User Manual

This manual documents the administration and use of the TinyCOBOL compiler, version 0.61.

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About This Manual

What is TinyCOBOL

TinyCOBOL is an Open Source COBOL compiler released under the GNU license. The long-term goal of the developers it to create a COBOL compiler that is reasonably close to the COBOL 85 standards.

Who Should Use This Manual

This manual is written for TinyCOBOL administrators and programmers. This manual assumes that the administrator or programmer does not have a strong knowledge Linux or FreeBSD, so some sections over-describes basic procedures.

Platforms Discussed in This Manual

This manual only covers the Linux implementation and the FreeBSD port of TinyCOBOL. TinyCOBOL has also been ported to Windows using Open Systems emulators. It has also been ported to BeOS.

Writing Conventions

System commands are written in mono spaced, bold font. Program names, file names and command parameters are written in italics. So *htcobol* is the name of an executable program, and `htcobol` is the command that executes the *htcobol* program.

TinyCOBOL Contributors

Project Creator

Pragana, Rildo

Source Code

Bizzarri, Paolo - Several RTS patches

Bufford, Sean - Patch to fix indexed file index file I/O offset calculation

Cameron, Andrew - RTS file I/O, initial DB 1.85.4 for Win32 ports, lock server and client code

Colbert, Glen - Initial code for command line front end and for regression test suite

Connolly, Stephen

Cox, Alan - Initial code to generate GNU assembler

Essex, David - Preprocessor, math grammar generation, RTS

Giroud, Bernard - Intrinsic functions, finished CALL statement, many little clauses for Cobol 85, RTS fixes, test suite

Hollard, Gerard - Qualification problem fix

Lucari, Alain - Fixes for write with advancing

Mobach, Fred - Resident COBOL standard expert

Morcombe, Jim - External file MF compatibility option

Nishida, Keisuke - Grammar and miscellaneous fixes

Noeth, Jim - Move routines in RTS (Run Time System)

Pragana, Rildo - Scanner and parser code, RTS

Pegueroles, Ferran - RTS curses functionality for Screen I/O, DISPLAY and ACCEPT, majority of intrinsic functions

Smith, Jeff - RTS math

Stakaowski, Mariusz - INSPECT TALLYING

Tweedy, Laura - Initial lex code for preprocessor and cobf2f utility

Binary Packages

Billsbrough, David - Sample spec file for RPM version 4 format

Douthitt, David - libc6 RPM packages for releases

Essex, David - libc5 RPM packages, Win32 packages (MinGW, Cygwin)

Manzo, Luciano D. C. - Initial spec file to create RPMs

Pegueroles, Ferran - Debian packages

Takahashi, Keiichi - libc6 RPM packages

O/S Ports

Cameron, Andrew - Win32 Cygwin port

Cox, Alan - Initial Linux port

Essex, David - Win32 MinGW port

Gardella, Patrick - FreeBSD port and configuration

Verran, Matt - BeOS port and configuration

Documentation

Ball, Scott – TinyCOBOL User Manual

Giroud, Bernard -- French man files

Martínez, Juan J. - Spanish *man* files, Spanish version of *Introduction to COBOL and TinyCOBOL*

Reis, Hudson - Portuguese version of *man* files, Portuguese version of *Introduction to COBOL and TinyCOBOL*

Riddell, Jonathan - *Introduction to COBOL and TinyCOBOL*

Rizzini, Mario Lodi -- Italian version of *man* files

Teatini, Fabio -- Italian version of *Introduction to COBOL and TinyCOBOL*

Contents

Introduction

GNU Software

The TinyCOBOL compiler is licensed under the GPL license and the TinyCOBOL run-time library is licensed under the LGPL license. For more information about these licenses, see the GNU website at http://www.gnu.org

Licensing

The TinyCOBOL run-time library is distributed under the LGPL, and does not impose license restrictions on compiled binaries.

The Berkeley DB is needed to run TinyCOBOL. Note that only Berkeley DB version 1.85.x and 1.86 are released under the LGPL. More recent releases of Berkeley DB have a more restrictive license requiring you to release your source code with your executables if you distribute your programs. If you use a more recent release of Berkeley DB and you do not want to release your source code, you must purchase a license from Sleepycat Software. See the licensing requirements at <http://www.sleepycat.com>.

