GIT, CMAKE, CONAN

HOW TO SHIP AND REUSE OUR C++ PROJECTS?

Mateusz Pusz

April 9, 2018

THE MOST COMMON C++ TOOLSET

VERSION CONTROL SYSTEM	git
BUILDING	CMake
PACKAGE MANAGEMENT	None

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- Conan is a strong contender to become the Package Manager for C++

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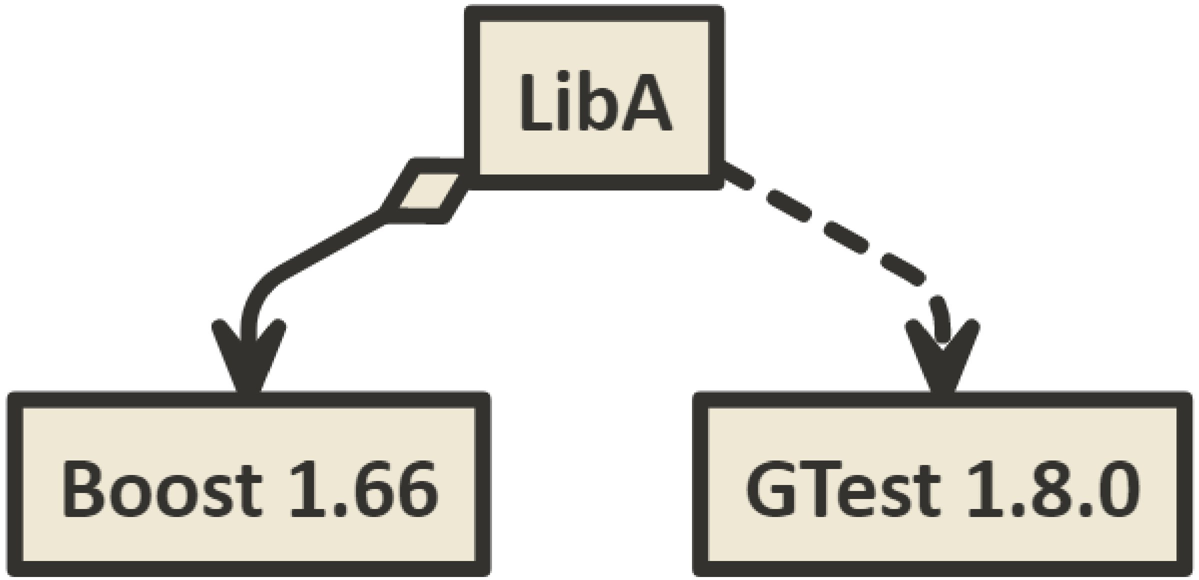
4. Usage of other languages' toolsets (i.e. maven)
5. Dedicated C++ package managers (i.e. Conan)

`add_subdirectory()` FOR DEPS?



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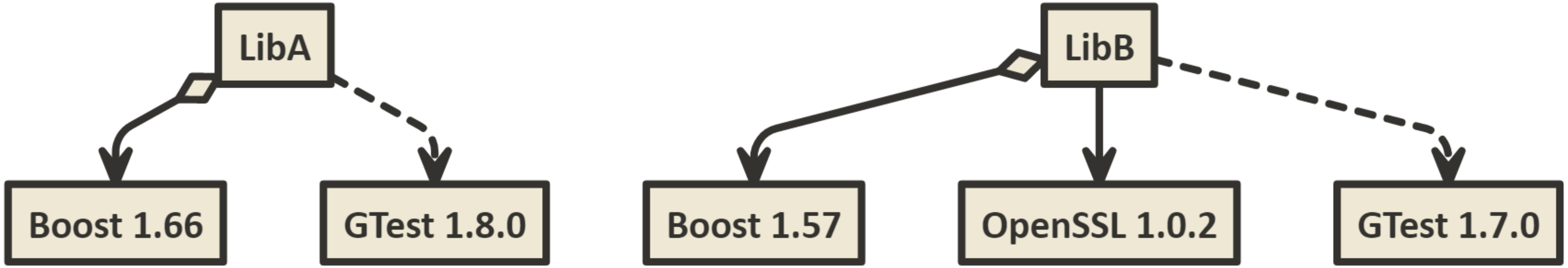

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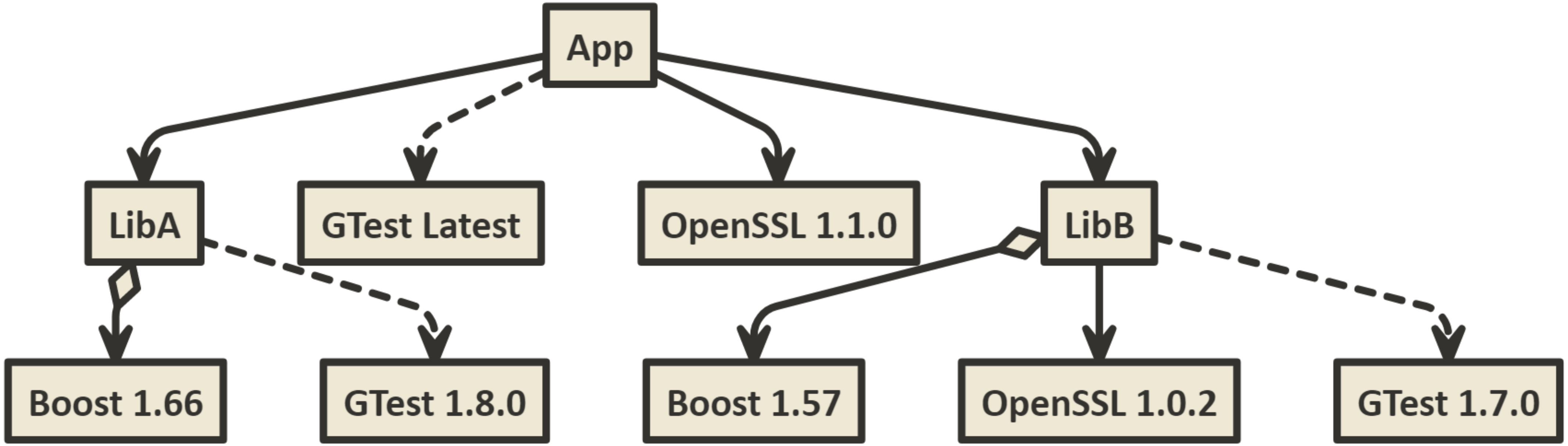

