

# Creating a Project Using an Existing Build System

You can use the `cpptestscan` or `cpptesttrace` utility to create a C++test project that you would normally build using tools such as GNU make, CMake, and QMake. The utilities collect information from the build process of an existing code base that C++test can use to automatically create a project. You can also build a project and manually configure it using the information collected by the utilities.

## The Build Data File concept

Build information, such as the working directory, command line options for the compilation, and link processes of the original build, are stored in a file called the build data file. The following example is a fragment from a build data file:

```
----- cpptestscan v. 9.4.x.x -----
working_dir=/home/place/project/hypos/pscom
project_name=pscom
arg=g++
arg=-c
arg=src/io/Path.cc
arg=-Iinclude
arg=-I.
arg=-o
arg=/home/place/project/hypos/product/pscom/shared/io/Path.o
```

The build data file can be used as a source of information about project source files, compiler executable, compiler options, linker executable, and options used to build the project. There are three ways to use the build data file to create a project:

- Manually setting up 'Use options from the build data file' as the options source for the project and selecting appropriate build data file (see [Creating a Project from the GUI](#)).
- Using the GUI to automatically import a project. See [Importing project using Build Data File with the GUI wizard](#).
- Using the command line to automatically import a project. See [Importing a Project from the Command Line](#).



### Note

Required environment variables can also be stored in the build data file if the following apply:

- Your build system sets up the required environment variables for the compiler / linker to work correctly
- These variables are not available in the environment when run C++tests.

See description of the '`--cpptestscanEnvInOut`' option below.

## Using cpptestscan or cpptesttrace to Create a Build Data File

The `cpptestscan` and `cpptesttrace` executables are located in the C++test installation directory. They collect information from the build process of an existing code base, generate build data files with the information, and append information about each execution into a file.

The `cpptestscan` utility is used as a wrapper for the compiler and/or linker during the normal build. To use `cpptestscan` with an existing build, build the code base with `cpptestscan` as the prefix for the compiler / linker executable of an existing build to build the code base. This can be done in two ways:

- Modify the build command line to use `cpptestscan` as the wrapper for the compiler/linker executables
- If you don't want to (or cannot) override the compiler variable on the command line, embed `cpptestscan` in the actual make file or build script.

To use `cpptesttrace` with an existing build, build the code base with `cpptesttrace` as the prefix for the entire build command. `cpptesttrace` will trace the compiler and linker processes executed during the build and store them in the build data file.

In both cases, you need to either add the C++test installation directory to your PATH environment variable, or specify the full path to either utility.

Additional options for `cpptestscan` and `cpptesttrace` are summarized in the following table. Options can be set directly for the `cpptestscan` command or via environment variables. Most options can be applied to `cpptestscan` or `cpptesttrace` by changing the prefix in command line.

Basic `cpptestscan` usage:

- Windows: `cpptestscan.exe [options] [compile/link command]`
- Linux: `cpptestscan [options] [compile/link command]`

Basic `cpptesttrace` usage:

- Windows: `cpptesttrace.exe [options] [build command]`
- Linux: `cpptesttrace [options] [build command]`

Option	Environment Variable	Description	Default
<pre>-- cpptestscanOutputFile= &lt;OUTPUT_FILE&gt;  -- cpptesttraceOutputFile= &lt;OUTPUT_FILE&gt;</pre>	CPPTTEST_SCAN_OUTPUT_FILE)	Defines file to append build information to.	cpptestscan.bdf
<pre>-- cpptestscanProjectName e=&lt;PROJECT_NAME&gt;  -- cpptesttraceProjectName e=&lt;PROJECT_NAME&gt;</pre>	CPPTTEST_SCAN_PROJECT_NAME	Defines suggested name of the C++test project.	name of the current working directory
<pre>-- cpptestscanRunOriginalCommand= [yes no]  -- cpptesttraceRunOriginalCommand= [yes no]</pre>	CPPTTEST_SCAN_RUN_ORIG_CMD	If set to "yes", original command line will be executed.	yes
<pre>-- cpptestscanQuoteCommandLineMode= [all sq none]  -- cpptesttraceQuoteCommandLineMode= [all sq none]</pre>	CPPTTEST_SCAN_QUOTE_CMD_LINE_MODE	<p>Determines the way C++test quotes parameters when preparing cmd line to run.</p> <p>all: all params will be quoted</p> <p>none: no params will be quoted</p> <p>sq: only params with space or quote character will be quoted</p> <p>cpptestscanQuoteCommandLineMode is not supported on Linux</p>	all
<pre>-- cpptestscanCmdLinePrefix= &lt;PREFIX&gt;  -- cpptesttraceCmdLinePrefix= &lt;PREFIX&gt;</pre>	CPPTTEST_SCAN_CMD_LINE_PREFIX	If non-empty and running original executable is turned on, the specified command will be prefixed to the original command line.	[empty]
<pre>-- cpptestscanEnvInOutput= [yes no]  -- cpptesttraceEnvInOutput= [yes no]</pre>	CPPTTEST_SCAN_ENV_IN_OUTPUT	Enabling dumps the selected environment variables and the command line arguments that outputs the file. For advanced settings use – cpptestscanEnvFile and – cpptestscanEnvvars options	no

