

# An Introduction to CMake/CTest

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**Advanced Programming Concepts Workshop 2012**

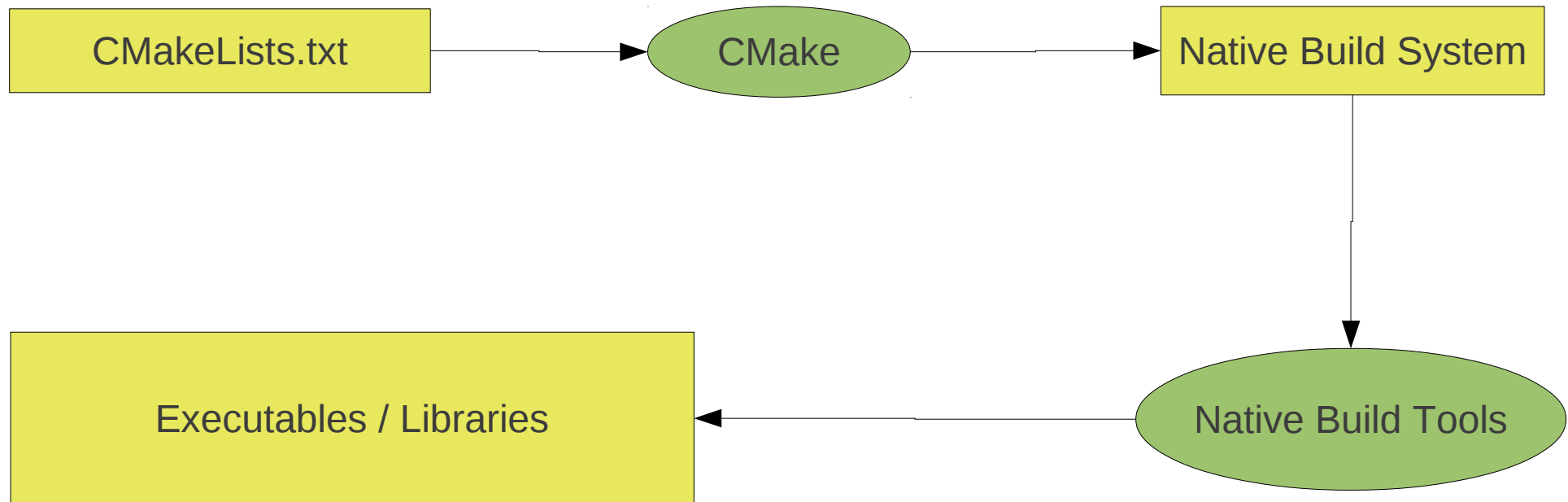
**Desy, 2012-10-11**



- CMake
  - is a tool for generating native build environments
    - UNIX/Linux -> Makefiles
    - Windows -> VS Projects/Workspaces
    - Apple -> XCode
  - Open-Source :)
  - Cross-Platform



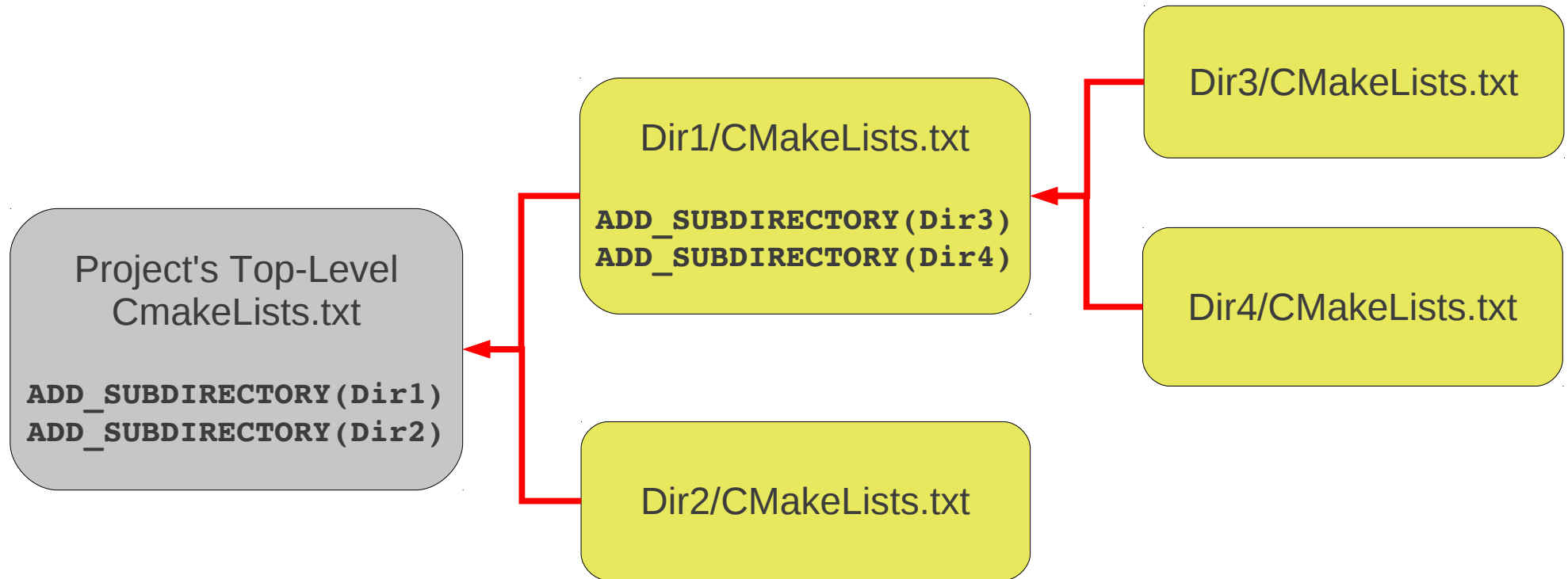
- CMake's nice features:
  - Manage complex, large build environments (KDE4)
  - Simple, intuitive syntax
  - Flexible
    - Support for Macros
    - So called **CMake modules** are available for finding existing software
      - FindGSL.cmake, FindOpenGL.cmake, FindZLib.cmake ...
      - Can be customized, e.g. FindROOT.cmake
    - Create custom targets/commands
    - Support for regular expressions (\*nix style)
  - Support for **out-of-source** builds
  - Cross Compiling
  - Integrated Testing & Packaging (CTest, CPack)