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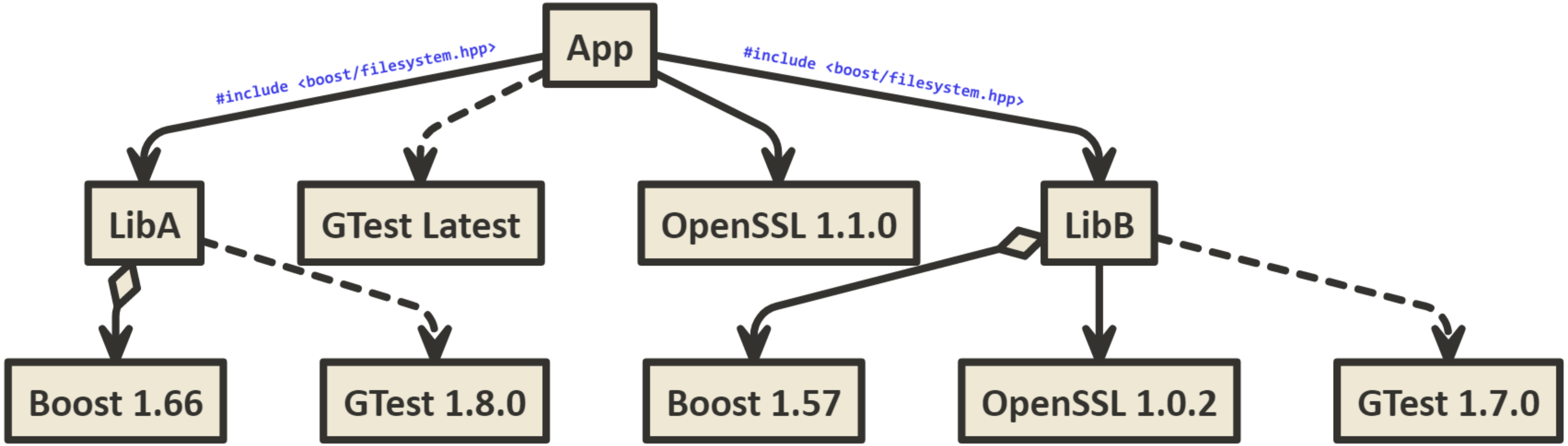

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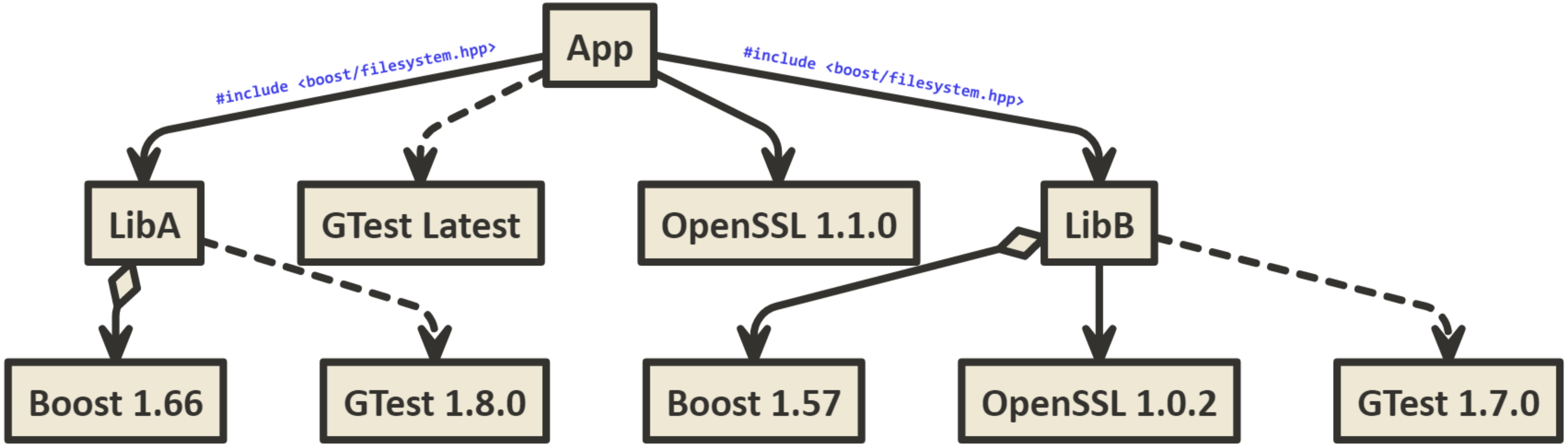


Handling dependencies as subdirectories does not scale!

CMake

Not a build system!

Cross-platform C++ build generator

TYPICAL CMAKE WORKFLOW

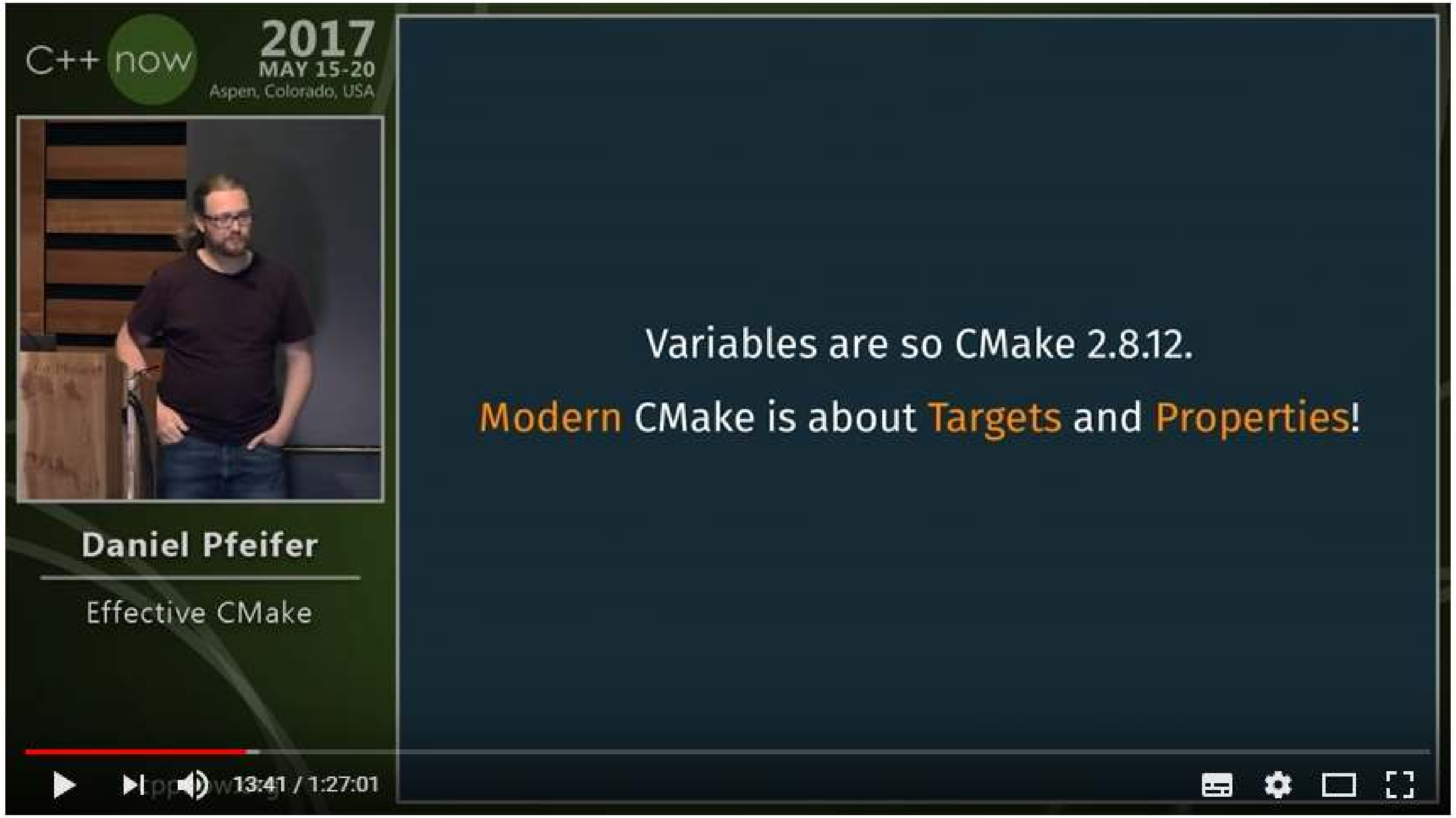
GCC

```
cmake -DCMAKE_BULD_TYPE=Release -DCMAKE_INSTALL_PREFIX=~/.local ..
cmake --build .
ctest -VV
cmake --build . --target install
```

