvg scrollutil rtext
 83: poClipboardViewer   3.1.0   Tclkit cawt tcllib tablelist Img twapi tksvg scrollutil
 84: poImg               3.0.1   Tk
 85: poLibs              3.1.0   Tcl Tk
 86: poMemory            1.0.0   Tcl
 87: printer             0.9.6.16 Tk TkStubs hdc
 88: publisher           2.0     Tcl
 89: puppyicons          0.1     Tk tksvg
 90: Python              3.7.7
 91: rbc                 0.2     Tk
 92: Redistributables
 93: rl_json             0.16.0  Tcl
 94: rtext               0.1     Tcl Tk
 95: ruff                2.5.0   Tcl
 96: scrollutil          2.6     Tk
 97: SDL                 2.26.2  CMake
 98: SetupPython                 Python
 99: SetupTcl                    All
100: shellicon           0.1.1   Tk TkStubs
101: Snack               2.2.12  Tk TkStubs
102: sqlite3             3.47.1
103: SWIG                4.3.1
104: tablelist           7.7     Tk
105: tbcload             1.7.2   Tcl
106: Tcl                 8.6.17
107: tcl3dExtended       1.0.1   CMake Tk TkStubs SWIG Freetype FTGL SDL
108: tcl3dFull           1.0.1   CMake Tk TkStubs SWIG Freetype FTGL SDL OpenSceneGraph
109: tcl9migrate         1.0     Tcl
110: Tcladdressbook      1.2.4   Tcl
```

```
111: tclAE              2.0.7    Tcl
112: Tclapplescript     2.2      Tcl
113: tclargp            0.2      Tcl
114: tclcompiler        1.7.4    Tcl
115: tclcsv             2.4.3    Tcl
116: tcldebugger        2.0.1    Tk Tclkit tcllib tclparser
117: tclfpdf            1.7.1    Tk
118: tclgd              1.4.1    Tcl libgd
119: Tclkit                      Tcl Tk
120: tcllib             2.0      Tcl critcl Tclkit
121: tclMuPdf           2.5.1    Tk TkStubs CMake mupdf publisher
122: tclparser          1.9      Tcl
123: tclpy              0.4.1    Tk TkStubs Python
124: tclssg             3.0.1    Tcl Tclkit tcllib
125: TclStubs           8.6.17
126: TclTkManual                 Tcl Tk
127: tcltls             1.7.23   Tcl libressl
128: tcluvc             0.1      Tcl Tk
129: tclvfs             1.5.0    Tcl
130: tclws              3.5.0    Tcl tdom tcllib
131: tclx               9.0.0    Tcl
132: tdom               0.9.6    Tcl
133: thtmlview          2.0.0    Tk
134: TIFF               4.7.0    JPEG ZLib xz
135: tinyxml2           9.0.0    CMake
136: Tix                8.4.4    Tk
137: Tk                 8.6.17   Tcl
138: tkchat             1.482    Tclkit
139: tkcon              2.8      Tk
140: tkdnd              2.9.5    CMake Tk TkStubs
141: Tkhtml             3.0.2    Tcl Tk
142: tklib              0.9      Tk
143: tko                0.4      Tk
144: tkpath             0.4.2    Tk
145: tkribbon           1.2      Tk TkStubs
146: tksqlite           0.5.14   Tcl Tclkit tablelist Tktable treectrl Img
147: TkStubs            8.6.17   TclStubs
148: tksvg              0.14     Tk
149: Tktable            2.12     Tk
150: tkwintrack         2.1.1    Tk
151: treectrl           2.5.1    Tk
152: Trf                2.1.4    Tcl Zlib
153: trofs              0.4.9    Tk
154: tserialport        1.1.1    Tcl
155: tsw                1.2      Tk
156: twapi              5.1.1    Tcl
157: tzint              1.1.1    Tcl PNG
158: udp                1.0.12   Tcl
159: ukaz               2.1      Tk
160: vectcl             0.2.1    Tcl
161: Vim                9.0.0
162: vlerq              4.1      Tcl
163: wcb                4.2      Tk
164: windetect          2.0.1    Tk
165: winhelp            1.1.1    Tcl Tk
166: Xerces             3.2.4    CMake
167: xz                 5.4.1
168: yasm               1.3.0
169: ZLib               1.3.1
```

List of all libraries (using command line option `--authors`)

```
  #: Name               Version  ScriptAuthor
-------------------------------------------------
  1: apave              4.4.10   Paul Obermeier
  2: awthemes           10.4.0   Paul Obermeier
  3: BawtLogViewer      3.1.0    Paul Obermeier
  4: Blender            3.0.0    Paul Obermeier
  5: Boost              1.75.0   Paul Obermeier
  6: BWidget            1.10.1   Paul Obermeier
  7: Cal3D              0.120    Paul Obermeier
  8: Canvas3d           1.2.3    Paul Obermeier
  9: cawt               3.1.1    Paul Obermeier
 10: cawtapp            3.1.1    Paul Obermeier
 11: ccl                4.0.6    Paul Obermeier
```