- **CMakeLists.txt**
  - Input text files that contain the project parameters and describe the flow control of the build process in simple CMake language.
- **Source Tree** (where source files are located)
  - CmakeLists.txt
  - Source files (hello.cc)
  - Header files (hello.h)
- **Binary Tree** (where build files are located)
  - Native build system files (Makefiles)
  - Output from build process:
    - Libraries, executables
    - Any other build generated files
- Source and Binary trees may be:
  - In the same directory (**in-source build**)
  - In different directories (**out-of-source build**)

- Subdirectories added with **ADD\_SUBDIRECTORY**
- Child inherits from parent (lacking feature in traditional Makefiles)
- Order of processing: Dir1;Dir3;Dir4;Dir2
  - When CMake finds an ADD\_SUBDIRECTORY command it stops processing the current file and goes down the tree branch



- CMake variables
  - CMAKE\_INSTALL\_PREFIX
    - Where to put files when calling 'make install'
  - CMAKE\_BUILD\_TYPE
    - Type of build (Debug, Release, ...)
  - BUILD\_SHARED\_LIBS
    - Switch between shared and static libraries
  - CMAKE\_MODULE\_PATH
    - Path to find own written cmake modules (e.g. FindMyPackage.cmake)
- CMake variables can be set in the CMakeLists.txt and dynamically changed on the command line as follows:
  - `cmake -DBUILD_SHARED_LIBS=OFF`
  - GUI also available: `ccmake`