VISUAL STUDIO

```
cmake -G "Visual Studio 15 2017 Win64" -DCMAKE_INSTALL_PREFIX=~/.local ..
cmake --build . --config Release
ctest -VV -C Release
cmake --build . --target install --config Release
```

MODERN CMake



Variables are so CMake 2.8.12.

Modern CMake is about Targets and Properties!

C++Now 2017: Daniel Pfeifer “Effective CMake”

MODERN CMake

Build flags don't scale!

- Every change in public flags has to be propagated upwards
- Not possible to maintain flags on a large scale
- Different targets may require conflicting flag values

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CMake TARGET TYPES

EXECUTABLES	`add_executable`
SHARED LIBRARIES	`add_library(SHARED)`
STATIC LIBRARIES	`add_library(STATIC)`
OBJECT LIBRARIES	`add_library(OBJECT)`
INTERFACE LIBRARIES	`add_library(INTERFACE)`
ALIAS LIBRARIES	`add_library(ALIAS)`
IMPORTED LIBRARIES	`add_library(IMPORTED [GLOBAL])`

- If no type is given explicitly to **`add_library()`** the type is **`STATIC`** or **`SHARED`** based on whether the current value of the variable **`BUILD_SHARED_LIBS`** is **`ON`**

MODERN CMake: MODULAR DESIGN

- Available since version 2.8.12 (Oct 2013)
- Specified by **`target_xxx()`** commands

```
target_link_libraries(<target>
                       <PRIVATE|PUBLIC|INTERFACE> <item>...
                      [<PRIVATE|PUBLIC|INTERFACE> <item>...]...)
```

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	NEEDED BY ME	NOT NEEDED BY ME
NEEDED BY DEPENDERS	PUBLIC	INTERFACE
NOT NEEDED BY DEPENDERS	PRIVATE	:-)

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INTERFACE and **PUBLIC** dependencies are **transitive** while **PRIVATE** are not

ALIAS TARGETS

```
add_library(MyLibrary lib_source.cpp)
add_library(MyCompany::MyLibrary ALIAS MyLibrary)
```

ALIAS TARGETS

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add_library(MyLibrary lib_source.cpp)
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```

```
# find_package(MyLibrary CONFIG REQUIRED)

target_link_libraries(MyLibraryTest
    PUBLIC
        MyCompany::MyLibrary
        GTest::Main
)
```

- Unifies with **`find_package()`** target naming
- **`::`** has to be followed with Target name (prevents typos)

GENERATOR EXPRESSIONS

```
target_compile_definitions(foo
    PRIVATE
        "VERBOSITY=$<IF:$<BOOL:${VERBOSE}>,30,10>")
```

- Use the **$<>** syntax
- *Not evaluated* by the command interpreter
- **Evaluated during build system generation**

GENERATOR EXPRESSIONS

BAD

```
add_executable(hello main.cpp)
if(CMAKE_BUILD_TYPE STREQUAL DEBUG)
    target_sources(hello PRIVATE helper_debug.cpp)
else()
    target_sources(hello PRIVATE helper_release.cpp)
endif()
```

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GOOD

```cmake
add_executable(hello main.cpp
    $<IF:$<CONFIG:Debug>:helper_debug.cpp,helper_release.cpp>)
```

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add_executable(hello main.cpp
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Never use **`CMAKE_BUILD_TYPE`** in **`if()`**

GENERATOR EXPRESSIONS

The library interface may change during installation. Use **`BUILD_INTERFACE`** and **`INSTALL_INTERFACE`** generator expression filters.

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```
target_include_directories(Foo PUBLIC
        $<BUILD_INTERFACE:${Foo_BINARY_DIR}/include>
        $<BUILD_INTERFACE:${Foo_SOURCE_DIR}/include>
        $<INSTALL_INTERFACE:include>)
```

MODERN LIBRARY EXAMPLE

```cmake
cmake_minimum_required(VERSION 3.8)
project(MyLibrary VERSION 0.0.1)

# dependencies
find_package(Foo 1.0 REQUIRED)

# library definition
add_library(MyLibrary lib_source.cpp)
target_compile_features(MyLibrary PUBLIC cxx_std_17)
target_include_directories(MyLibrary PUBLIC
    $<BUILD_INTERFACE:${CMAKE_CURRENT_SOURCE_DIR}/include>
    $<INSTALL_INTERFACE:include>
)
target_link_libraries(MyLibrary PRIVATE Foo::Foo)
add_library(MyCompany::MyLibrary ALIAS MyLibrary)
```

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target_include_directories(MyLibrary PUBLIC
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    $<INSTALL_INTERFACE:include>
)
target_link_libraries(MyLibrary PRIVATE Foo::Foo)
add_library(MyCompany::MyLibrary ALIAS MyLibrary)
```

Avoid *custom* variables in the arguments of project commands

MODERN LIBRARY USAGE

```cmake
cmake_minimum_required(VERSION 3.8)
project(MyLibraryTests)

# dependencies
enable_testing()
find_package(GTest MODULE REQUIRED)
if(NOT TARGET MyCompany::MyLibrary)
    find_package(MyLibrary CONFIG REQUIRED)
endif()

# target definition
add_executable(MyLibraryTests tests_source.cpp)
target_link_libraries(MyLibraryTests
    PRIVATE
        MyCompany::MyLibrary
        GTest::Main
)
add_test(NAME MyLibrary.UnitTests
    COMMAND MyLibraryTests
)
```