TinyCOBOL Language Standards

ISO IEC 1989:1995: Programming Languages – COBOL.

ISO IEC 1989/AMD1:1992: Programming Languages – COBOL. Amendment 1 – Intrinsic function module.

ANSI X3.23-1985: Programming Languages – COBOL.

ANSI X23a-1998: Programming Languages – COBOL. Amendment 1: Intrinsic function module.

X/Open XPG3: COBOL programming language extensions.

How You Can Contribute to the TinyCOBOL Project

The TinyCOBOL project can use your experience. The workplace for TinyCOBOL is sourceforge. The project can use developers, testers and technical writers. You don't need a lot of experience.

The easiest way to start is by opening the TinyCOBOL home page, http://www.tinycobol.org and then opening the mailing list link. Subscribe to the Tiny-cobol-users mailing list, spend some time looking through the archives to see what we people are doing, and then send note to introduce yourself.

Where to Get Help

The best source for help is the TinyCOBOL mailing list described above. This is a very active user list. Please check this user manual and the TinyCOBOL.org website before submitting questions to the user group.   When sending a question to the user group, consider giving the name and version of your operating system, the TinyCOBOL version number.

Where to Post TinyCOBOL Bugs

Two places are available for posting TinyCOBOL bugs.

The TinyCOBOL bug tracker is available in sourceforge.net at
http://sourceforge.net/tracker/?group_id=383&atid=100383

Bugs can also be posted in the TinyCOBOL users mailing list described above. An execution log can often be helpful. On most systems, an execution log can be generated by using the *script* command as follows:

```
$ script
```

```
$ [run your command or commands]
```

```
$ exit
```

This will generate a log file named *typescript.*. Attach *typescript* to your post in the TinyCOBOL users mailing list.

Note to BSD Users About *make*

BSD *make* is different from *make* on Linux and does not work the same. Where this User Manual refers to *make*, substitute *gmake*.

Supported Environments

Hardware Architecture

The current version of TinyCOBOL compiler creates GNU assembler and machine code for the Intel IA32 (x86) architecture. No other hardware platforms are supported at this time.

Operating Systems

Ports have been made to the following operating systems. All ports use *gcc*

- BeOS
- BSD
- Linux
- Win32 using MinGW (Mingw32) native Win32 compiler
- Win32 using Cygwin

Runtime environment

Environment Summary

Required Libraries

l*ibhtcobol.so* – Soft link to TinyCOBOL run-time

l*ibhtcobol.so.0* – Soft link to TinyCOBOL run-time

l*ibhtcobol.so.0.61.x* - TinyCOBOL run-time (version 0.61.x)

libc.so - GNU C

libdl.so - Dynamic loader

libm.so - GNU C math

libdb.so - Berkeley's DB API (this is sometimes a soft link)

libncurses.so - Curses for screen I/O

ld-linux.so - Linux loader (Linux O/Ses only)

Environment Variables

All environment variables are optional.

TCOB_OPTIONS - Resource options file name

TCOB_OPTIONS_PATH - Directory path to the resource options file

TCOB_PP_PATH - Preprocessor directory path

TCOB_LD_LIBRARY_PATH – Directory path to the dynamically loaded libraries

TEMP - Directory path to the temporary files

Default Directory Structure from *tarball* and FreeBSD *sysinstall*

/usr/local/bin/ – Compiler location

/usr/local/lib/ – Runtime libraries location

/usr/local/share/htcobol/ – Preprocessor, resource file

/usr/local/share/htcobol/copybooks/ - Default copybook library

Default Directory Structure from RPM

/usr/bin/ – Compiler location

/usr/lib/ – Runtime libraries location

/usr/share/htcobol/ – Preprocessor, resource files

/usr/share/htcobol/copybooks/ – Copybook default library

/usr/share/doc/tinycobol-0.61/ – Documentation, readme, release notes

Files

htcobolrc – Default runtime library

External Programs

lockserver – A daemon for handling record locking

Environment Details

libhtcobol.so, libhtcobol.so.0, libhtcobol.so.0.61.x

The TinyCOBOL run-time libraries.

libhtcobol.so.0.61.x is the runtime library used by the 0.61.x version of TC. *libhtcobol.so* and *libhtcobol.so.0* are soft links to *libhtcobol.so.0.61.x*.

libc.so

The GNU C runtime library.

libdl.so

The dynamic loader library.