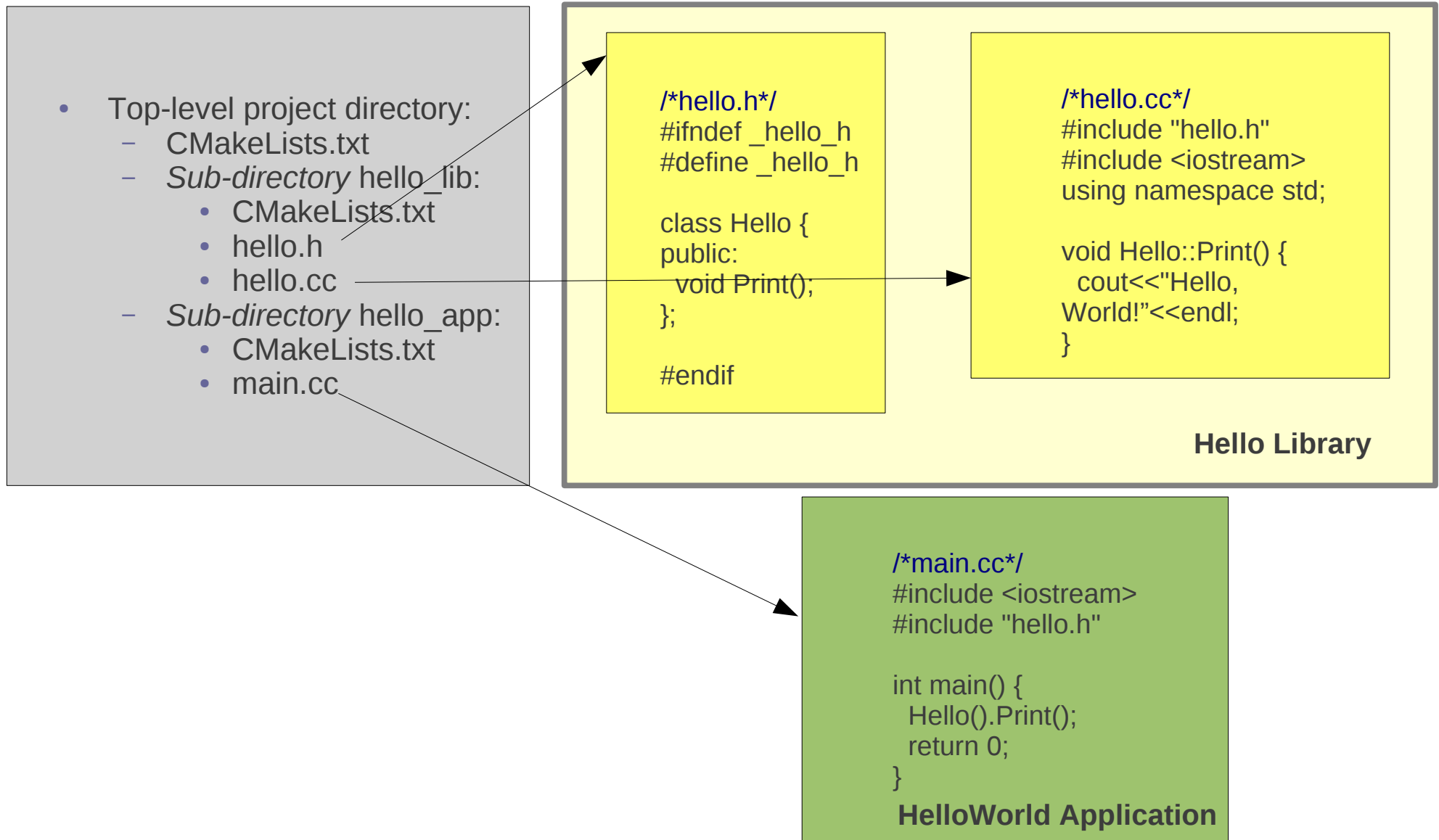


- **Create a build directory** (“out-of-source-build” concept)
  - `mkdir build ; cd build`
- **Configure**
  - `cmake [options] <source_tree>`
- **Build**
  - `make`
- **Install**
  - `make install`
- The Build step is automatically called with 'make install'

Similar to Auto-tools



# Hello World project using CMake (1)



# Hello World project using CMake (2)



```
# Top-Level CMakeLists.txt
```

```
PROJECT( HelloWorld )
```

```
ADD_SUBDIRECTORY( hello_lib )
```

```
ADD_SUBDIRECTORY( hello_app )
```

```
# CMakeLists.txt in hello_lib dir
```

```
# Adds a library called Hello (libHello.a under Linux) from the source file hello.cc
```

```
ADD_LIBRARY( Hello hello )
```

```
# CMakeLists.txt in hello_app dir
```

```
# Make sure the compiler can find include files from our Hello library.
```

```
INCLUDE_DIRECTORIES(${PROJECT_SOURCE_DIR}/Hello)
```

```
# Add binary called "helloWorld" that is built from the source file "main.cc".
```

```
# The extension is automatically found.
```