FILES ORGANIZATION

MYLIBRARY/SRC

- Standalone library definition and installation

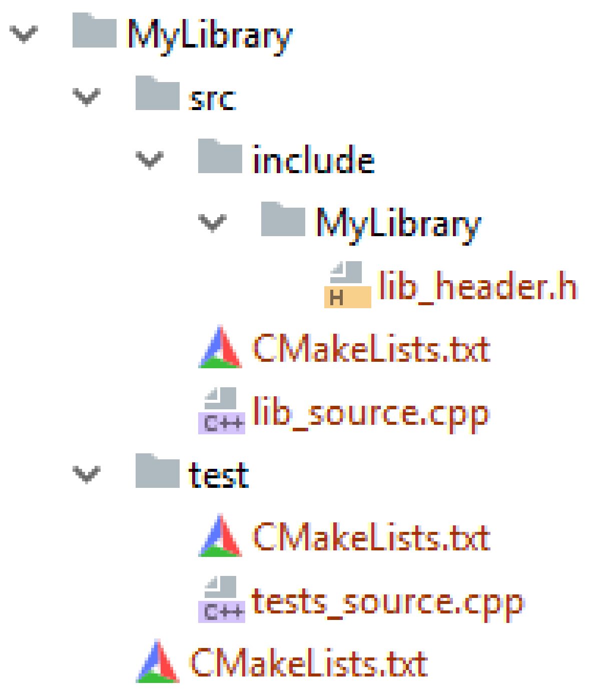
MYLIBRARY/UNIT_TESTS

- Standalone unit_tests definition

MYLIBRARY

- Entry point for development
- Subdirectories added with

  `add_subdirectory()`



```
MyLibrary
  src
    include
      MyLibrary
        lib_header.h
    CMakeLists.txt
    lib_source.cpp
  test
    CMakeLists.txt
    tests_source.cpp
  CMakeLists.txt
```

WRAPPER / ENTRY POINT

```
cmake_minimum_required(VERSION 3.5)
project(MyLibrary)

# add project code
add_subdirectory(src)

# add unit tests
enable_testing()
add_subdirectory(test)
```

- Useful for project development
  - no need to install in order to run unit tests
- Entry Point for IDEs like CLion or Visual Studio

MODERN CMAKE CODE OF CONDUCT

- Don't use macros that affect all targets
  - `add_definitions()`
  - `add_compile_options()`
  - `include_directories()`
  - `link_directories()`
  - `link_libraries()`

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  - **`link_libraries()`**
- Don't use **`file(GLOB)`** in projects
- Avoid unnecessary variables
- Keep your hands out of **`CXX_FLAGS`**
- Don't use **`target_include_directories()`** with a path outside of your module
- Don't use **`target_link_libraries()`** without specifying **`PRIVATE`**, **`PUBLIC`** or **`INTERFACE`**

COMPILED, BUILT, TESTED

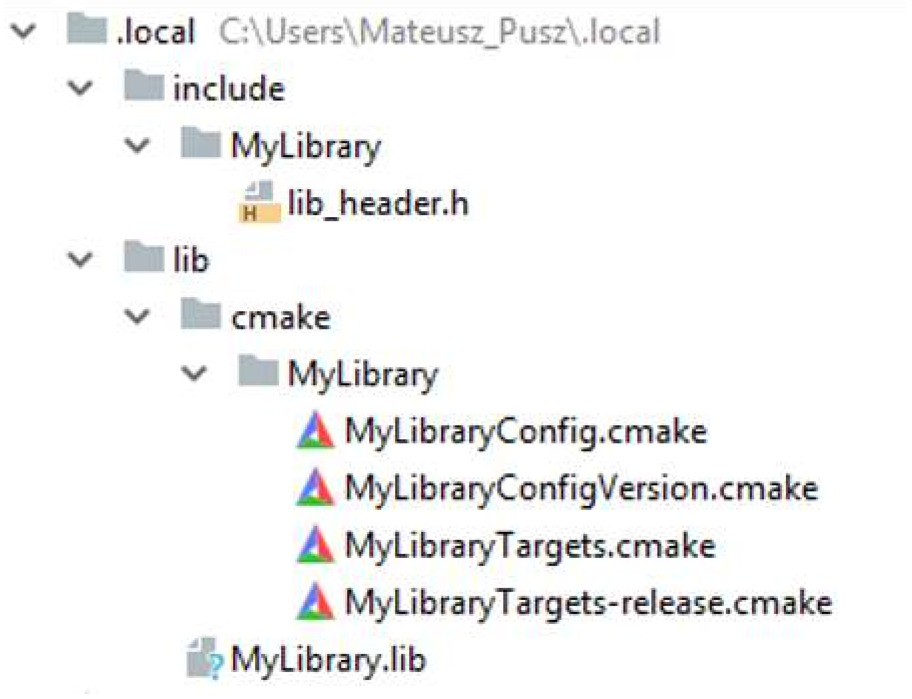
Done?

DON'T BE ASOCIAL!

a·so·cial (āˈsōSHəl) adjective avoiding social interaction; inconsiderate of or hostile to others.
asocial code
4:17 / 1:28:44

David Sankel: Big Projects, and CMake, and Git, Oh My!

EXPORT YOUR LIBRARY INTERFACE



```
.local  C:\Users\Mateusz_Pusz\.local
  include
    MyLibrary
      lib_header.h
  lib
    cmake
      MyLibrary
        MyLibraryConfig.cmake
        MyLibraryConfigVersion.cmake
        MyLibraryTargets.cmake
        MyLibraryTargets-release.cmake
    MyLibrary.lib
```

EXPORT YOUR LIBRARY INTERFACE

CMAKELISTS.TXT

```
cmake_minimum_required(VERSION 3.8)
project(MyLibrary VERSION 0.0.1)
find_package(Foo 1.0 REQUIRED)
add_library(MyLibrary lib_source.cpp)
```

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```

```
install(TARGETS MyLibrary EXPORT MyLibraryTargets
        LIBRARY DESTINATION lib
        ARCHIVE DESTINATION lib
        RUNTIME DESTINATION bin
        INCLUDES DESTINATION include)
install(EXPORT MyLibraryTargets
        DESTINATION lib/cmake/MyLibrary
        FILE MyLibraryTargets.cmake
        NAMESPACE MyCompany::)
```

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        INCLUDES DESTINATION include)
install(EXPORT MyLibraryTargets
        DESTINATION lib/cmake/MyLibrary
        FILE MyLibraryTargets.cmake
        NAMESPACE MyCompany::)
```