```
 12: cffi                2.0.3    Paul Obermeier
 13: cfitsio             4.1.0    Paul Obermeier
 14: CMake               3.25.2   Paul Obermeier
 15: critcl              3.3      Paul Obermeier
 16: curl                7.70.0   Paul Obermeier
 17: DiffUtil            0.4.3    Paul Obermeier
 18: DirectXTex          2021_11  Paul Obermeier
 19: Doxygen             1.8.15   Paul Obermeier
 20: Eigen               3.3.9    Paul Obermeier
 21: expect              5.45.4.1 Paul Obermeier
 22: Ffidl               0.9.1    Paul Obermeier
 23: ffmpeg              4.4.4    Paul Obermeier
 24: fftw                3.3.9    Paul Obermeier
 25: fitsTcl             2.5.1    Paul Obermeier
 26: freeglut            3.2.2    Paul Obermeier
 27: Freetype            2.13.3   Paul Obermeier
 28: FTGL                2.1.3    Paul Obermeier
 29: gdal                2.4.4    Paul Obermeier
 30: gdi                 0.9.9.15 Paul Obermeier
 31: GeographicLib       1.52     Paul Obermeier
 32: GeographicLibData            Paul Obermeier
 33: geos                3.7.2    Paul Obermeier
 34: giflib              5.2.1    Paul Obermeier
 35: Gl2ps               1.4.2    Paul Obermeier
 36: GLEW                2.2.0    Paul Obermeier
 37: glfw                3.3.8    Paul Obermeier
 38: gorilla             1.6.1    Paul Obermeier
 39: hdc                 0.2.0.1  Paul Obermeier
 40: Img                 2.1.0    Paul Obermeier
 41: imgjp2              0.1.1    Paul Obermeier
 42: imgtools            0.3.1    Paul Obermeier
 43: InnoSetup           6.2.2    Paul Obermeier
 44: iocp                2.0.2    Paul Obermeier
 45: itk                 4.2.5    Paul Obermeier
 46: iwidgets            4.1.2    Paul Obermeier
 47: jasper              2.0.25   Paul Obermeier
 48: jigsaw              2.0      Paul Obermeier
 49: JPEG                9.f      Paul Obermeier
 50: KDIS                2.9.0    Paul Obermeier
 51: libffi              3.4.8    Paul Obermeier
 52: libgd               2.3.2    Alexander Schoepe
 53: libressl            2.9.2    Paul Obermeier
 54: libwebp             1.2.4    Paul Obermeier
 55: libxml2             2.10.3   Paul Obermeier
 56: materialicons       0.2      Paul Obermeier
 57: mawt                0.4.4    Paul Obermeier
 58: memchan             2.3.1    Alexander Schoepe
 59: mentry              4.5      Paul Obermeier
 60: Mpexpr              1.2.1    Paul Obermeier
 61: mqtt                4.0      Paul Obermeier
 62: mupdf               1.26.0   Paul Obermeier
 63: MuPDFWidget         2.4      Paul Obermeier
 64: nacl                1.1.1    Paul Obermeier
 65: nsf                 2.4.0    Paul Obermeier
 66: OglInfo             1.0.1    Paul Obermeier
 67: ooxml               1.10     Paul Obermeier
 68: openjpeg            2.5.3    Paul Obermeier
 69: OpenSceneGraph      3.6.5    Paul Obermeier
 70: OpenSceneGraphData  3.4.0    Paul Obermeier
 71: oratcl              4.6.1    Alexander Schoepe
 72: osgcal              0.2.1    Paul Obermeier
 73: osgearth            2.10.1   Paul Obermeier
 74: pandoc              3.5      Paul Obermeier
 75: parse_args          0.5.1    Paul Obermeier
 76: pawt                1.2.0    Paul Obermeier
 77: pdf4tcl             0.9.4    Paul Obermeier
 78: pgintcl             3.5.2    Paul Obermeier
 79: photoresize         0.2.1    Paul Obermeier
 80: pkgconfig           0.29.2   Paul Obermeier
 81: PNG                 1.6.48   Paul Obermeier
 82: poApps              3.1.0    Paul Obermeier
```