The compiler uses the *dl* program to dynamically load other programs. Parameters from *htcobolrc* are passed to *dl*. The parameters are modified under some circumstances.

libm.so

The GNU C math library.

libdb.so

The library for Berkeley DB. Use version 1.85.4 or newer.

On some systems, this will be a link to another library because the actual library was given another name. The TinyCOBOL *INSTALL* file has more information on this and so does the section in this User Manual titled "Berkeley DB."

Berkeley DB is required for the use of indexed files.

libncurses.so

The PDcurses library which is used for screen I/O. Use version 2.4 or newer. A section on screen I/O is included in this manual. PDcurses is available through the TinyCOBOL.org download page.

ld-linux.so

The Linux loader . This is not needed by FreeBSD.

TCOB_OPTIONS

The environment variable used to override the name of the resource options file.

If this variable is not defined, the name of the resource option file is *htcobolrc*.

TCOB_OPTIONS_PATH

The environment Directory path to the resource options file.

If this variable is not defined, the path to the resource options file is

/usr/local/share/htcobol/ for tarball and FreeBSD installations or

/usr/share/htcobol/ for RPM installations.

TCOB_PP_PATH

The path to the preprocessor.

If this variable is not defined, the path to the preprocessor is

/usr/local/share/htcobol/ for tarball and FreeBSD installations or

/usr/share/htcobol/ for RPM installations.

TCOB_LD_LIBRARY_PATH

The path to the dynamically loaded libraries.

If this variable is not defined, the path to the load library is

/usr/local/lib/ for tarball and FreeBSD installations or

/usr/lib/ for RPM installations.

TEMP

The path to the temporary files created by the TC compiler.

htcobolrc

The file containing the default values for the compiler options. A section on *htcobolrc* is included in this manual.

lockserver

A daemon which handles record locking services for indexed files. *lockserver* must be installed and running before TinyCOBOL programs can user record locking on indexed files. A section on the lockserver is included in this manual.

Installation

The TinyCOBOL compiler can be installed by compiling the source code or by using a prepackaged binary installation such as RPM on Redhat Linux.

An RPM binary installation can work for Linux, but only if the RPM is built specifically for the system that TinyCOBOL is being installed onto. An RPM installation can be challenging, if not impractical, because of software version dependencies.

People experienced with software installation on Linux and BSD recommend installing TinyCOBOL by compiling the source code. Compiling is the simpler and more reliable installation method.

Building TinyCOBOL

Building TinyCOBOL by compiling the source can be a challenging task. The main challenge is putting the Berkeley DB files in the right directories. The TinyCOBOL *configure* script checks for the Berkeley DB libraries, *libdb*.**, in the */usr/local* directory. If they are located somewhere else on your system, you will modify, either to the *configure* script, the location of *libdb*.*,* or both, as described later in this section.

The *configure* script will also verify that your system's Berkeley DB is compatible with Berkeley DB version 1.85.4. If your system's Berkeley DB is not compatible, you will must either install a compatible version or reinstall your current version with a version 1.85 compatibility flag. The *configure* script will also check for a usable Berkeley DB header file. The header file must be in either */usr/include* or */usr/include/db**, where * is "1", "2", "3", or "4".

BSD presents another small challenge. The *configure* and *make* scripts are designed to use the dynamic linker, *dl*, which is in *libdl.so*. BSD does not have *dl* or *libdl.so*. Fortunately, BSD does not need *dl*, because it uses a different dynamic linker. A few minor modifications are needed in the *configure*, *Makefile*, and post installation test scripts to work around this challenge. The modifications are described later in this section.

Compiler requirements

Most of the requirements for compiling TinyCOBOL are included in the installation notes that come with the TinyCOBOL source code package. This section will cover some of the basics, so people who are less experienced with Linux and BSD can do a compiled installation.