```
install(DIRECTORY include/MyLibrary
        DESTINATION include)
```

EXPORT YOUR LIBRARY INTERFACE

CMAKELISTS.TXT

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cmake_minimum_required(VERSION 3.8)
project(MyLibrary VERSION 0.0.1)
find_package(Foo 1.0 REQUIRED)
add_library(MyLibrary lib_source.cpp)
```

```
include(CMakePackageConfigHelpers)
write_basic_package_version_file(MyLibraryConfigVersion.cmake
        COMPATIBILITY SameMajorVersion)
install(FILES MyLibraryConfig.cmake ${CMAKE_CURRENT_BINARY_DIR}/MyLibraryConfigVersion.cmake
        DESTINATION lib/cmake/MyLibrary)
```

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cmake_minimum_required(VERSION 3.8)
project(MyLibrary VERSION 0.0.1)
find_package(Foo 1.0 REQUIRED)
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```

```
include(CMakePackageConfigHelpers)
write_basic_package_version_file(MyLibraryConfigVersion.cmake
        COMPATIBILITY SameMajorVersion)
install(FILES MyLibraryConfig.cmake ${CMAKE_CURRENT_BINARY_DIR}/MyLibraryConfigVersion.cmake
        DESTINATION lib/cmake/MyLibrary)
```

MYLIBRARYCONFIG.CMAKE

```
include(CMakeFindDependencyMacro)
find_dependency(Foo 1.0)
include("${CMAKE_CURRENT_LIST_DIR}/MyLibraryTargets.cmake")
```

PACKAGE TESTING

- Create and install the package

```
mkdir src/build
cd src/build
cmake -DCMAKE_BULD_TYPE=Release -DCMAKE_INSTALL_PREFIX=~/.local ..
cmake --build . --target install
```

PACKAGE TESTING

- Create and install the package

```
mkdir src/build
cd src/build
cmake -DCMAKE_BULD_TYPE=Release -DCMAKE_INSTALL_PREFIX=~/.local ..
cmake --build . --target install
```

- Compile and run tests importing the library

```
mkdir test/build
cd test/build
cmake -DCMAKE_BULD_TYPE=Release -DCMAKE_INSTALL_PREFIX=~/.local ..
ctest -VV
```

PURE CMAKE: DEPENDENCIES THE WRONG WAY

PROCESS

- Build each repository *in isolation*, generate and install its binaries along with a CMake config file
- For each project that has dependencies, use **`find_package()`** to load the config file and use the library

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PROBLEMS

- Updating a program implies *recompiling* its package and then every one of its dependers *manually*
- *It doesn't scale* (many levels of dependencies, many configurations, ...)
- What about *supporting different versions*?
  - Release, Debug, RelWithDebInfo, ...
  - different compilers (gcc, clang, ...), compiler versions, C++ libraries (libc++ vs libstdc++)
  - different runtime libraries
  - different package configurations (no exceptions, shared lib, ...)

WHAT WE WANT?

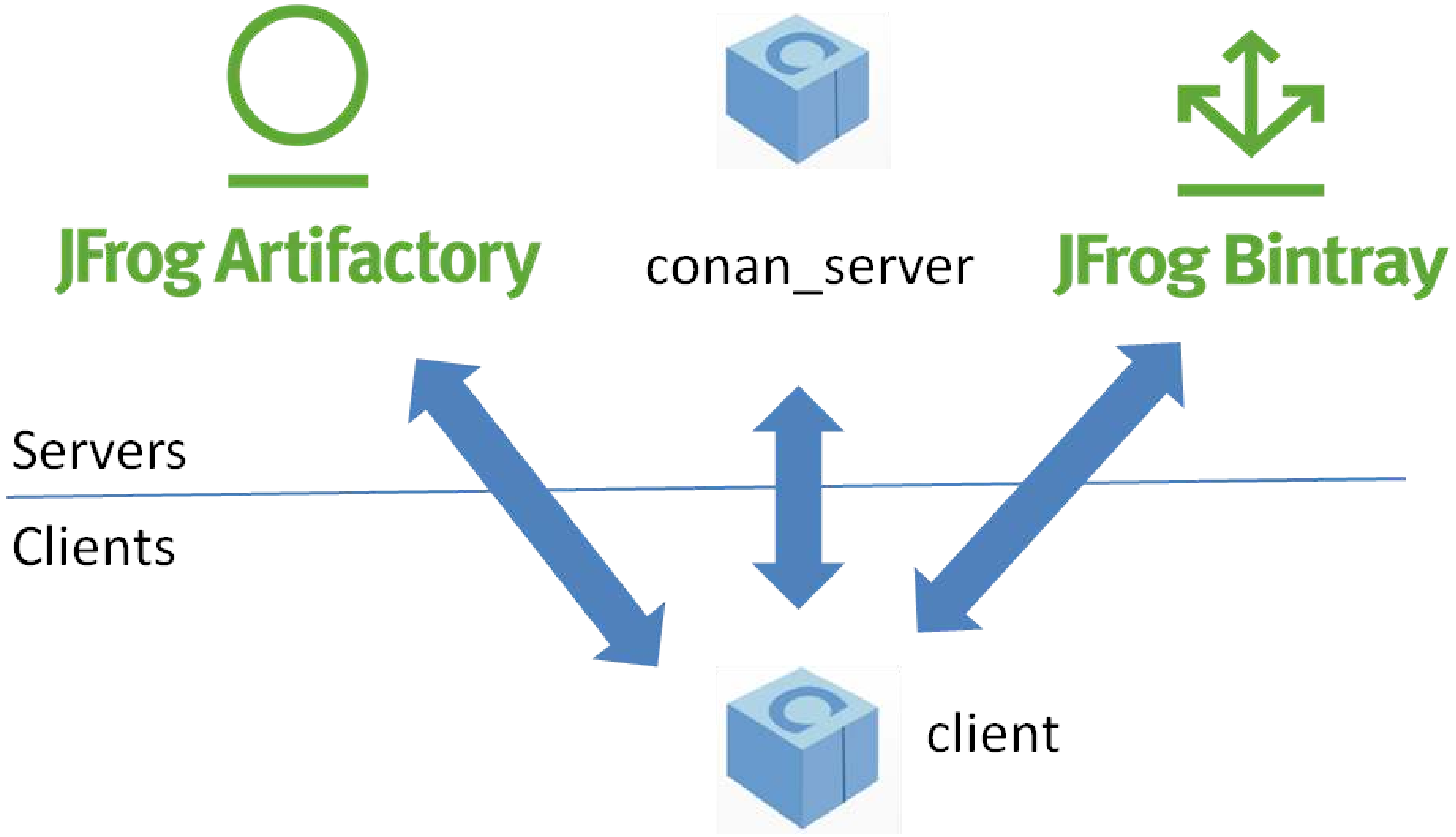
- One build process *builds the project and all dependencies*
- *Only required* dependencies are being *rebuilt*
  - reuse of prebuilt binaries if available and up-to-date
- *No need to manually* download, build and install the dependencies
- Possibility to use *our own versions of dependencies* (ZLib, Boost, etc) instead of using system versions

