Doxygen

Tom Latham

(based on material from Matt Williams)

Documentation

- Documentation is just as important as the code itself
- Without docs, you wouldn't know how to use a library: *cppreference.com* or the *Boost* docs are essential
- You should make sure you always document your code for external use (or just to remind yourself in 6 months!)
- A standard syntax exists called *Doxygen*

Doxygen syntax

- Doxygen comments are generally placed within the header (.hpp) files, rather than the source (.cpp) files

- Doxygen comments are marked in a special way

```
/// Doxygen single-line comments start with three slashes

/**
 * Doxygen multi-line comments start with a slash and two stars
 * In both cases, Doxygen reads what's inside the comment
 */
```

- Comments *precede* the statement that they want to document

Doxygen commands

- Doxygen provides its own syntax to be used inside comments
- They are detailed in full in the manual but there are a few which are most commonly used:
- The descriptions of functions, classes, enums, etc. often need to be quite detailed, so it's good to also have a short one-line description that is used at the head of the page – use the `\brief` command
- `\param` is used to document function arguments
- `\return` is used to describe the return value of a function

```
/**
 * \brief This function is amazing
 *
 * More detailed description of all
 * the very special stuff it does
 */
void foo();
```

```
/**
 * \param key the cipher key
 */
void setKey(const size_t key);
```

```
/**
 * \return the number of elements
 */
int size() const;
```

Function example

- Describe the function in a good degree of detail
- Always document all function parameters and return values

```cpp
/**
 * \brief An amazing function which does something very special
 *
 * A longer description of this function is that is can be used
 * to do something very interesting, which this longer description
 * explains in detail.
 *
 * \param input the string that we want to convert
 *
 * \return the converted string
 */
std::string convert(const std::string& input);
```

Class example

- Class docs should describe the purpose of the class and give examples of usage

```
/**
 * \brief A cipher encodes and decodes
 *
 * Cipher is an abstract base class, which provides the ability
 * to encode and decode strings based on a key
 *
 * Use it like
 * \code{.cpp}
   class MyCipher : public Cipher {...};
 * \endcode
 *
 * \since 0.1.3
 */
class Cipher {
```

Enum example

- Enumerations should have a general description and each state should also be documented

- A common style is to use 'suffix' comments for the individual state descriptions

```
/**
 * \brief The rank of the employee
 */
enum class Rank {
  Junior, ///< A new person at the company
  Senior, ///< Someone who has been here a while
  Chief   ///< Someone super special
};
```

Separate page example

- Can create pages of documentation that are perhaps not specific to particular classes or functions
- Can create files with .dox extension that use the Doxygen syntax
- Or you can use Markdown files – note that we've simply used our README.md to create the front page of the documentation

```
/**
 * \mainpage Welcome to MPAGS Cipher
 *
 * Blah blah
 *
 * \section Introduction
 * Blah blah
 *
 * \subsection Usage
 *
 * \code{.cpp}
   CaesarCipher c {"4"};
   std::cout << c.applyCipher("test");
 * \endcode
 */
```

Configuring Doxygen

- Doxygen itself is a program that, given a configuration file, generates a set of HTML (or LaTeX, or …) files

- A default configuration file can be created with

  ```
  $ doxygen -G Doxyfile
  ```

  but we will just use the one that we've provided in the Documentation folder of today's git repository

- It's a simple (if slightly long) file, so feel free to read through it

Automating generation of documentation

Documentation/CMakeLists.txt

```cmake
# Find the Doxygen tools
find_package(Doxygen REQUIRED)

# Copy Doxyfile.in (in source dir) to Doxyfile (in build dir)
# and replace any @VAR@ with with CMake variables called VAR
configure_file( Doxyfile.in Doxyfile @ONLY )

# Tells CMake how to 'create' ${CMAKE_CURRENT_BINARY_DIR}/html/index.html
add_custom_command(
  OUTPUT "${CMAKE_CURRENT_BINARY_DIR}/html/index.html"
  COMMAND ${DOXYGEN_EXECUTABLE}
  WORKING_DIRECTORY ${CMAKE_CURRENT_BINARY_DIR}
  DEPENDS Doxyfile.in
          MPAGSCipher
          ${PROJECT_SOURCE_DIR}/README.md
          ${PROJECT_SOURCE_DIR}/CMakeLists.txt
  COMMENT "Doxygenating ${PROJECT_NAME}"
)

# Adds the ability to do 'make doc' which will try to create ".../html/index.html"
add_custom_target(doc ALL DEPENDS "${CMAKE_CURRENT_BINARY_DIR}/html/index.html")
```

Exercise 1 – build the documentation

- The starter repository for today should contain the necessary files form which to build the documentation
  - Look at what has changed in the top level CMakeLists.txt file
  - Take a look at the new files in the Documentation subdirectory
- Try running "make doc" in your build area
  - Open the resulting documentation in your web browser (instructions for two ways to do this on the next slides)
- Can you work out how to have the private members of the CaesarCipher class appear in the documentation?
- Throughout the rest of the day, when adding new code always make sure to document new classes, functions, etc.