You will need:

- The TinyCOBOL v 0.61.x source code package. This can be downloaded from the TinyCOBOL.org homepage. You can use either *tinycobol-0.61.tar.gz* or *tinycobol-0.61.src.rpm*. This manual will only address *tinycobol-0.61.tar.gz.*

- *flex* the lexical analyzer must be installed on the target system. Another lexical analyzer can be substituted if you know what you are doing. This manual will only address *flex*. Verify that *flex* is installed by executing:

  ```
  flex --version
  ```

- A special version of yacc version 1.9.3, the compiler compiler, must be installed. This is named *yacc193* to avoid confusion with other *yacc* programs. This manual will only address *yacc193*. Other versions of *yacc* won't work with TinyCOBOL because they aren't robust enough for COBOL's syntax. *bison* may also work, but the TinyCOBOL developers found that *yacc* is more stable. *yacc193* should be downloaded from the TinyCOBOL home page because the home page version is the same version used by the TinyCOBOL compiler developers.

- Berkeley DB is needed for reading and writing indexed files. The TinyCOBOL compiler requires the Berkeley DB C header file named *db.h* or *db_185.h*. The TinyCOBOL installation process will verify that the appropriate header is on your system.

- A C language compiler. While a number of C compilers might work, GNU C is the default and is recommended. This manual will only address GNU C.. As of this writing, GNU C versions 3.2.x are highly recommended because the compler developers use these versions. More recent versions such as 3.3.x may have some compatibility problems due to changing C standards.

- Miscellaneous utilities that should come with your O/S distribution.

- BSD users will need *gmake*. Where this documentation refers to *make*, BSD users should substitute *gmake*. BSD has a *make* utility, but it is different from the Linux *make*. ***BSD* make *and Linux* make *do not work the same way and are not compatible.***

- The program *lockserver* is needed by TinyCOBOL programs that use record locking. *lockserver* is a server that must be started before a TinyCOBOL program can do record locking. Your system probably does not have *lockserver* installed on it. If you know your system will never use record locking, *lockserver* installation is not necessary. **lockserver *v 1.0* does not seem to work with FreeBSD. Installing lockserver *on FreeBSD may make the compiler unusable.***

Installing *flex*

If *flex* isn't already installed, locate and install an appropriate *flex* for your system. The installation of *flex* is outside of the scope of this user manual.

Installing *yacc193*

yacc193 is usually easy to install.

After downloading *yacc-1.9.3-1.tar.gz* from the TinyCOBOL.org Downloads page, from a command line **cd** into its directory and execute:

```
tar -xvf yacc-1.9.3-1.tar
```

This will unpack and unarchive the TinyCOBOL *yacc193* source files and build files.

cd into the *yacc-1.9.3* directory.

Read the installation instructions in the *INSTALL.txt* file, then read the following before installing.

You must have write permission to the system executables directory to install. If your user id doesn't have write permissions, **su** to root to install.

make install will put the *yacc193* man files into directory */usr/man/man1*. Verify that your system has a */usr/man/man1* directory. If your system does not have have directory */usr/man/man1*, find your system's *man1* directory. It will be full of files with ".gz" extensions and you will see *man2* through *man9* directories beside man1 in its parent directory. Then edit the *yacc193 Makefile*, replacing */usr/man/man1* with your system's *man1* directory.

make install will put the yacc193 documentation files into */usr/doc/yacc-1.9.3-1* by default. Verify that your system has a */usr/doc* directory. If your system does not have directory */usr/doc*, either create it or modify the *yacc193 Makefile* replacing */usr/doc* with your system's correct document directory.

Run **make** from the *yacc-1.9.3* directory to build the object code. If using BSD, remember to use **gmake** instead of **make**.

Run **make install** from the *yacc-1.9.3* directory to link the object code and install *yacc193* and its documentation.

make install will put program *yacc193* into directory */usr/local/bin*. Verify that */usr/local/bin* is in your *PATH* environment variable. If it isn't, add */usr/local/bin* to your *PATH* variable.

Berkeley DB

TinyCOBOL uses Berkeley DB to handle indexed files. Berkeley DB must be installed on your system before installing TinyCOBOL. Either Berkeley DB versions 1.85.4 or 1.86 must be installed, or version 2.1 or newer built with version 1.85 compatability must be installed.

Setting up Berkeley DB is often the most difficult part of the installation process. Less experienced Linux and BSD users should leave their Berkeley DB untouched if possible. ***Installing a version of Berkeley DB which is different from your current version can mess up your system!***

As of version 1.86, Berkeley DB uses a database format that is incompatible with earlier versions. When building version 2.1 or newer, the use of

`../dist/config --enable-compat185`

will build Berkeley DB with an API for version 1.85. If you upgrade from 1.85 to a newer version, you will have to upgrade the database format even if you are using the 1.85 API.