CONAN

- Conan is **OSS**, with an MIT license
- **Decentralized** package manager with
  a client-server architecture
- The servers are just package storage
  - they do not build nor create the packages
- *The packages are created by the client*
  - packaging of **prebuilt** binaries
  - building from **sources** if needed
- **Portable** to any platform supporting Python
- *Works with any build system*
- Uses **Python** as its scripting language
- Easy hosting in cloud or on a local server

conan.io
C++ package manager

CONAN CLIENT-SERVER ARCHITECTURE



CONAN CLIENT-SERVER ARCHITECTURE

CONAN CLIENT

- Console/terminal application
- Package creation and consumption
- Local cache for package storage (allows offline work)

CONAN SERVER

- Quite simple TCP server
- User can run it as a daemon or service

JFROG ARTIFACTORY

- Offers conan repositories
- More powerful than conan server (WebUI, multiple auth protocols, High Availability, ...)
- JFrog Artifactory Community Edition for C/C++

JFROG BINTRAY

- Provides public and free hosting service for OSS conan packages
- Account is only needed to upload packages (anonymous read access)
- conan-center - moderated official repository

CONAN PACKAGE IDENTIFIER

```
package_name/package_version@user/channel
```

PACKAGE_NAME

- Usually project/library name

PACKAGE_VERSION

- Any string

USER

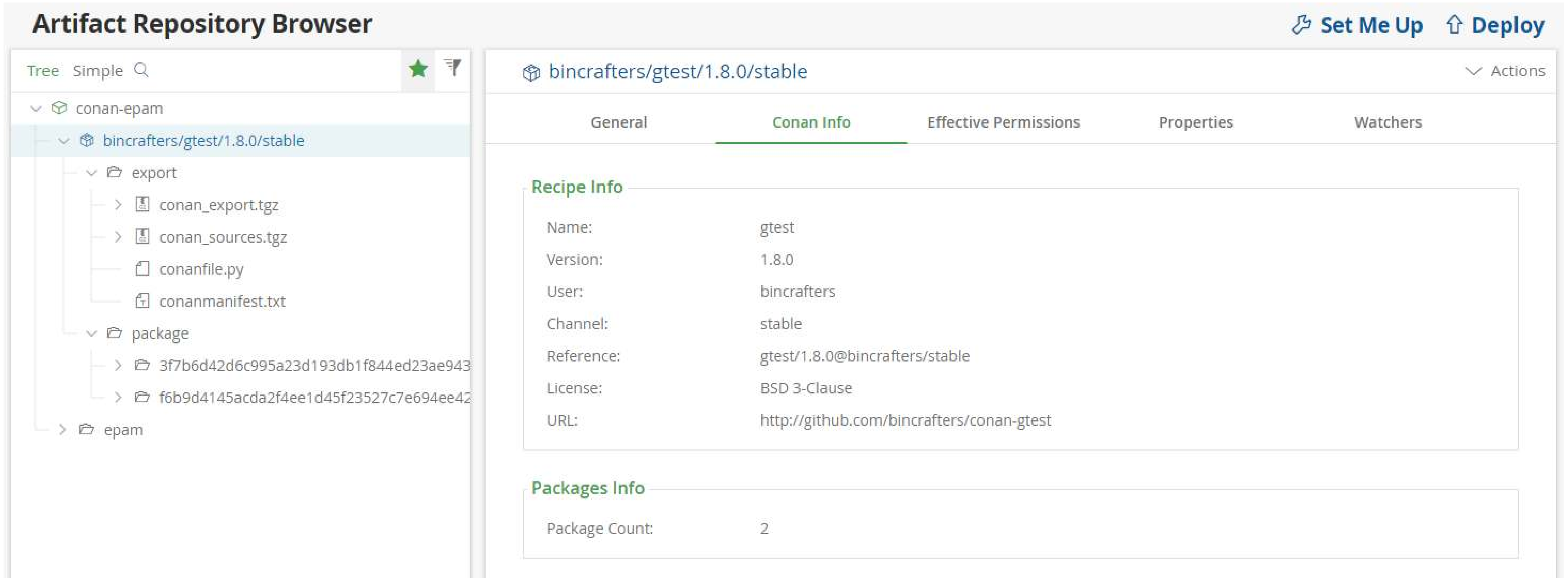
- Owner of the package version
- Namespace that allows different users to have their own packages for the same library with the same name

CHANNEL

- Allows different packages for the same library
- Usually denote the maturity of a package ("stable", "testing")

CONAN PACKAGES

- gtest/1.8.0@bincrafters/stable



bincrafters/gtest/1.8.0/stable

```
conan-epam
  bincrafters/gtest/1.8.0/stable
    export
      conan_export.tgz
      conan_sources.tgz
      conanfile.py
      conanmanifest.txt
    package
      3f7b6d42d6c995a23d193db1f844ed23ae943
      f6b9d4145acda2f4ee1d45f23527c7e694ee42
  epam
```

Recipe Info

Name:	gtest
Version:	1.8.0
User:	bincrafters
Channel:	stable
Reference:	gtest/1.8.0@bincrafters/stable
License:	BSD 3-Clause
URL:	http://github.com/bincrafters/conan-gtest