Using a webserver to view the Doxygen docs

- In order to view the documentation files built by Doxygen, you can start a webserver in your container that can serve the pages to your host system
- This can be done using the following commands (which assume that you are currently in your build directory):

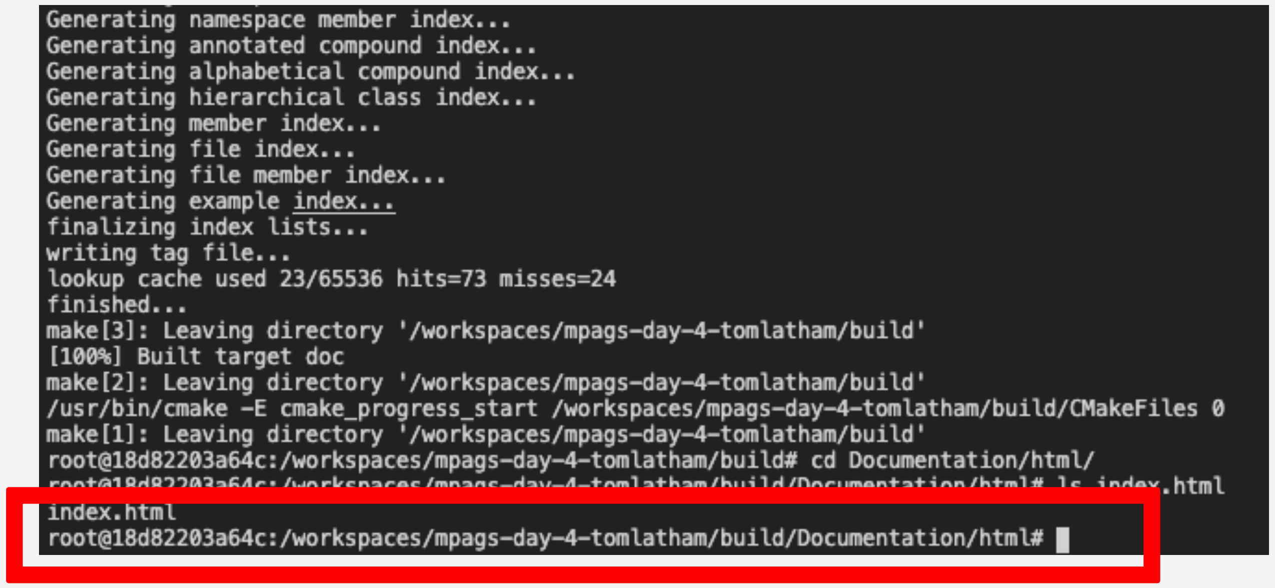
  ```
  cd Documentation/html
  python3 -m http.server 8000
  ```

- At this point VSCode will likely pop up with a box asking if you want to open in a browser – click "Open in Browser" and the pages should appear in your browser
- If you don't see that dialogue box, you should just be able to open a browser and put in the following address:
  http://localhost:8000/index.html
- If at any point you want to close the webserver you can just Ctrl+C in the terminal from which you issued the python3 command to start the server

Copying files from dev container to host

- In order to view the documentation files built by Doxygen you can alternatively copy them from your dev container to your host system
- This can be done using the ‘`docker cp`’ command
- You’ll need to to know the unique ID of your container and the full path to the generated html files, which will likely be:

  `/workspaces/<your_repo>/build/Documentation/html`
- The unique ID can be easily obtained from the VSCode terminal – it may already be part of your terminal prompt (see the screenshot on the right and compare with the command below)
- Otherwise, use the ‘`hostname`’ command in the VSCode terminal



```
Generating namespace member index...
Generating annotated compound index...
Generating alphabetical compound index...
Generating hierarchical class index...
Generating member index...
Generating file index...
Generating file member index...
Generating example index...
finalizing index lists...
writing tag file...
lookup cache used 23/65536 hits=73 misses=24
finished...
make[3]: Leaving directory '/workspaces/mpags-day-4-tomlatham/build'
[100%] Built target doc
make[2]: Leaving directory '/workspaces/mpags-day-4-tomlatham/build'
/usr/bin/cmake -E cmake_progress_start /workspaces/mpags-day-4-tomlatham/build/CMakeFiles 0
make[1]: Leaving directory '/workspaces/mpags-day-4-tomlatham/build'
root@18d82203a64c:/workspaces/mpags-day-4-tomlatham/build# cd Documentation/html/
root@18d82203a64c:/workspaces/mpags-day-4-tomlatham/build/Documentation/html# ls index.html
index.html
root@18d82203a64c:/workspaces/mpags-day-4-tomlatham/build/Documentation/html# 
```

- The below docker command will copy the whole html directory to the current directory of your host filesystem, so first change directory to wherever you want to copy the files
- Then, in a terminal on your host system, run the command (substituting your unique ID and path):

```
docker cp 18d82203a64c:/workspaces/mpags-day-4-tomlatham/build/Documentation/html .
```

- Finally, you can open the html/index.html file in your browser