If you install version 1.85.4, make sure you install the patches to the source code before compiling. Without the patch, the source may not compile correctly.

The TinyCOBOL *INSTALL* file has some relevant developer's notes on installing TinyCOBOL with Berkeley DB. You may need to find where the Berkeley DB library, *libdb.so* is located on your system. Berkeley DB is usually in */usr/lib*, but could be installed elsewhere, such as */usr/local/lib*. The TinyCOBOL installer will search for *libdb.so*. You may need to create a copy or a hard link to your system's Berkeley DB. For example, if your Berkeley DB is version 4.1 and it is installed as */usr/local/lib/libdb41.so*, you would us *ln -n* to create a hard link */usr/lib/libdb.so* that points to */usr/local/lib/libdb41.so* and, similarly, to create a hard link */usr/lib/libdb.a* that points to */usr/local/lib/libdb41.a*.

The TinyCOBOL installer searches for Berkeley DB in */usr/lib* by default. If your Berkeley DB is installed in a different directory, you will either have to create hard links from */usr/lib* to your Berkeley DB library, or you will have to copy your *libdb** files to the */usr/lib* directory, or you will have to modify the TinyCOBOL installer so it uses your Berkeley DB library directory.

The TinyCOBOL installer searches for the Berkekely DB header files (*db.h* or *db_185.h*) in */usr/include* or */usr/include/db**, where * is "*1*", "*2*", "*3*" or "*4*". If your system's Berkeley DB header files are not in one of these directories, you must apply a fix similar to the fix for the library files.   If */usr/include/db** is not present, you may want to create it before linking to your installation's *db.h* and d*b_185.h* files.

Unless you are building a specialized application for distribution, you should be able to use your default Berkeley DB installation.

Berkeley DB installation is outside of the scope of this user manual. Sleepycat Software distributes Berkeley DB and has the necessary installation notes. IBiblio.org has older versions of Berkeley DB.

Installing *gcc*

If *gcc* isn't already installed, locate and install *gcc* for your system. *gcc* installation is outside of the scope of this user manual.

Building TinyCOBOL from Source Code

Download tinycobol-0.61.tar.gz from the TinyCOBOL.org Downloads page. **cd** into the directory containing tinycobol-0.61 and execute:

```
gunzip tinycobol-0.61.tar.gz

tar -xvf tinycobol-0.61.tar
```

This will unpack and unarchive the TinyCOBOL source files and build files.

cd to the *tinycobol-0.61* directory.

Read the *README* file and the installation instructions in the *INSTALL* file.

The *configure* script will set up some parameters for building TinyCOBOL. The *configure* script will examine your system to set up options for the *make* program. *configure* uses the *bison* compiler compiler by default, but this manual uses the *yacc193* compiler compiler , so use the command line option **--with-yacc=yacc193**.

Depending on how your system's Berkeley DB is set up, you might also need to use the option that specifies your version of Berkeley DB, the **--with-libdb=**[your Berkeley DB version number]. If your systemlibrary directory contains *libdb.so* and *libdb.a*, this option is not needed. Otherwise, with *libdb1.** use **--with-libdb=1**, with *libdb2.** use **--with-libdb=2**, with *libdb3.** use **--with-libdb=3**, and with *libdb-4.** use **--with-libdb=4**. Check the *INSTALL* file and the *configure* script for more information.

Other configuration options are available. The *INSTALL* file and the *configure* script provide more information.

The *configure* script will set up the system to use the *libdl.so* library by default. BSD doesn't usually have or need *libdl.so*, so the following three changes are needed in the *configure* script *in BSD only*:

1. **define_with_dl** must be assigned a value of "no" or "".

2. Change **htg_ld_args_dl="-ldl"** to **htg_ld_args_dl=""**   Change this in both places in the file.

3. Remove all other references to **-ldl** in the main *Makefile* and the *Makefile*s in the subdirectories.

Review the options in **configure** to determine what options you will need. A common option is **--enable-lockserv**. Create the configuration options by running the appropriate command:

./configure --with-yacc=yacc193 [your options]

or

./configure --with-yacc=yacc193 --with-libdb=# [your options]

Make sure the *INSTMAN1* variable in the *tinycobol-0.61/info/Makefile* file points to your system's man directory.   If necessary, edit the *tinycobol-0.61/info/Makefile* file and change the *INSTMAN1* variable to point to the appropriate man directory.