Packages Info

Package Count:	2

CONAN PACKAGES

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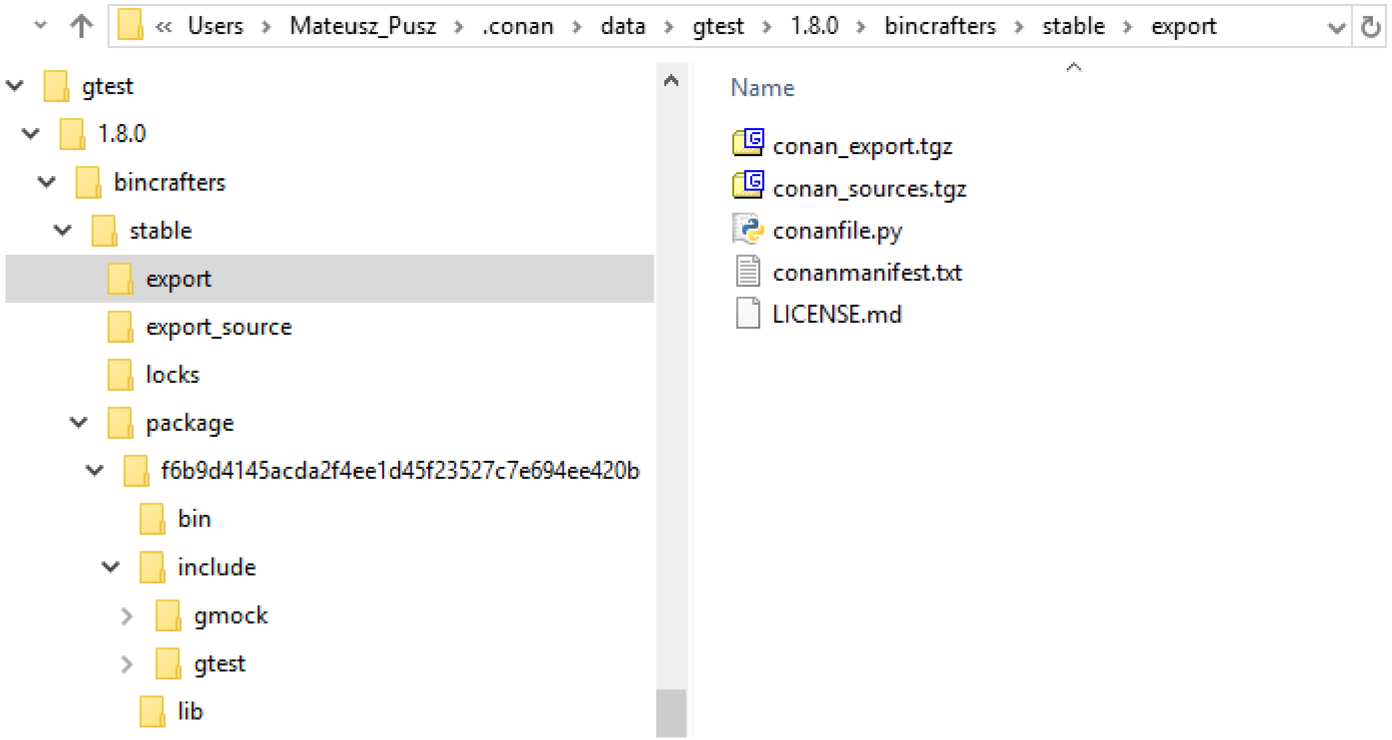

« Users › Mateusz_Pusz › .conan › data › gtest › 1.8.0 › bincrafters › stable › export

```
gtest
  1.8.0
    bincrafters
      stable
        export
        export_source
        locks
        package
          f6b9d4145acda2f4ee1d45f23527c7e694ee420b
            bin
            include
              gmock
              gtest
            lib
```

Name

```
conan_export.tgz
conan_sources.tgz
conanfile.py
conanmanifest.txt
LICENSE.md
```

INSTALLING DEPENDENCIES

- Installing specific package by hand

```
conan install gtest/1.8.0@bincrafters/stable -g cmake
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conan install ..
```

- Optionally a profile name can be provided (otherwise **`default`** is used)

```
conan install .. -pr vs2017
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```
conan install ..
```

- Optionally a profile name can be provided (otherwise **`default`** is used)

```
conan install .. -pr vs2017
```

- Build packages from sources if prebuilt one is not available

```
conan install .. --build=missing
```

conanfile.txt

```
[requires]
Foo/1.0@my_channel/stable
gtest/1.8.0@bincrafters/stable

[options]

[generators]
cmake
```

- **`cmake`** generator creates **`conanbuildinfo.cmake`** file that defines CMake
  - variables (module paths include paths, library names, ...)
  - helper functions (defining targets, configuring CMake environment, ...)
- Many different generators provided to support any build system

INSPECTING DEPENDENCIES

- List packages in the local cache

```
conan search
```

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- Inspect binary package details

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conan search gtest/1.8.0@bincrafters/stable
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```

- Inspect your current project’s dependencies

```
conan info ..
```

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conan search gtest/1.8.0@bincrafters/stable
```

- Inspect your current project’s dependencies

```
conan info ..
```

- Possibility to generate table of all binary packages and graph of all dependencies

```
conan search gtest/1.8.0@bincrafters/stable --table=conan_matrix.html
conan info .. --graph=graph.html
```

PACKAGE DETAILS

```
> conan info OpenSSL/1.1.0g@conan/stable
  OpenSSL/1.1.0g@conan/stable
      ID: 606fdb601e335c2001bdf31d478826b644747077
      BuildID: None
      Remote: conan-center=https://conan.bintray.com
      URL: http://github.com/lasote/conan-openssl
      License: The current OpenSSL licence is an 'Apache style' license: https://www.openssl.org/source/license.html
      Updates: Version not checked
      Creation date: 2018-03-29 18:34:10
      Required by:
          None
      Requires:
          zlib/1.2.11@conan/stable
  zlib/1.2.11@conan/stable
      ID: 6cc50b139b9c3d27b3e9042d5f5372d327b3a9f7
      BuildID: None
      Remote: conan-center=https://conan.bintray.com
      URL: http://github.com/lasote/conan-zlib
      License: http://www.zlib.net/zlib_license.html
      Updates: Version not checked
      Creation date: 2018-04-02 15:25:03
      Required by:
          OpenSSL/1.1.0g@conan/stable
```

PACKAGE DETAILS

```
> conan search gtest/1.8.0@bincrafters/stable
Existing packages for recipe gtest/1.8.0@bincrafters/stable:

    Package_ID: f6b9d4145acda2f4ee1d45f23527c7e694ee420b
        [options]
            build_gmock: True
            shared: False
        [settings]
            arch: x86_64
            build_type: Debug
            compiler: Visual Studio
            compiler.runtime: MDd
            compiler.version: 15
            os: Windows
        Outdated from recipe: False
```

SETTING PACKAGE OPTIONS

- `conanfile.txt`

```
[requires]
Foo/1.0@my_channel/stable
gtest/1.8.0@bincrafters/stable

[options]
gtest:shared=True

[generators]
cmake
```

SETTING PACKAGE OPTIONS

- **conanfile.txt**

```
[requires]
Foo/1.0@my_channel/stable
gtest/1.8.0@bincrafters/stable

[options]
gtest:shared=True

[generators]
cmake
```

- Command line

```
conan install .. -o gtest:shared=True
```

```
conan install .. -o *:shared=True
```

FIXING IMPORTS FOR SHARED LIBRARIES

CONANFILE.TXT

```
[requires]
Foo/1.0@my_channel/stable
gtest/1.8.0@bincrafters/stable

[options]
gtest:shared=True

[generators]
cmake

[imports]
bin, *.dll -> ./bin    # Copies all dll files from packages bin folder to my "bin" folder
lib, *.dylib* -> ./bin # Copies all dylib files from packages lib folder to my "bin" folder
```

CONAN PROFILES

```
> conan profile show vs2017
Configuration for profile vs2017:

[settings]
os=Windows
arch=x86_64
compiler=Visual Studio
compiler.version=15
build_type=Release
arch_build=x86_64
os_build=Windows
[options]
[build_requires]
[env]
```

CONAN PROFILES