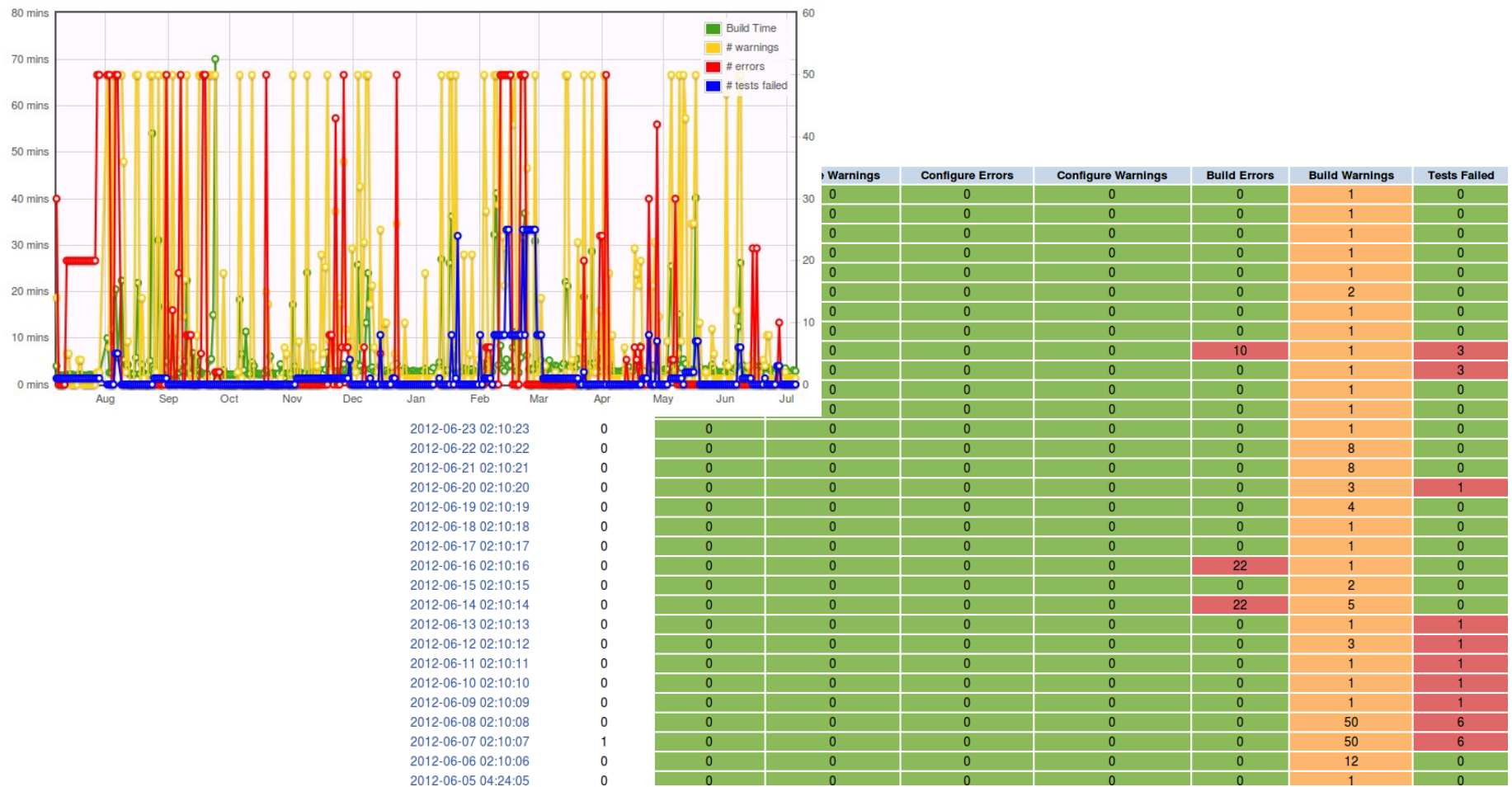
```
ADD_EXECUTABLE(helloWorld main)
```

```
# Link the executable to the Hello library.
```

```
TARGET_LINK_LIBRARIES(helloWorld Hello)
```




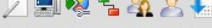

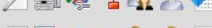
- CTest
  - Integrated testing in CMake
  - Uses flexible CMake syntax
  - Support for regular expressions (\*nix style)
  - Support for running custom commands
  - Dashboard (CDash) for displaying test results in web page
  - More on live demo..

- CDash



- CDash

Nightly										
Site	Build Name	Update	Configure		Build		Test			Build Time
		Files	Error	Warn	Error	Warn	Not Run	Fall	Pass	
it-xenvm027	Linux-c++	0	0	0	0	1	0	1	28	13 hours ago
grid-ilc-pa0	Linux-c++	0	0	0	0	1	0	0	29	13 hours ago

My Projects						
Project Name	Actions	Bulds	Bulds per day	Success Last 24h	Errors Last 24h	Warnings Last 24h
CED		1134	2	2	0	0
CEDViewer		1122	2	2	0	0
ForwardTracking		263	2	2	0	0
GEAR		1127	2	2	0	0
iLCTest		1700	2	0	0	2
KalDet		1118	2	2	0	0
KalTest		1122	2	2	0	0
LCCD		1126	2	2	0	0
LCIO		1122	2	2	0	0
Marlin		1126	2	2	0	0
MarlinReco		1110	2	2	0	0
MarlinTPC		984	2	2	0	0
MarlinTrk		928	2	2	0	0
MarlinUtil		1123	2	2	0	0
Overlay		1110	2	2	0	0
RAIDA		1130	2	2	0	0

- References:
  - <http://www.cmake.org>
  - <http://www.cdash.org>
  - **Mastering CMake**
    - Ken Martin, Bill Hoffman
    - Published by Kitware, Inc.
    - ISBN: 1-930934-16-5