<pre>-- cpptestscanEnvFile=&lt;ENV_FILE&gt; NV_FILE&gt; -- cpptesttraceEnvFile=&lt;ENV_FILE&gt; NV_FILE&gt;</pre>	<b>CPPTTEST_SCAN_ENV_FILE</b>	If enabled, the specified file keeps common environment variables for all build commands; the main output file will only keep differences. Use this option to reduce the size of the main output file. Use this option with <code>--cpptestscanEnvInOut</code> put enabled	[empty]
<pre>-- cpptestscanEnvVars=[* &lt;ENVVAR_NAME&gt;,...] -- cpptesttraceEnvVars=[* &lt;ENVVAR_NAME&gt;,...]</pre>	<b>CPPTTEST_SCAN_ENV_VARS</b>	Selects the names of environment variables to be dumped or "" to select them all. Use this option with <code>--cpptestscanEnvInOut</code> put enabled.	*
<pre>-- cpptestscanUseVariable=[VAR_NAME=VALUE,...] -- cpptesttraceUseVariable=[VAR_NAME=VALUE,...]</pre>	<b>CPPTTEST_SCAN_USE_VARIABLE</b>	Replaces each occurrence of "VALUE" string in the scanned build information with the "\${VAR_NAME}" variable usage.	[empty]
<pre>-- cpptesttraceTraceCommand</pre>	<b>CPPTTEST_SCAN_TRACE_COMMAND</b>	Defines the command names that will be traced when collecting build process information. These names, specified as regular expressions, should match original compiler / linker commands used in the build process.	

## Example: Modifying GNU Make Build Command to Using cpptestscan

Assuming that a make-based build in which the compiler variable is CXX and the original compiler is g++:

```
make -f </path/to/makefile> <make target> [user-specific options] CXX="cpptestscan --cpptestscanOutputFile=/path/to/name.bdf --cpptestscanProjectName=<projectname> g++"
```

This will build the code as usual, as well as generate a build data file (name.bdf) in the specified directory.



### Note

When the build runs in multiple directories:

- If you do not specify output file, then each source build directory will have its own .bdf file. This is good for creating one project per source directory.
- If you want a single project per source tree, then a single .bdf file needs to be specified, as shown in the above example.

## Example: Modifying GNU Make Build Command Using cpptesttrace

Assume that a regular make-based build is executed with:

```
make clean all
```

you could use the following command line:

```
cpptesttrace --cpptesttraceOutputFile=/path/to/name.bdf --cpptesttraceProjectName=<projectname> make clean all
```

This will build the code as usual and generate a build data file (name.bdf) in the specified directory.



#### Note

If the compiler and/or linker executable names do not match default `cpptesttrace` command patterns, they you will need to use `--cpptesttraceTraceCommand` option described below to customize them. Default `cpptestscan` command trace patterns can be seen by running `'cpptesttrace --cpptesttraceHelp'` command.

## Example: Modifying GNU Makefile to use cpptestscan

If your Makefile uses `CXX` as a variable for the compiler executable and is normally defined as `CXX=g++`, you can redefine the variable:

```
ifeq ($(BUILD_MODE), PARASOFT_CPPTTEST)
CXX="/usr/local/parasoft/cpptestscan --cpptestscanOutputFile=<selected_location>/MyProject.bdf --cpptestscanProjectName=MyProject g++"
else
CXX=g++
endif
```

Next, run the build as usual and specify an additional `BUILD_MODE` variable for make:

```
make BUILD_MODE=PARASOFT_CPPTTEST
```

The code will be built and a build data file (`MyProject.bdf`) will be created. The generated build data file can then be used to create a project from the GUI or from the command line.