```
 83: poClipboardViewer  3.1.0    Paul Obermeier
 84: poImg              3.0.1    Paul Obermeier
 85: poLibs             3.1.0    Paul Obermeier
 86: poMemory           1.0.0    Paul Obermeier
 87: printer            0.9.6.16 Paul Obermeier
 88: publisher          2.0      Paul Obermeier
 89: puppyicons         0.1      Paul Obermeier
 90: Python             3.7.7    Paul Obermeier
 91: rbc                0.2      Alexander Schoepe
 92: Redistributables            Paul Obermeier
 93: rl_json            0.16.0   Paul Obermeier
 94: rtext              0.1      Paul Obermeier
 95: ruff               2.5.0    Paul Obermeier
 96: scrollutil         2.6      Paul Obermeier
 97: SDL                2.26.2   Paul Obermeier
 98: SetupPython                 Paul Obermeier
 99: SetupTcl                    Paul Obermeier
100: shellicon          0.1.1    Paul Obermeier
101: Snack              2.2.12   Paul Obermeier
102: sqlite3            3.47.1   Paul Obermeier
103: SWIG               4.3.1    Paul Obermeier
104: tablelist          7.7      Paul Obermeier
105: tbcload            1.7.2    Alexander Schoepe
106: Tcl                8.6.17   Paul Obermeier
107: tcl3dExtended      1.0.1    Paul Obermeier
108: tcl3dFull          1.0.1    Paul Obermeier
109: tcl9migrate        1.0      Paul Obermeier
110: Tcladdressbook     1.2.4    Alexander Schoepe
111: tclAE              2.0.7    Alexander Schoepe
112: Tclapplescript     2.2      Alexander Schoepe
113: tclargp            0.2      Paul Obermeier
114: tclcompiler        1.7.4    Alexander Schoepe
115: tclcsv             2.4.3    Paul Obermeier
116: tcldebugger        2.0.1    Paul Obermeier
117: tclfpdf            1.7.1    Paul Obermeier
118: tclgd              1.4.1    Alexander Schoepe
119: Tclkit                      Paul Obermeier
120: tcllib             2.0      Paul Obermeier
121: tclMuPdf           2.5.1    Paul Obermeier
122: tclparser          1.9      Alexander Schoepe
123: tclpy              0.4.1    Paul Obermeier
124: tclssg             3.0.1    Paul Obermeier
125: TclStubs           8.6.17   Paul Obermeier
126: TclTkManual                 Paul Obermeier
127: tcltls             1.7.23   Alexander Schoepe
128: tcluvc             0.1      Paul Obermeier
129: tclvfs             1.5.0    Paul Obermeier
130: tclws              3.5.0    Paul Obermeier
131: tclx               9.0.0    Paul Obermeier
132: tdom               0.9.6    Paul Obermeier
133: thtmlview          2.0.0    Paul Obermeier
134: TIFF               4.7.0    Paul Obermeier
135: tinyxml2           9.0.0    Paul Obermeier
136: Tix                8.4.4    Paul Obermeier
137: Tk                 8.6.17   Paul Obermeier
138: tkchat             1.482    Paul Obermeier
139: tkcon              2.8      Paul Obermeier
140: tkdnd              2.9.5    Paul Obermeier
141: Tkhtml             3.0.2    Paul Obermeier
142: tklib              0.9      Paul Obermeier
143: tko                0.4      Paul Obermeier
144: tkpath             0.4.2    Paul Obermeier
145: tkribbon           1.2      Paul Obermeier
146: tksqlite           0.5.14   Paul Obermeier
147: TkStubs            8.6.17   Paul Obermeier
148: tksvg              0.14     Paul Obermeier
149: Tktable            2.12     Paul Obermeier
150: tkwintrack         2.1.1    Paul Obermeier
151: treectrl           2.5.1    Paul Obermeier
152: Trf                2.1.4    Paul Obermeier
153: trofs              0.4.9    Paul Obermeier
```

```
154: tserialport         1.1.1    Alexander Schoepe
155: tsw                 1.2      Paul Obermeier
156: twapi               5.1.1    Paul Obermeier
157: tzint               1.1.1    Alexander Schoepe
158: udp                 1.0.12   Paul Obermeier
159: ukaz                2.1      Paul Obermeier
160: vectcl              0.2.1    Paul Obermeier
161: Vim                 9.0.0    Paul Obermeier
162: vlerq               4.1      Paul Obermeier
163: wcb                 4.2      Paul Obermeier
164: windetect           2.0.1    Paul Obermeier
165: winhelp             1.1.1    Paul Obermeier
166: Xerces              3.2.4    Paul Obermeier
167: xz                  5.4.1    Paul Obermeier
168: yasm                1.3.0    Paul Obermeier
169: ZLib                1.3.1    Paul Obermeier
```

List of all libraries (using command line option `--homepages`)

```
  #: Name               Version  Homepage
-------------------------------------------------------------------------------------------------------
---
  1: apave              4.4.10   https://aplsimple.github.io/en/tcl/pave/index.html
  2: awthemes           10.4.0   https://sourceforge.net/projects/tcl-awthemes/
  3: BawtLogViewer      3.1.0    https://www.tcl3d.org/bawt/
  4: Blender            3.0.0    https://www.blender.org/
  5: Boost              1.75.0   https://www.boost.org/
  6: BWidget            1.10.1   https://core.tcl-lang.org/bwidget/
  7: Cal3D              0.120    https://github.com/mp3butcher/Cal3D
  8: Canvas3d           1.2.3    http://3dcanvas.tcl-lang.org/
  9: cawt               3.1.1    https://www.tcl3d.org/cawt/
 10: cawtapp            3.1.1    https://www.tcl3d.org/cawt/
 11: ccl                4.0.6    https://sourceforge.net/projects/cigi/
 12: cffi               2.0.3    https://github.com/apnadkarni/tcl-cffi
 13: cfitsio            4.1.0    https://heasarc.gsfc.nasa.gov/fitsio/
 14: CMake              3.25.2   https://www.cmake.org/
 15: critcl             3.3      https://andreas-kupries.github.io/critcl/
 16: curl               7.70.0   https://curl.haxx.se/libcurl/
 17: DiffUtil           0.4.3    https://github.com/pspjuth/DiffUtilTcl/
 18: DirectXTex         2021_11  https://github.com/microsoft/DirectXTex/
 19: Doxygen            1.8.15   http://www.doxygen.org/
 20: Eigen              3.3.9    http://eigen.tuxfamily.org/
 21: expect             5.45.4.1 https://sourceforge.net/projects/expect/
 22: Ffidl              0.9.1    https://github.com/prs-de/ffidl
 23: ffmpeg             4.4.4    https://www.ffmpeg.org/
 24: fftw               3.3.9    http://www.fftw.org/
 25: fitsTcl            2.5.1
https://heasarc.gsfc.nasa.gov/docs/software/ftools/fv/fitsTcl_home.html
 26: freeglut           3.2.2    https://sourceforge.net/projects/freeglut/
 27: Freetype           2.13.3   http://www.freetype.org/
 28: FTGL               2.1.3    https://sourceforge.net/projects/ftgl/
 29: gdal               2.4.4    https://www.gdal.org/
 30: gdi                0.9.9.15 http://www.schwartzcomputer.com/tcl-tk/tcl-tk.html
 31: GeographicLib      1.52     https://geographiclib.sourceforge.io/
 32: GeographicLibData           https://geographiclib.sourceforge.io/
 33: geos               3.7.2    http://trac.osgeo.org/geos/
 34: giflib             5.2.1    http://giflib.sourceforge.net/
 35: Gl2ps              1.4.2    http://www.geuz.org/gl2ps/
 36: GLEW               2.2.0    https://github.com/nigels-com/glew/
 37: glfw               3.3.8    https://www.glfw.org/
 38: gorilla            1.6.1    https://github.com/zdia/gorilla/wiki
 39: hdc                0.2.0.1  http://www.schwartzcomputer.com/tcl-tk/tcl-tk.html
 40: Img                2.1.0    https://tkimg.sourceforge.net/
 41: imgjp2             0.1.1    https://www.androwish.org/home/dir?name=jni/imgjp2
 42: imgtools           0.3.1    https://tkimgtools.sourceforge.net/
 43: InnoSetup          6.2.2    http://www.jrsoftware.org/isinfo.php
 44: iocp               2.0.2    https://github.com/apnadkarni/iocp/
 45: itk                4.2.5    https://core.tcl-lang.org/itk/
 46: iwidgets           4.1.2    https://sourceforge.net/projects/incrtcl/
 47: jasper             2.0.25   https://github.com/jasper-software/jasper/
 48: jigsaw             2.0      http://www.easton.me.uk/tcl/jigsaw/index.html
 49: JPEG               9.f      http://www.ijg.org/
 50: KDIS               2.9.0    https://sourceforge.net/projects/kdis/
 51: libffi             3.4.8    https://github.com/libffi/libffi
 52: libgd              2.3.2    https://libgd.github.io
```