You must have write permission to the system executables directory to install. If your user id doesn't have write permissions, **su** to root to install and then execute the two commands:

make

make install

If using BSD, remember to use **gmake** instead of **make**.

Reboot if necessary and verify the install by running the command:

htcobol -V

Post Installation Tasks

In BSD, the */usr/local/share/htcobol/htcobolrc* file will need a minor modification.   Two variables refer to the dynamic loader, *dl*. Because BSD does not normally have *dl*, all references to *dl* should be removed. Change

LD_EXTRA_LIBS: -ldl
LD_DCALL_LIBS: -ldl

to

LD_EXTRA_LIBS:
LD_DCALL_LIBS:

The *htcobol* program uses a variable, *LD_PATH*, in the *htcobolrc* file to point to the linker libraries.   The installer assigns a value which is useful for building and testing the compiler. Change this variable to point to your library directories. Normally, you will change the variable as follows:

```
LD_PATH: -L. -L/usr/lib -L/usr/local/lib
```

If your installation will use statically linked libraries, you must install the static libraries. To install the statically linked libraries, **cd** to the TinyCOBOL *./lib* directory and run:

```
make devel
```

```
make install-static
```

If you are using ***lockserver***, build it now if you have not already done so. Please be aware that ***lockserver*** may not work with FreeBSD.

Verifying the Compiler Build

After building TinyCOBOL, test it to ensure that it works correctly. Run the test suites included in the TinyCOBOL tar file. Running the test suites is relatively easy.

cd to the *test_suite* directory. If you are using BSD, the main testing script *cobol_test.pl*, must be modified because it uses *dl*, which is not normally installed on BSD. A variable must be modified to prevent the test script from crashing. Remove **-ldl** from the line:

```
$LIBS=$g_libraries  . " -L../../lib  -lhtcobol " . $LIBDBNAME . " -ldl" . " -lm";
```

like so:

```
$LIBS=$g_libraries  . " -L../../lib  -lhtcobol " . $LIBDBNAME . " -lm";
```

Execute **make**. You should get almost all PASSed messages in the *TEST###.log* file. A few COBOL verbs are not fully implemented at this time, so a handful of tests will fail. The FAILs will mostly be SELECT and INSPECT statements. Those are expected in this version of Tiny COBOL.

Dynamic linking can be a problems, so compile and run the dyntest program in *test.code/t33* to verify dynamic linking. Expect some successful tests as well as failure test.

Installation Using an RPM Binary

RPM installation is not recommended unless you know that the RPM was built specifically for your system. Even if the RPM was built for your O/S distribution, RPM still may not work. If you use an RPM installation, RPM is simple so this manual will not discuss how to us it. If you attempt an RPM install and RPM can't install because of numerous library dependencies, you probably should build TinyCOBOL from the source code.

Uninstalling

Uninstalling a TinyCOBOL RPM is trivial and will not be addressed in this manual.

To uninstall from a compiled version, **cd** to the *tinycobol-0.61* directory and execute the two commands:

```
make cleanall
```

```
make distclean
```

Compiler Environment and Options Setup

The compiler uses three levels of controls for compile options.

The first level is the compiler environment. The term "compiler environment" refers to the directories and files *htcobol* uses to compile a COBOL program. By default, *htcobol* reads the file *htcobolrc* from directory */usr/local/share/htcobol* to determine the default compile options. The default dynamically loaded libraries are normally in */usr/local/lib*. The default location of the preprocessor, *htcobolpp*, is */usr/local/share/htcobol*. These defaults can be overriden by setting environment variables, *TCOB_OPTIONS*, *TCOB_OPTIONS_PATH*, *TCOB_LD_LIBRARY_PATH*, and *TCOB_PP_PATH* to the file or path you want to use.

The second level of control is the compiler options contained in *htcobolrc*. The options are documented in the htcobolrc file. Some of the *htcobolrc* options can be commented out and the compiler will use a default value. The compiler defaults are documented in the *htcobolrc* file.