#### Note

The `cpptestscan` and `cpptesttrace` utilities can be used in the parallel build systems where multiple compiler executions can be done concurrently. When preparing Build Data File on the multicore machine, for example, you can pass the `-j <number_of_parallel_jobs>` parameter to the GNU make command to build your project and quickly prepare the Build Data File.

## Example: Using cpptesttrace with CMake build

Assuming that you have a CMake-based build, you can produce a build data file using `cpptesttrace`:

1. Run the original CMake command to use CMake to generate make files. For example:

```
cmake -G "Unix Makefiles" ../project_root
```

2. Setup environment variables for `cpptestscan` making sure to use an absolute path for the output file:

```
export CPPTTEST_SCAN_PROJECT_NAME=my_project
export CPPTTEST_SCAN_OUTPUT_FILE=$PROJ_ROOT/cpptestscan.bdf
```

3. Make sure the `cpptesttrace` executable is available on the `PATH`.
4. Run the project build normally but with `cpptesttrace` as a wrapper. For example if normal build command is `make clean all` for the build with `'cpptesttrace'` the command will be `cpptesttrace make clean all`

A build data file will be generated in the location defined by the `CPPTTEST_SCAN_OUTPUT_FILE` variable. If the variable is isn't set, the build data file(s) will be generated in the Makefiles' locations.

## Example: Using cpptestscan with CMake build

All scripts and commands are bash-based – adapt them as needed for different shells.

Assuming a CMake-based build, do the following to produce a build data file using `cpptestscan`:

1. Use CMake to re-generate make files with the `'cpptestscan'` used as a compiler prefix. Make sure the `'cpptestscan'` executable is available on the `PATH`.
  - a. If original CMake command is `cmake -G "Unix Makefiles" ../project_root`, then you need to get rid of existing CMake cache and run `cmake` overriding compiler variables. The following example assumes `'gcc'` is used as a C compiler and `'g++'` as a C++ compiler executable:

```
rm CMakeCache.txt
CC="cpptestscan gcc" CXX="cpptestscan g++" cmake -G "Unix Makefiles" ../project_root
```

- b. Look in the CMakeCache.txt file to see if CMAKE\_\*\_COMPILER variables point to cpptestscan.
  - c. If the make files are re-generated, jump to step 5. Continue if `cmake` failed in the boot-strap phase because the compiler wasn't recognized.
2. Prepare the `cpptestscan` wrapper scripts that will behave like a CMake compiler by creating the following BASH scripts. In this example, we assume 'gcc' is used as a C compiler and 'g++' as a C++ compiler executable:

```
>cat cpptest_gcc.sh
#!/bin/bash
cpptestscan gcc --cpptestscanRunOrigCmd=no $* > /dev/null 2>&1 gcc $*
exit $?

>cat cpptest_g++.sh
#!/bin/bash
cpptestscan g++ --cpptestscanRunOrigCmd=no $* > /dev/null 2>&1 g++ $*
exit $?
```

- The first script invokes `cpptestscan` to extract options without running the compiler. The second script runs the actual compiler so that the entire script looks and acts like a compiler in order to be "accepted" by CMake.
3. Give the scripts executable attributes and place them in a common location so they are accessible to everyone who needs to scan make files. Make sure the `cpptestscan` and the scripts are available on the PATH.
  4. Use CMake to re-generate make files with the scripts used as compilers by extending the original CMake command with options that re-generate make files from the prepared scripts.
    - Original CMake command is `cmake -G "Unix Makefiles" ../project_root` then you need to get rid of existing CMake cache and run `cmake` overriding compiler variables. In the following example, we assume 'gcc' is used as a C compiler and 'g++' as a C++ compiler executable:

```
rm CMakeCache.txt
cmake -G "Unix Makefiles" -D CMAKE_C_COMPILER=cpptest_gcc.sh -D CMAKE_CXX_COMPILER=cpptest_g++.sh
../project_root
```

- Look in the CMakeCache.txt file to see if CMAKE\_\*\_COMPILER variables point to prepared wrappers.
5. Setup environment variables for `cpptestscan`; make sure to use an absolute path for the out-put BDF file:

```
export CPPTTEST_SCAN_PROJECT_NAME=my_project
export CPPTTEST_SCAN_OUTPUT_FILE=$PROJ_ROOT/cpptestscan.bdf
```

6. Run the project build normally without overwriting any make variables. Build data files(s) will be generated in location defined by the `CPPTTEST_SCAN_OUTPUT_FILE` variable or - if not set - in location of Makefiles.