```
 53: libressl           2.9.2    https://www.libressl.org/
 54: libwebp            1.2.4    https://developers.google.com/speed/webp/
 55: libxml2            2.10.3   https://gitlab.gnome.org/GNOME/libxml2
 56: materialicons      0.2
https://www.androwish.org/home/dir?ci=tip&name=assets/materialicons0.2
 57: mawt               0.4.4    https://www.tcl3d.org/mawt/
 58: memchan            2.3.1    https://memchan.sourceforge.net/
 59: mentry             4.5      http://www.nemethi.de/
 60: Mpexpr             1.2.1    https://sourceforge.net/projects/mpexpr/
 61: mqtt               4.0      https://chiselapp.com/user/schelte/repository/mqtt/home
 62: mupdf              1.26.0   https://mupdf.com/
 63: MuPDFWidget        2.4      https://sourceforge.net/projects/irrational-numbers/
 64: nacl               1.1.1    https://tcl.sowaswie.de/repos/fossil/nacl/home
 65: nsf                2.4.0    https://next-scripting.org
 66: OglInfo            1.0.1    https://www.tcl3d.org/
 67: ooxml              1.10     https://fossil.sowaswie.de/ooxml/home
 68: openjpeg           2.5.3    http://www.openjpeg.org/
 69: OpenSceneGraph     3.6.5    http://www.openscenegraph.org/
 70: OpenSceneGraphData 3.4.0    http://www.openscenegraph.org/
 71: oratcl             4.6.1    https://github.com/sm-shaw/Oratcl
 72: osgcal             0.2.1    https://sourceforge.net/projects/osgcal/
 73: osgearth           2.10.1   http://osgearth.org/
 74: pandoc             3.5      https://pandoc.org/
 75: parse_args         0.5.1    https://github.com/RubyLane/parse_args
 76: pawt               1.2.0    https://www.tcl3d.org/pawt/
 77: pdf4tcl            0.9.4    https://sourceforge.net/projects/pdf4tcl/
 78: pgintcl            3.5.2    https://sourceforge.net/projects/pgintcl/
 79: photoresize        0.2.1    https://github.com/auriocus/PhotoResize
 80: pkgconfig          0.29.2   https://www.freedesktop.org/wiki/Software/pkg-config/
 81: PNG                1.6.48   http://www.libpng.org/pub/png/
 82: poApps             3.1.0    https://www.tcl3d.org/poApps/
 83: poClipboardViewer  3.1.0    http://www.poSoft.de/
 84: poImg              3.0.1    https://www.tcl3d.org/poPkgs/poImg.html
 85: poLibs             3.1.0    http://www.poSoft.de/
 86: poMemory           1.0.0    https://www.tcl3d.org/poPkgs/poMemory.html
 87: printer            0.9.6.16 http://www.schwartzcomputer.com/tcl-tk/tcl-tk.html
 88: publisher          2.0      https://sourceforge.net/projects/irrational-numbers/
 89: puppyicons         0.1      https://www.androwish.org/home/dir?ci=tip&name=undroid/puppyicons0.1
 90: Python             3.7.7    http://www.python.org/
 91: rbc                0.2      https://www.sourceforge.net/projects/rbctoolkit/
 92: Redistributables            https://learn.microsoft.com/en-us/cpp/windows/latest-supported-vc-
redist
 93: rl_json            0.16.0   https://github.com/RubyLane/rl_json
 94: rtext              0.1      https://chiselapp.com/user/fvogel/repository/rtext
 95: ruff               2.5.0    https://ruff.magicsplat.com/
 96: scrollutil         2.6      http://www.nemethi.de/
 97: SDL                2.26.2   https://www.libsdl.org/
 98: SetupPython                 https://www.tcl3d.org/bawt/
 99: SetupTcl                    https://www.tcl3d.org/bawt/
100: shellicon          0.1.1    http://wiki.tcl-lang.org/17859
101: Snack              2.2.12   https://github.com/scottypitcher/tcl-snack
102: sqlite3            3.47.1   https://www.sqlite.org/
103: SWIG               4.3.1    http://www.swig.org/
104: tablelist          7.7      http://www.nemethi.de/
105: tbcload            1.7.2    https://github.com/ActiveState/teapot/tree/master/lib/tbcload
106: Tcl                8.6.17   https://core.tcl-lang.org/tcl/
107: tcl3dExtended      1.0.1    https://www.tcl3d.org/
108: tcl3dFull          1.0.1    https://www.tcl3d.org/
109: tcl9migrate        1.0      https://github.com/apnadkarni/tcl9-migrate
110: Tcladdressbook     1.2.4    https://sourceforge.net/projects/tcladdressbook/
111: tclAE              2.0.7    https://sourceforge.net/projects/tclae/
112: Tclapplescript     2.2      https://sourceforge.net/projects/tclapplescript/
113: tclargp            0.2      https://wiki.tcl-lang.org/page/argp
114: tclcompiler        1.7.4    https://github.com/ActiveState/teapot/tree/master/lib/tclcompiler
115: tclcsv             2.4.3    https://sourceforge.net/projects/tclcsv
116: tcldebugger        2.0.1    https://github.com/tcltk-depot/tcl-debugger
117: tclfpdf            1.7.1    https://github.com/lamuzzachiodi/tclfpdf
118: tclgd              1.4.1    https://github.com/flightaware/tcl.gd
119: Tclkit                      https://sourceforge.net/projects/kbskit/
120: tcllib             2.0      https://core.tcl-lang.org/tcllib
121: tclMuPdf           2.5.1    https://sourceforge.net/projects/irrational-numbers/
122: tclparser          1.9      https://github.com/tcltk-depot/tcl-parser
123: tclpy              0.4.1    https://github.com/aidanhs/libtclpy
124: tclssg             3.0.1    https://github.com/tclssg/tclssg
125: TclStubs           8.6.17   https://core.tcl-lang.org/tcl/
126: TclTkManual                 http://www.tcl-lang.org
127: tcltls             1.7.23   http://core.tcl-lang.org/tcltls/
128: tcluvc             0.1      https://www.androwish.org/home/dir?ci=tip&name=jni/tcluvc
129: tclvfs             1.5.0    https://core.tcl-lang.org/tclvfs/
130: tclws              3.5.0    https://core.tcl-lang.org/tclws/
```