```
> conan profile show vs2017
Configuration for profile vs2017:

[settings]
os=Windows
arch=x86_64
compiler=Visual Studio
compiler.version=15
build_type=Release
arch_build=x86_64
os_build=Windows
[options]
[build_requires]
[env]
```

- Easy to override or extend the profile

```
conan install .. -pr vs2017 -s build_type=Debug
```

CONAN PROFILES

```
[settings]
setting=value

[options]
MyLib:shared=True

[env]
env_var=value

[build_requires]
Tool1/0.1@user/channel
Tool2/0.1@user/channel, Tool3/0.1@user/channel
```

- Stored in the default profile folder or anywhere in a project

CONAN PROFILES

- Example of a profile to install Poco dependencies as shared and in debug mode

DEBUG_SHARED

```
include(default)

[settings]
build_type=Debug

[options]
Poco:shared=True
Poco:enable_apacheconnector=False
OpenSSL:shared=True
```

```
conan install .. -pr=../debug_shared
```

USING CONAN WITH CMAKE

```
cmake_minimum_required(VERSION 3.5)
project(MyLibrary)

if(EXISTS ${CMAKE_BINARY_DIR}/conanbuildinfo.cmake)
    include(${CMAKE_BINARY_DIR}/conanbuildinfo.cmake)
    conan_basic_setup(TARGETS)
endif()

# add project code
add_subdirectory(src)

# add unit tests
enable_testing()
add_subdirectory(unit_tests)
```

- Above code supports optional use of Conan
- **`if()`** statement can be skipped if Conan usage is mandatory in a project

USING CONAN WITH CMAKE

- Full Conan support with definition of **`CONAN_PKG::XXX`** packages

```
if(EXISTS ${CMAKE_BINARY_DIR}/conanbuildinfo.cmake)
    include(${CMAKE_BINARY_DIR}/conanbuildinfo.cmake)
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endif()
```

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if(EXISTS ${CMAKE_BINARY_DIR}/conanbuildinfo.cmake)
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    conan_basic_setup(TARGETS)
endif()
```

- Enough to make **`find_package()`** work

```
if(EXISTS ${CMAKE_BINARY_DIR}/conanbuildinfo.cmake)
    include(${CMAKE_BINARY_DIR}/conanbuildinfo.cmake)
    conan_set_find_paths()
endif()
```

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if(EXISTS ${CMAKE_BINARY_DIR}/conanbuildinfo.cmake)
    include(${CMAKE_BINARY_DIR}/conanbuildinfo.cmake)
    conan_set_find_paths()
endif()
```

```
if(EXISTS ${CMAKE_BINARY_DIR}/conanbuildinfo.cmake)
    include(${CMAKE_BINARY_DIR}/conanbuildinfo.cmake)
    set(CMAKE_MODULE_PATH ${CONAN_CMAKE_MODULE_PATH} ${CMAKE_MODULE_PATH})
endif()
```

USING CONAN WITH CMAKE

- Running both **`find_package(GTest)`** and **`conan_basic_setup(TARGETS)`** duplicates targets
  - **`GTest::GTest`**, **`GTest::Main`**
  - **`CONAN_PKG::gtest`** (linking **`gmock_main`**, **`gmock`** and **`gtest`**)
- Which one to use?

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- Which one to use?
- It depends...
- In general **`find_package(XXX)`** targets are more mature
- But...
  - Difficult to make it properly address transitivity (WIP)
  - Does not support multi-configuration

USING CONAN WITH CMAKE

- Issues with **`find_package(XXX)`** are often patched by Conan recipe

```
googletest\include\gtest\gtest-printers.h(600): error C2220: warning treated as error - no 'object' file generated
                                                            [googlemock\gtest\gtest.vcxproj]
     googletest\include\gtest\gtest-printers.h(600): warning C4996: 'std::tr1': warning STL4002: The non-Standard
             std::tr1 namespace and TR1-only machinery are deprecated and will be REMOVED. You can define
             _SILENCE_TR1_NAMESPACE_DEPRECATION_WARNING to acknowledge that you have received this warning.
                                                            [googlemock\gtest\gtest.vcxproj]
```

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                                                            [googlemock\gtest\gtest.vcxproj]
```

CONANFILE.PY

```
class GTestConan(ConanFile):

    def package_info(self):
        # ...
        if self.settings.compiler == "Visual Studio" and float(str(self.settings.compiler.version)) >= 15:
            self.cpp_info.defines.append("GTEST_LANG_CXX11=1")
            self.cpp_info.defines.append("GTEST_HAS_TR1_TUPLE=0")
```

USING CONAN WITH CMAKE

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```
googletest\include\gtest\gtest-printers.h(600): error C2220: warning treated as error - no 'object' file generated
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```

FINDGTEST.CMAKE

```
set_property(TARGET GTest::Main PROPERTY INTERFACE_COMPILE_DEFINITIONS ${CONAN_COMPILE_DEFINITIONS_GTEST})
```

USING CONAN WITH CMAKE

- Choosing **CONAN_PKG::XXX**

```
if(CONAN)
    target_link_libraries(MyLibraryTests PRIVATE MyCompany::MyLibrary CONAN_PKG::gtest)
else()
    target_link_libraries(MyLibraryTests PRIVATE MyCompany::MyLibrary GTest::Main)
endif()
```

USING CONAN WITH CMAKE

- Choosing **CONAN_PKG::XXX**

```
if(CONAN)
    target_link_libraries(MyLibraryTests PRIVATE MyCompany::MyLibrary CONAN_PKG::gtest)
else()
    target_link_libraries(MyLibraryTests PRIVATE MyCompany::MyLibrary GTest::Main)
endif()
```

- Starting from CMake 3.11

```
if(EXISTS ${CMAKE_BINARY_DIR}/conanbuildinfo.cmake)
    include(${CMAKE_BINARY_DIR}/conanbuildinfo.cmake)
    conan_basic_setup(TARGETS)
    add_library(GTest::Main INTERFACE IMPORTED)
    target_link_libraries(GTest::Main INTERFACE CONAN_PKG::gtest)
else()
    find_package(GTest MODULE REQUIRED)
endif()
target_link_libraries(MyLibraryTests PRIVATE MyCompany::MyLibrary GTest::Main)
```

CONAN PACKAGE CREATION

- It is a complex subject and we are out of time
- Please refer to great Conan documentation
- Or wait for another lecture :-)

SUMMARY

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CMAKE

- Many projects still do not use CMake at all
- Many projects still do not use CMake in a Modern way
- Many projects still do not provide installation option with proper CMake configuration files generation

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CONAN

- Production quality Package Manager designed with C++ in mind
- For free and on MIT license
- Quite easy to use
- The docs are really good
- Give it a try!

CAUTION
Programming
is addictive
(and too much fun)