#### Note

By default CMake-generated make files only print information about performed actions without actual compiler/linker command lines. Add "VERBOSE=1" to the make command line to see executed compiler/linker command lines.

## Using cpptestscan or cpptesttrace with other Build Systems

For non-make based build systems, usage of `cpptestscan` and `cpptesttrace` is very similar to the examples shown above. Typically, a compiler is defined as a variable somewhere in the build scripts. To create a Build Data File from that build system using `cpptestscan`, prefix the original compiler executable with `cpptestscan`. To create a Build Data File from that build system using `cpptesttrace`, prefix whole build command line with `cpptesttrace`.

### When should I use `cpptestscan`?

It is highly recommended that the procedures to prepare a build data file are integrated with the build system. In this way, generating the build data file can be done when the normal build is performed without additional actions.

To achieve this, prefix your compiler and linker executables with the `cpptestscan` utility in your Makefiles / build scripts.

### When should I use `cpptesttrace`?

Use `cpptesttrace` as the prefix for the whole build command when modifying your Makefiles / build scripts isn't possible or when prefixing your compiler / linker executables from the build command line is too complex.

## Importing project using Build Data File with the GUI wizard

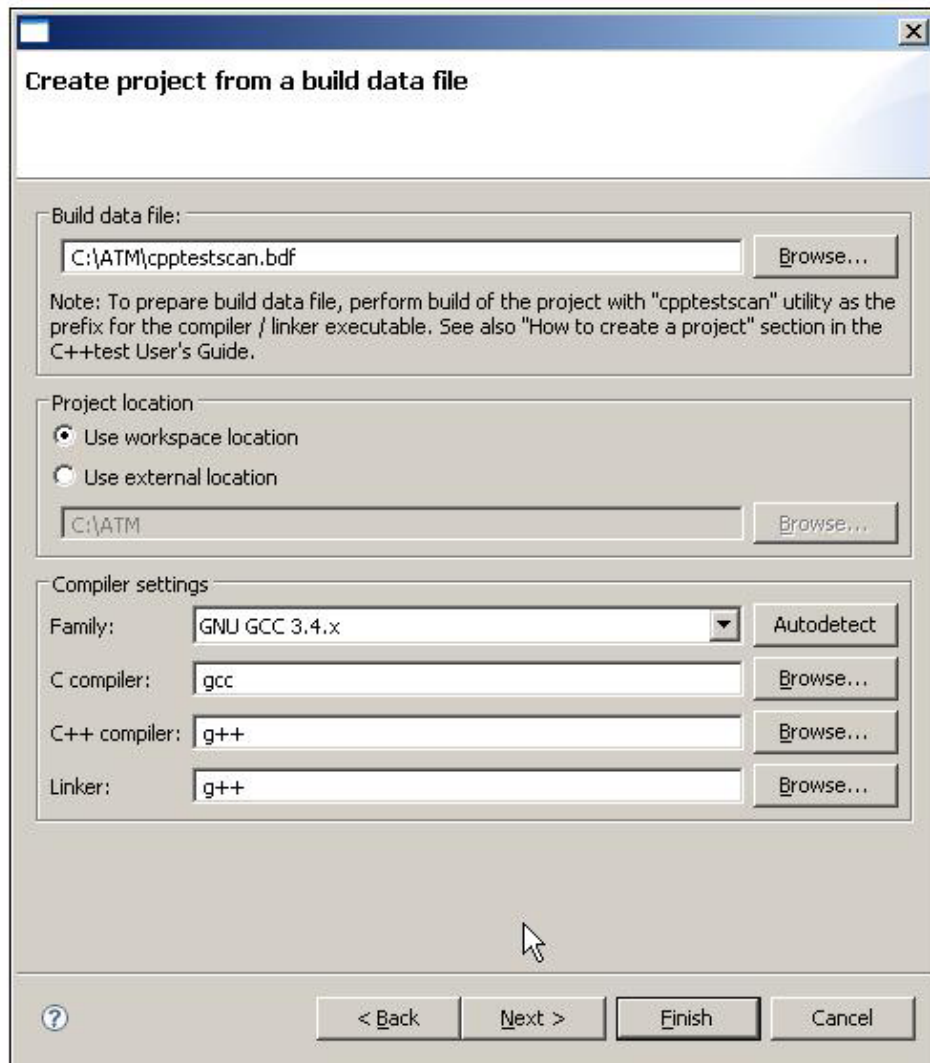
Once you have used `cpptestscan` or `cpptesttrace` to generate a build data file for code you want to test in C++test, you can use the Project Creation wizard to create a C++test project.