```
131: tclx               9.0.0    https://github.com/tcltk-depot/tclx
132: tdom               0.9.6    http://tdom.org/
133: thtmlview          2.0.0    https://github.com/mittelmark/thtmlview/
134: TIFF               4.7.0    http://www.simplesystems.org/libtiff/
135: tinyxml2           9.0.0    https://github.com/leethomason/tinyxml2
136: Tix                8.4.4    https://tix.sourceforge.net/
137: Tk                 8.6.17   https://core.tcl-lang.org/tk/
138: tkchat             1.482    http://tkchat.tcl-lang.org/
139: tkcon              2.8      https://github.com/bohagan1/TkCon/
140: tkdnd              2.9.5    https://github.com/petasis/tkdnd
141: Tkhtml             3.0.2    http://tkhtml.tcl.tk/index.html
142: tklib              0.9      https://core.tcl-lang.org/tklib
143: tko                0.4      https://chiselapp.com/user/rene/repository/tko/index
144: tkpath             0.4.2    https://github.com/tcltk-depot/tkpath
145: tkribbon           1.2      https://github.com/petasis/tkribbon
146: tksqlite           0.5.14   http://reddog.s35.xrea.com/wiki/TkSQLite.html
147: TkStubs            8.6.17   https://core.tcl-lang.org/tk/
148: tksvg              0.14     https://github.com/oehhar/tksvg/
149: Tktable            2.12     https://github.com/bohagan1/TkTable/
150: tkwintrack         2.1.1    https://sourceforge.net/projects/tkwintrack/
151: treectrl           2.5.1    https://github.com/tcltk-depot/tktreectrl
152: Trf                2.1.4    https://tcltrf.sourceforge.net/
153: trofs              0.4.9    https://math.nist.gov/~DPorter/tcltk/trofs/
154: tserialport        1.1.1    https://fossil.sowaswie.de/tserialport
155: tsw                1.2      http://www.nemethi.de/
156: twapi              5.1.1    https://github.com/apnadkarni/twapi
157: tzint              1.1.1    https://fossil.sowaswie.de/tzint/
158: udp                1.0.12   https://core.tcl-lang.org/tcludp/
159: ukaz               2.1      https://github.com/auriocus/ukaz
160: vectcl             0.2.1    https://github.com/auriocus/VecTcl/
161: Vim                9.0.0    https://www.vim.org/
162: vlerq              4.1      https://www.equi4.com/vlerq-org/
163: wcb                4.2      http://www.nemethi.de/
164: windetect          2.0.1    https://sourceforge.net/projects/tkwintrack/
165: winhelp            1.1.1    https://www.androwish.org/index.html/dir?name=undroid/winhelp
166: Xerces             3.2.4    http://xerces.apache.org/
167: xz                 5.4.1    https://sourceforge.net/projects/lzmautils/
168: yasm               1.3.0    https://github.com/yasm/yasm/
169: ZLib               1.3.1    http://www.zlib.net/
```

9 MSYS / MinGW Information

This chapter describes the development environments `MSYS` and `MinGW`. These packages provide an environment using the GNU compiler collection (`gcc`) to build typical Open Source projects like ***Tcl/Tk*** under Windows.

9.1 Introduction

MSYS

MSYS, a contraction of "Minimal SYStem", is a Bourne Shell command line interpreter system. Offered as an alternative to Microsoft's cmd.exe, this provides a general purpose command line environment, which is particularly suited to use with MinGW, for porting of many Open Source applications to the MS-Windows platform.

MSYS is a collection of Unix tools for Windows. It contains all tools which are needed for the typical build process using the `configure / make` toolset.

Examples: `autogen, cp, rm, mv, mkdir, m4, make`

`MSYS` is available as 32-bit version only. This version can be used in conjunction with both the 32-bit and 64-bit version of `MinGW`.

MSYS2

MSYS2 is a newer version of MSYS.
It is available from https://www.msys2.org/.

MinGW

Short description from the homepage of MinGW-w64: https://sourceforge.net/projects/mingw-w64/

MinGW, a contraction of "Minimalist GNU for Windows", is a minimalist development environment for native Microsoft Windows applications.

MinGW provides a complete Open Source programming tool set which is suitable for the development of native MS-Windows applications, and which do not depend on any 3rd-party C-Runtime DLLs. (It does depend on a number of DLLs provided by Microsoft themselves, as components of the operating system; most notable among these is MSVCRT.DLL, the Microsoft C runtime library. Additionally, threaded applications must ship with a freely distributable thread support DLL, provided as part of MinGW itself).

