# Building and Using Bio-Formats with C++

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# Overview

# Java and C++

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- Bio-Formats-C++ (native C++ implementation)
  - OME-TIFF **Reference implementation**
  - OME-XML model objects
  - Metadata store
  - Reading
  - Writing

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  - Reading
  - Writing
- Initial uses:
  - **Image acquisition** writing OME-TIFF
  - **Image analysis** reading OME-TIFF

# Source and documentation downloads

- (Download source)
- (Documentation)
- (Tutorial)
- (Doxygen API reference)

# Default compilers

- FreeBSD: LLVM/`clang++` or GCC/`g++`
- Linux: GCC/`g++`
- MacOS X: XCode (custom LLVM/`clang++`)
- Windows: Visual Studio or Visual Studio Express (MSVC/`cl`)

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- Note Visual Studio isn't yet fully supported by the build and CI infrastructure but is in the pipeline

# Package managers

- FreeBSD: Ports (e.g. `pkg`, `portmaster`)
- Linux: Distribution package manager (e.g. `apt-get` or `yum`)
- MacOS X: homebrew (`brew`)
- Windows: Yeah, right. You need to manually download all the tools and then compile all the libraries by hand for your specific version of Visual Studio. (Microsoft love to make development for their platform easy and painless. Not!)

# Required packages

## Libraries

- Boost
- HDF5
- PNG
- TIFF
- Xerces-C

## Tools

- CMake
- Doxygen + Graphviz
- Git
- Graphicsmagick
- Python + genshi + sphinx
- TEXLive