### Custom compiler prerequisite

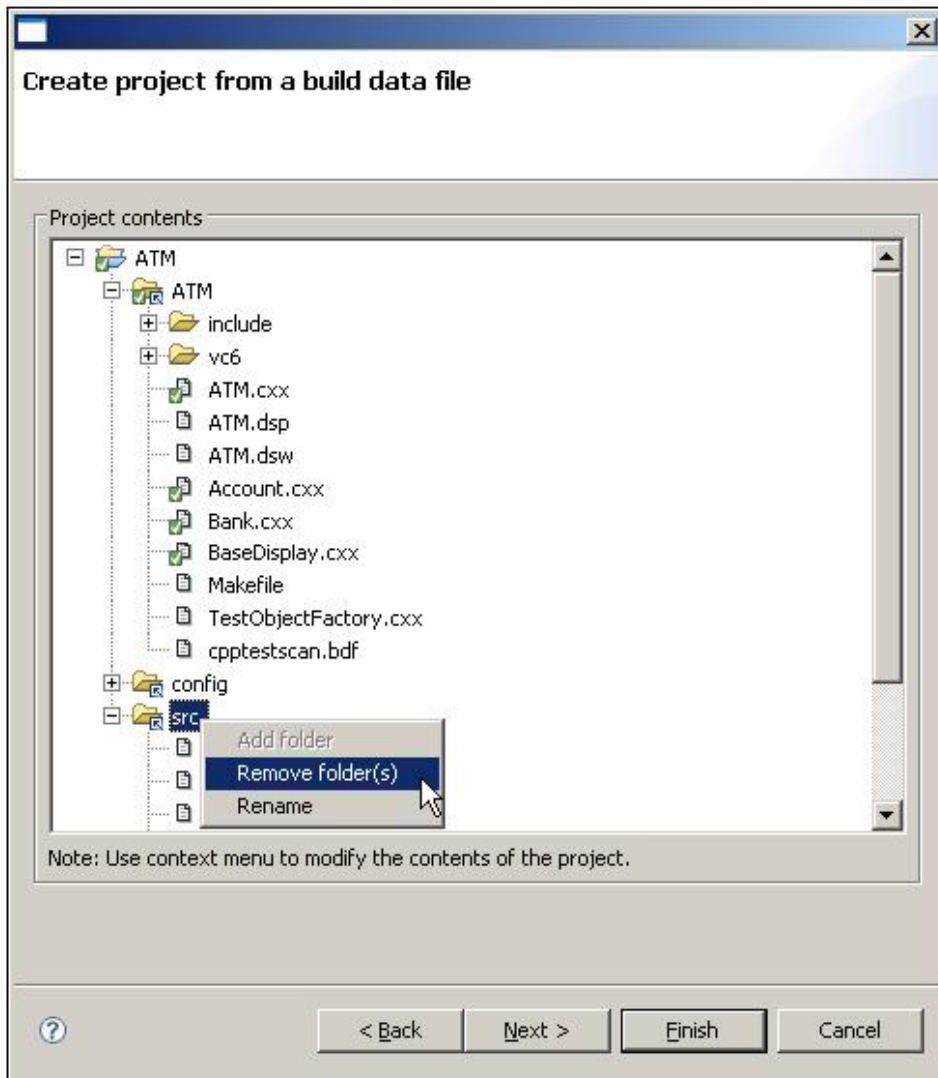
If you are using a custom compiler, add it as described in [Configuring Testing with the Cross Compiler](#) *before* starting the wizard.