MinGW compilers provide access to the functionality of the Microsoft C runtime and some language-specific runtimes. MinGW, being Minimalist, does not, and never will, attempt to provide a POSIX runtime environment for POSIX application deployment on MS-Windows.

`MinGW` provides the GNU Compiler Collection `gcc` for Windows. The SourceForge project `MinGW-w64` supplies 32-bit and 64-bit versions of `gcc`.

The `MinGW-w64` project also supplies an extended version of `MSYS` (see chapter *9.2 Installation* below for details).

9.2 Installation of MSYS

The following instructions were used to create the BAWT MSYS/MinGW distributions for gcc versions 4.9.2, 5.2.0, 7.2.0 and 8.1.0.

9.2.1 Download MSYS

Entry page:
https://sourceforge.net/projects/mingwbuilds/files/external-binary-packages/

File: *msys+7za+wget+svn+git+mercurial+cvs-rev13.7z*

Link:
https://sourceforge.net/projects/mingwbuilds/files/external-binary-packages/msys%2B7za%2Bwget%2Bsvn%2Bgit%2Bmercurial%2Bcvs-rev13.7z/download

9.2.2 Download MinGW

Entry page for 32-bit version:
https://sourceforge.net/projects/mingw-w64/files/Toolchains%20targetting%20Win32/Personal%20Builds/mingw-builds/

Entry page for 64-bit version:
https://sourceforge.net/projects/mingw-w64/files/Toolchains%20targetting%20Win64/Personal%20Builds/mingw-builds/

32-bit gcc 4.9.2

File: *i686-4.9.2-release-posix-dwarf-rt_v4-rev4.7z*

Link:
https://sourceforge.net/projects/mingw-w64/files/Toolchains%20targetting%20Win32/Personal%20Builds/mingw-builds/4.9.2/threads-posix/dwarf/i686-4.9.2-release-posix-dwarf-rt_v4-rev4.7z/download

32-bit gcc 5.2.0

File: *i686-5.2.0-release-posix-dwarf-rt_v4-rev0.7z*

Link:
https://sourceforge.net/projects/mingw-w64/files/Toolchains%20targetting%20Win32/Personal%20Builds/mingw-builds/5.2.0/threads-posix/dwarf/i686-5.2.0-release-posix-dwarf-rt_v4-rev0.7z/download

32-bit gcc 7.2.0

File: *i686-7.2.0-release-posix-dwarf-rt_v5-rev1.7z*

Link:
https://sourceforge.net/projects/mingw-w64/files/Toolchains%20targetting%20Win32/Personal%20Builds/mingw-builds/7.2.0/threads-posix/dwarf/i686-7.2.0-release-posix-dwarf-rt_v5-rev1.7z/download

32-bit gcc 8.1.0

File: *i686-8.1.0-release-posix-dwarf-rt_v6-rev0.7z*

Link:
https://sourceforge.net/projects/mingw-w64/files/Toolchains%20targetting%20Win32/Personal%20Builds/mingw-builds/8.1.0/threads-posix/dwarf/i686-8.1.0-release-posix-dwarf-rt_v6-rev0.7z/download

64-bit gcc 4.9.2
File: *x86_64-4.9.2-release-posix-seh-rt_v4-rev4.7z*

Link:
https://sourceforge.net/projects/mingw-w64/files/Toolchains%20targetting%20Win64/Personal%20Builds/mingw-builds/4.9.2/threads-posix/seh/x86_64-4.9.2-release-posix-seh-rt_v4-rev4.7z/download

64-bit gcc 5.2.0
File: *x86_64-5.2.0-release-posix-seh-rt_v4-rev0.7z*

Link:
https://sourceforge.net/projects/mingw-w64/files/Toolchains%20targetting%20Win64/Personal%20Builds/mingw-builds/5.2.0/threads-posix/seh/x86_64-5.2.0-release-posix-seh-rt_v4-rev0.7z/download

64-bit gcc 7.2.0
File: *x86_64-7.2.0-release-posix-seh-rt_v5-rev1.7z*

Link:
https://sourceforge.net/projects/mingw-w64/files/Toolchains%20targetting%20Win64/Personal%20Builds/mingw-builds/7.2.0/threads-posix/seh/x86_64-7.2.0-release-posix-seh-rt_v5-rev1.7z/download

64-bit gcc 8.1.0
File: *x86_64-8.1.0-release-posix-seh-rt_v6-rev0.7z*

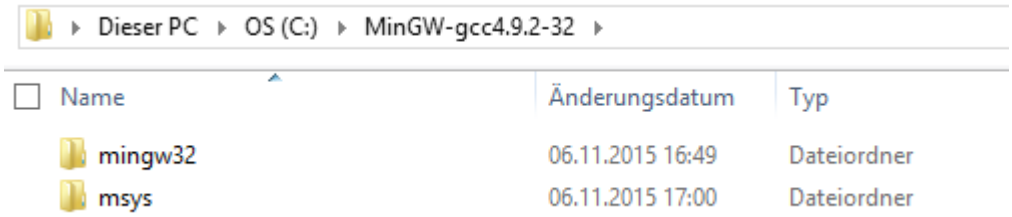
Link:
https://sourceforge.net/projects/mingw-w64/files/Toolchains%20targetting%20Win64/Personal%20Builds/mingw-builds/8.1.0/threads-posix/seh/x86_64-8.1.0-release-posix-seh-rt_v6-rev0.7z/download

9.2.3 Configuration

The following instructions use the 32-bit version of gcc 4.9.2. Installation is done on drive C: Adapt file and directory names accordingly, when using other versions.

- Create directory `C:\MinGW-gcc4.9.2-32`
- Extract downloaded MinGW file in directory `C:\MinGW-gcc4.9.2-32`
- Extract downloaded MSYS file in directory `C:\MinGW-gcc4.9.2-32`

Your directory structure should now look as follows:



Insert the next two lines into file `C:\MinGW-gcc4.9.2-32\msys\etc\fstab`