BSD users must change the *LD_EXTRA_LIBS*, and *LD_DCALL_LIBS* options before using the compiler. The installer will default these two options to refer to the *dl* dynamic linker, which is not normally used by BSD. BSD users should delete **-ldl** from the *LD_EXTRA_LIBS* and *LD_DCALL_LIBS* options.

The third level of control is the command line options. The command line options override the compile options in *htcobolrc*. The compile options are documented fully in the *htcobol* man file.

Unlike many other COBOL compilers, TinyCOBOL does not have in-source-code compiler options.

How to Compile—A Quick Introduction

Experienced Linux and BSD users can skip this section. This section is a simple tutorial to get absolute beginners started.

The TinyCOBOL compiler is named *htcobol*. The command line options are documented in the *htcobol* man pages. The general format is:

```
 htcobol [options] [your program name]
```

The simplest way to get started compiling is through the command line. Shell scripts containing the command line statements can be used. Experienced developers usually use *make* files.

Command Line Compiling

If you are just getting started, create the following simple program in file and name it *hello.cob*:

```
IDENTIFICATION DIVISION.
PROGRAM-ID. HELLO.
PROCEDURE DIVISION.
DISPLAY "Hello, world!"
STOP RUN.
```

From the command line, **cd** to the folder containing *hello.cob* and run the two commands:

```
htcobol hello.cob

./hello
```

This should display the message "**Hello, world!**"

Shell Script Compiling

Place the commands

```
htcobol hello.cob

./hello
```

in a file named *hello.sh*. Run the command

```
sh hello.sh
```

This should display the message "**Hello, world!**"

make File Compiling

A complete tutorial for using *make* files is outside the scope of this manual. Here is a simple example of using a *make* file. BSD users will need to substitute *gmake* for *make*.

Create a new directory and copy the *hello.cob* program into it. Create a new file named *Makefile* and put the following text into it:

```
# Starter example for hello.cob

SRC_FILE=hello.cob

hello.exe : ${SRC_FILE}

          htcobol ${SRC_FILE}
```

Make sure that you put a tab in front of "**htcobol ${SRC_FILE}**", not spaces, otherwise *make* will not work. Run the commands:

```
make

./hello
```

This should display the message "**Hello, world!**"

Command Line Options

The command line options override the options in the *htcobolrc* file. Most of the TinyCOBOL command line options are sufficiently documented in the *htcobol* man page.

-a Create a static runtime library.

-B [**static** | **dynamic**] Determines if the libraries are being compiled into the object module or not.

-c Compile into a statically linked module.

-g Generate compiler debugging output.

-l[library name] Link to the library.

-m Create a shared library.

-S [ ]

-t [ ]

-x The default.

-C [ ]

htcobolrc Options

Compile Errors

Troubleshooting

Problem: Message -- **cannot find -lhtcobol**

Causes: The *libhtcobol.** library files are not in the linker's search path. The *libhtcobol.** library files are normally located in the */usr/local/lib* directory. Possible causes are :

* the libraries are missing,

* the libraries a located in an unexpected directory,

* the *LD_PATH* variable in *htcobolrc* is not set correctly,

* *htcobolrc* is not installed correctly,

* the **-B static** htcobol command line option was used and the TinyCOBOL static libraries were not installed.

To fix: Verify that the *LD_PATH* variable in *htcobolrc* points to the correct link directories. *LD_PATH* is typically set to:

LD_PATH: -L. -L/usr/lib -L/usr/local/lib

Verify that the *libhtcobol.** libraries are located where you think they should be. Normally, they are in */usr/local/lib*, but your system may have them in a different location. If they are in a different location, verify that *LD_PATH* is set correctly.

If *LD_PATH* is set correctly and the *libhtcobol.** libraries are where they should be, check the installation of *htcobolrc* by running the *htcobol* compiler using the **-L** option to explicitly decribe where the libraries are located. If the **-L** option eliminates the error, *htcobolrc* is not set up correctly.

If the **-B static** option was used, the static libraries may not have been installed. **cd** to the TinyCOBOL *./lib* directory. Run:

make devel

make install-static

Running a Program

Command Line Execution

xxx

Script File Execution

xxx

make Files

xxx

lockserver

xxx

Troubleshooting

xxx

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