To create a project from a build data file:

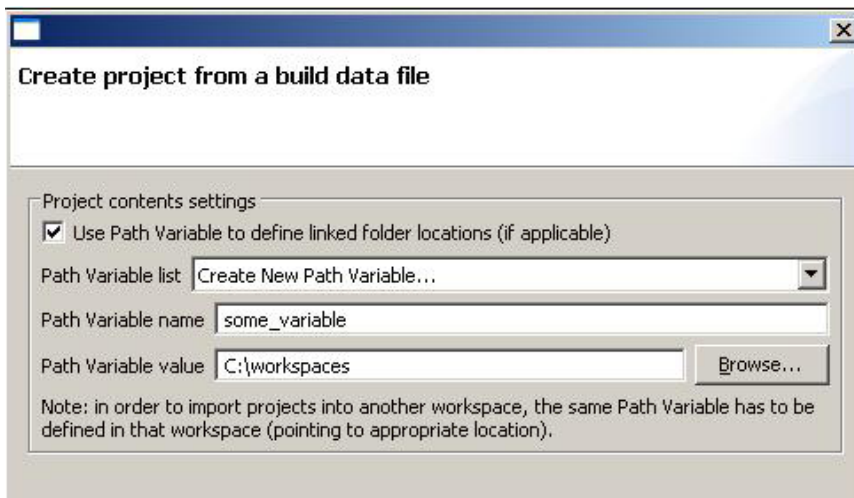
1. Open the wizard by choosing **File> New> Project**, select **C++test> Create project from a build data file**, then click **Next**. The wizard's first page will display.
2. Complete the first wizard page, then click **Next**.
  - In the **Build data file** field, enter or browse to the location of the build data file that was previously created (as described in [Using `cpptestscan` or `cpptesttrace` to Create a Build Data File](#)).
  - In the **Project location** section, specify where you want the projects created. There are two possibilities: workspace and external location. If workspace is chosen, the projects will be created in subdirectories within the workspace location. If external location is chosen, single projects will be created directly in that location. If multiple projects are created, then subdirectories for each project will be created in the specified external location.
    - For details on the available project creation options and their impacts, see [Working with C++test Projects](#)
  - In the **Compiler settings** section, specify the compiler family. The other options will be set automatically.
    - To get a list of valid compiler family values, use the `-list-compilers` switch to `cpptestcli`



3. In the second wizard page, which displays a project tree with the projects that will be created, verify the project's structure and content, making modifications as needed.
- The first level lists all projects that will be created. To change the project's name or link additional folders to the project, right-click the project name and choose the appropriate shortcut menu command.
  - The second level lists all folders that will be linked. To change a folder's name or prevent it from being included in the project, right-click the folder name and choose the appropriate shortcut menu command.
  - Deeper in the tree, you will see all folders and files which are present in linked folders. A green marker is used to indicate files referenced in the .bdf file.



4. (Optional) In the third wizard page, set Path Variables if needed.
- If you want Path Variables used in linked folders, check **Use Path Variable to define linked folder locations (if applicable)**.
  - To use a pre-defined Path Variable, select it from the **Path Variable list** box.
  - To use a custom Path Variable, choose **Custom** from the **Path Variable list** box, then manually enter the Path Variable name and value in corresponding fields.





Click **Finish**. C++test will create the specified project(s) in the specified location. The project(s) will include all source files whose options were scanned, and project properties should be set up appropriately.

## Creating a Project from the Command Line

You can also create a BDF-based projects in command line mode by using the `-bdf <cpptestscan.bdf>` switch to `cpptestcli`.

*If you want to perform analysis (e.g., static analysis and/or test generation) immediately after the project is created, ensure that the `cpptestcli` command uses `-config` to invoke the preferred Test Configuration. For example:*

```
cpptestcli -data "</path/to/workspace>" -resource "<projectname>" -config "team://Team Configuration" -localsettings "</path/to/name.properties>" -bdf "</path/to/name.bdf>"
```

*If you simply want to create the project (without performing any analysis), omit `-config`. For example:*

```
cpptestcli -data "</path/to/workspace>" -resource "<projectname>" -localsettings "</path/to/name.properties>" -bdf "</path/to/name.bdf>"
```

*Note that `-config "util/CreateProjectOnly"`, which was previously used for creating a project without testing, is no longer used in the current version of C++test. The fake Test Configuration `"util/CreateProjectOnly"` is no longer supported.*

You can define custom project settings in a plain text options file, which is passed to `cpptestcli` using the `-localsettings` switch. Settings can be specified in the options file as described in [Local Settings \(Options\) Files](#).