```
# Win32_Path                    Mount_Point
C:/MinGW-gcc4.9.2-32/mingw32    /mingw
```

Start the MSYS Shell by double-clicking onto file `C:\MinGW-gcc4.9.2-32\msys\msys.bat`
You may create a shortcut of `msys.bat` on your desktop for easier access.

9.3 Installation of MSYS2

The following instructions were used to create the BAWT MSYS/MinGW distributions for gcc versions 11.2.0, 12.2.0, 13.2.0 and 14.2.0.

Download the newest MSYS2 32-bit installer.
Change the gcc versions as appropriate.

9.3.1 MSYS2/MinGW 64-bit

- Execute the installer program and install into `C:\gcc13.2.0_x86_64-w64-mingw32`
- After installation perform the following commands to update the packages and add additional packages needed for BAWT.

```
> pacman -Syu
```

- Run "MSYS2 MSYS" from Start menu.
- Update the rest of the base packages:

```
> pacman -Su
```

- Install additional tools:

```
> pacman -S --needed base-devel
> pacman -S zip
```

- Install compiler for 64-bit:

```
> pacman -S --needed mingw-w64-x86_64-toolchain
```

- Select the following packages:
  mingw-w64-x86_64-binutils
  mingw-w64-x86_64-gcc
  mingw-w64-x86_64-make
  mingw-w64-x86_64-pkgconf
  mingw-w64-x86_64-tools-git

- Quit MSYS shell.

- Make adjustments for BAWT usage:
  Remove file InstallationLog.txt
  Remove directories mingw32 and installerResources.
  Create directory msys32 and move all files and directories except mingw64 into msys32.
  Remove subdirectory "User" from msys32/home.

- Create 7z file of `C:\gcc13.2.0_x86_64-w64-mingw32` using Ultra compression.

9.3.2 MSYS2/MinGW 32-bit

- Execute the installer program and install into `C:\gcc13.2.0_i686-w64-mingw32`
- After installation perform the following commands to update the packages and add additional packages needed for BAWT.

```
> pacman -Syu
```

- Run "MSYS2 MSYS" from Start menu.
- Update the rest of the base packages:

```
> pacman -Su
```

- Install additional tools:

```
> pacman -S --needed base-devel
> pacman -S zip
```

- Install compiler for 32-bit:

```
> pacman -S --needed mingw-w64-i686-toolchain
```

- Select the following packages:
  mingw-w64-i686-binutils
  mingw-w64-i686-gcc
  mingw-w64-i686-make
  mingw-w64-i686-pkgconf
  mingw-w64-i686-tools-git

- Quit MSYS shell.

- Make adjustments for BAWT usage:
  Remove file InstallationLog.txt
  Remove directories mingw64 and installerResources.
  Create directory msys32 and move all files and directories except mingw32 into msys32.
  Remove subdirectory "User" from msys32/home.

- Create 7z file of `C:\gcc13.2.0_i686-w64-mingw32` using Ultra compression.

9.4 Further Informations

Source: https://sourceforge.net/p/mingw-w64/wiki2/MSYS/

9.4.1 What is MSYS

MSYS is a Minimal SYStem, providing several crucial unix utilities under a compatibility layer (the msys-1.0.dll file). MSYS should provide everything to make compilation of common GNU software.

MSYS provided by the mingw-w64/w32 project

This package is not more than a collection of the 50+ packages provided by mingw.org. It was created as a (huge) convenience to our users, to let them be productive instead of downloading every part separately. The accompanying sources are also provided and can be found in the same download section as mentioned above.

This package is 32-bit, but will run flawlessly on x64 Windows. There will never be a 64-bit native MSYS (is there any need?) because the only compiler capable of building MSYS applications is the outdated gcc 3.4.4, which does not support x64 native Windows targets.

9.4.2 Where to get MSYS

There are three places you can get MSYS:

- The MinGW project, with separate packages of all official MSYS packages. Takes a long time to download and install everything.
- The all-in-one package on the MinGW-w64 download page. It is updated on request (see third option for very up to date collection)
- MinGW-builds provides an ultra-inclusive MSYS package with a bunch of additional useful stuff.

9.4.3 How to use MSYS

Installing MSYS is quite easy.

- You'll need to download the above package.
- Unzip it somewhere, for example C:\msys so that C:\msys\bin contains (among others) bash.exe.
- Doubleclick (or make a handy shortcut and run that) on C:\msys\msys.bat.
- Type sh /postinstall/pi.sh
- Answer the friendly questions and you're all set up.

Mingw-w64/w32 specifics

When running an autotools configure script, these options will come in handy:

- for a 64-bit build: --host=x86_64-w64-mingw32
- for a 32-bit build: --host=i686-w64-mingw32

If you are experiencing problems, you can also set --build to the same value. Some configure scripts also use --target instead of --host. Use configure --help to get all possible options.

--host, --target, and --build explained

--host specifies on what platform/architecture the compiled program is going to run. --target specifies the platform/architecture that the program should be configured for and will be compiled for. This should only have effect when building cross-compilers. --build specifies the platform/architecture the build process is going to be executed.

10 Release history

The following table gives an overview of the release history of ***BAWT***. For detailed release information see the BAWT homepage.

Version	Date	Release notes
0.1.0	2016-06-24	First version introduced at EuroTcl 2016 in Eindhoven.
0.2.0	2016-08-27	Improved build actions. New and updated libraries.
0.3.0	2016-10-23	Improved build actions. New and updated libraries.
0.4.0	2016-12-28	Improved build actions. New and updated libraries.
0.5.0	2017-03-19	Improved build actions. New and updated libraries.
0.6.0	2017-07-20	Improved build actions. New and updated libraries.
0.7.0	2017-08-26	Improved build actions. New and updated libraries.
0.7.1	2017-09-12	Support for Tcl/Tk 8.7.
0.7.2	2017-09-24	Support for Visual Studio 2017.
0.7.3	2018-01-04	Tcl/Tk 8.6.8. New and updated libraries.
0.8.0	2018-07-04	Support for nested Setup files. New and updated libraries.
0.9.0	2018-12-28	Tcl/Tk 8.6.9. New and updated libraries.
0.9.1	2019-03-09	Better support for Debug build mode. New and updated libraries.
1.0.0	2019-06-23	Several incompatible changes. Support for Visual Studio 2019.
1.1.0	2019-12-28	Tcl/Tk 8.6.10. Improved MinGW support for several libraries. New and updated libraries.
1.1.1	2020-01-12	Improved handling of C++ based Tcl extensions.
1.1.2	2020-02-16	Improved BawtLogViewer. New and updated libraries.
1.1.3	2020-03-15	Improved Linux build. Updated libraries.
1.1.4	2020-05-02	Improved MinGW support for several libraries. New and updated libraries.
1.2.0	2020-06-09	Additional MSYS2 support. New and updated libraries.
1.2.1	2020-09-05	Support for Tcl/Tk 8.7a4. New and updated libraries.
1.3.0	2021-01-08	Support for Tcl/Tk 8.6.11. Improved support for Tcl/Tk 8.7.a4. New and updated libraries.
2.0.0	2021-08-22	Support for primary and secondary compiler on Windows. Tcl/Tk 8.7.a5. New and updated libraries.
2.1.0	2021-12-28	Support for Tcl/Tk 8.6.12. New and updated libraries.
2.2.0	2022-04-15	Support for MinGW gcc 11. New and updated libraries.
2.2.1	2022-07-17	Maintenance release. New and updated libraries.
2.3.0	2022-12-18	Support for Tcl/Tk 8.6.13 and Apple Silicon (ARM). New and updated libraries.
2.3.1	2023-01-19	Maintenance release. New and updated libraries.
3.0.0	2024-12-28	Major release. Support for Tcl/Tk 9, Linux ARM and RISC-V. New and updated libraries.
3.0.1	2024-12-31	Patch release. Prefer BAWT supplied zip program on Windows.
3.1.0	2025-08-24	Maintenance release. Support for Tcl/Tk 8.6.17 and 9.0.2.