## Examples

The following examples demonstrate how to create a C++test project from the command line using `cpptestscan`. They use C++test's ATM example, which is available in the `<INSTALL_DIR>/Examples/ATM` directory

The examples use a make-based build; however, a `.bdf` file can be produced from any build system.

### Assumptions and Prerequisites

- The `cpptestscan` executable should be included on `$PATH` (it is located in C++test's installation directory).
- The `cpptestcli` executable should be included on `$PATH` (it is located in C++test's installation directory).
- `g++` is assumed to be the original compiler executable.
- The workspace and `.bdf` file locations have to be entered in a format supported by the given shell/command prompt. For example:
  - `/home/MyWorkspace` on UNIX/Cygwin
  - `c:\home\MyWorkspace` on Windows
  - `c:/home/MyWorkspace` on Cygwin
- To create a project without performing any testing, omit `-config`
- To create and test the new project, use the appropriate test configuration (e.g. `-config Must-HaveRules`).
- A full project rebuild will be performed ("clean all") to ensure that all objects are built in the make run

### Example 1 - Creating a C++test project in the workspace location with default settings

1. Create a build data file (`.bdf`) based on the original Makefile as follows:
  - a. Go to the `<INSTALL_DIR>/Examples/ATM` directory.
  - b. Build the ATM project while prefixing the original compiler executable with the `cpptestscan` executable:

```
> make CC="cpptestscan g++" clean all
```
  - c. Note that a new data file (`cpptestscan.bdf`) was created in the `<INSTALL_DIR>/Examples/ATM` directory.
2. Create a C++test project based on the build data file (`.bdf`) as follows:
  - a. Use C++test's CLI mode to create a new project in the `/home/MyWorkspace` workspace:

```
> cpptestcli -data /home/MyWorkspace -bdf cpptestscan.bdf
```
  - b. Note that a new C++test project (ATM) was created in MyWorkspace location. It contains all the source files and build options of the original `<INSTALL_DIR>/Examples/ATM` project.

### Example 2 - Creating a C++test project in original project's location with "Visual C++ 7.1" set as the compiler and "myProject" set as the project name

1. Create a build data file (`.bdf`) based on the original Makefile as follows:
  - a. Go to the `<INSTALL_DIR>/Examples/ATM` directory.
  - b. Build the ATM project while prefixing the original compiler executable with the `cpptestscan` executable:

```
> make CC="cpptestscan --cpptestscanProjectName=myProject g++" clean all
```
  - c. Note that a new data file (`cpptestscan.bdf`) was created in the `<INSTALL_DIR>/Examples/ATM` directory. Notice that `myProject` was set as project name.
2. Create a C++test project based on the build data file (`.bdf`) as follows:
  - First, override the default settings:
    - a. Create a plain text options file named `opts.properties` in `<INSTALL_DIR>/Examples/ATM`.

- b. Set the compiler family to Visual C++ 7.1 by entering `bdf.import.compiler.family=vc_7_1` into the `opts.properties` file.
  - c. Change the destination project location to the location of the `cpptestscan.bdf` file (which is located in the original project's directory) by entering:  
`bdf.import.location=BDF_LOC` into `opts.properties` file
- Next, use C++test's CLI mode to create a new project in the `/home/MyWorkspace` workspace:  
`cpptestcli -data /home/MyWorkspace -bdf cpptestscan.bdf -localsettings opts.properties`
  - Finally, note that a New C++test project (`myProject`) was created in `<INSTALL_DIR>/Examples/ATM` location, containing all the source files and build options of the original `<INSTALL_DIR>/Examples/ATM` project, having Visual C++ 7.1 set as compiler family.

Notes:

- `vc_7_1`, which is listed among supported compilers, was used in this example. To use a custom compiler, you would need to specify its path in the C++test Preferences panel (**Configurations> Custom directories> Custom compilers**). See [Configuring Testing with the Cross Compiler](#) for details.
- The `BDF_LOC` variable was used as the project location; this refers to the `cpptestscan.bdf` file's location

The generated build data file can be then used to create a project from the GUI or from the command line.