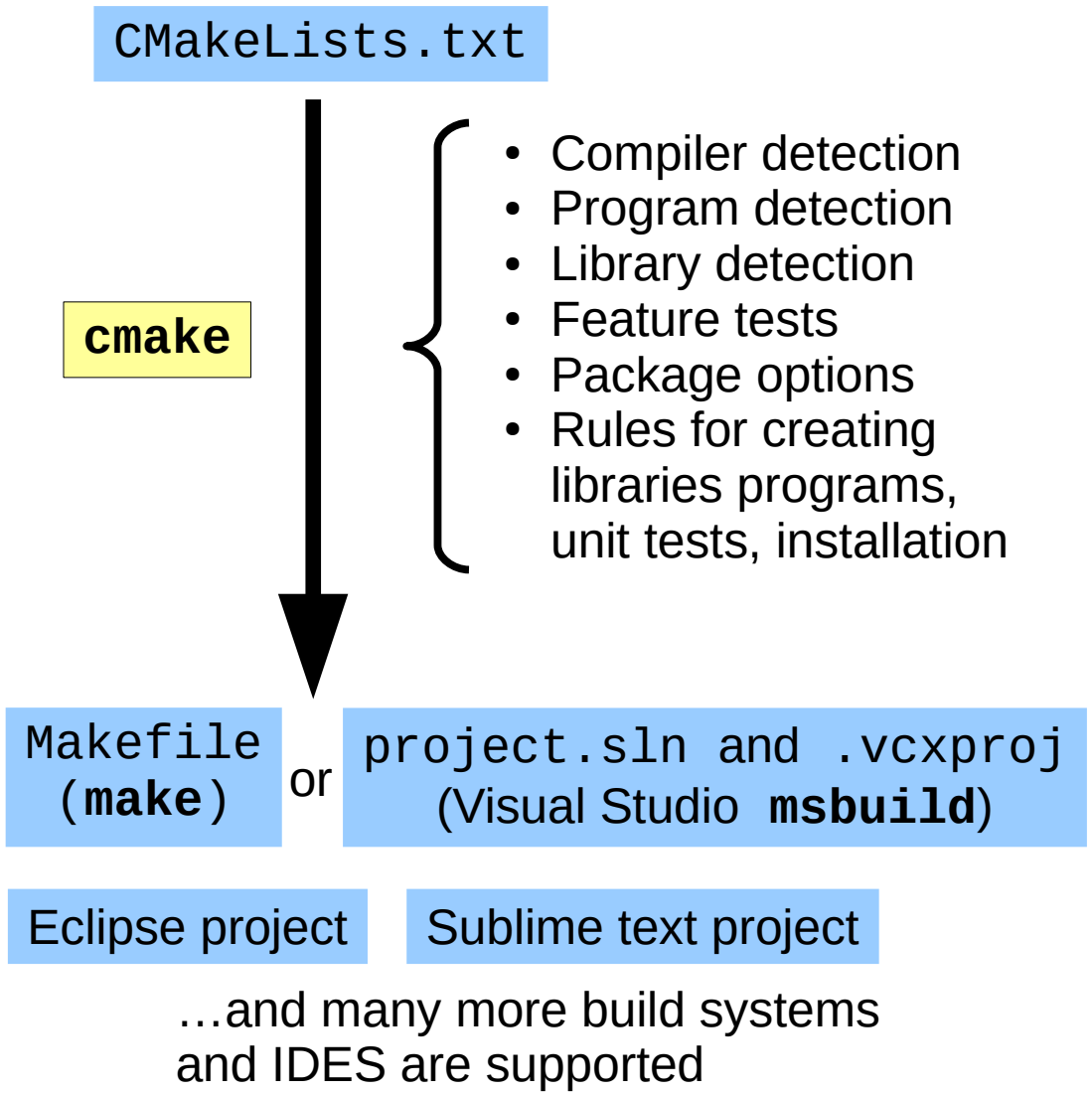
# System configuration

- In general, none of the tools should require any configuration
- LaTeX may require local font configuration to make the TeX Gyre fonts available.
  - Linux and FreeBSD: Use the provided `fontconfig` template or create your own
  - MacOS X: Add to system using FontBook
  - Windows: May need adding to the system fonts if not found automatically

# Environment configuration

- Primarily needed on Windows
- Rather than setting globally, make a batch file which can set up the environment.
- Activate a python virtualenv if needed
- Ensure that all tools are on the user `PATH`
  - `cmake`, `doxygen`, `dot`, `git`, `python`, `sphinx`, `xelatex`
- Set `CMAKE_PREFIX_PATH` if some libraries and tools are not on the default search path.
- Not all tools need to be on the default path; some will be discovered automatically by `cmake`
- No need to use a special Visual Studio shell when using `cmake`

# `cmake` overview



# `cmake` features

- `cmake` is a generic cross-platform build system
- `cmake` generates build files for a large number of common build systems
- On FreeBSD, Linux and MacOS X, `make` `Makefile`s will be used
- On Windows with Visual Studio, `msbuild` `.sln` solution files will be used
- Eclipse, Sublime Text, Kate, Code::Blocks or several other IDEs or build systems may be used instead, if desired

# Building Bio-Formats on Unix

## Basic cmake usage

- Basic options
- Available generators

## Build steps

- Configuring
- Building
- Testing
- Installing

# Configure and build with `cmake`

Building from git or source release:
Configure the build:

```
% mkdir /tmp/bfbuild
% cd /tmp/bfbuild
% cmake /path/to/bioformats
```

Run the build with either of:

```
% make [VERBOSE=1]
% cmake --build .
```

# Testing

Run the unit tests with any of:

```
% make test
% cmake --build . --target test
% ctest [-V]
```

Individual tests may be run by hand:

```
% ./bf-test cpp/test/ome-bioformats/pixelbuffer
```

# Installation

Install the build with either of:

```
% make install [VERBOSE=1] [DESTDIR=/staging/path]
% cmake --build . --target install
```

By default, this will install into *CMAKE_INSTALL_PREFIX* which will default to `/usr/local`. Use *DESTDIR* to install into an alternative prefixed location, which is useful for testing and packaging for release.

# Reading an OME-TIFF

```
OMETIFFReader reader;

reader.setGroupFiles(true);
reader.setId(filename);
shared_ptr<MetadataStore> store =
    reader.getMetadataStore();

for (dimension_size_type series = 0U; series <
    reader.getSeriesCount(); ++series) {
  reader.setSeries(series);
  for (dimension_size_type plane = 0U; plane <
      reader.getPlaneCount(); ++plane) {
    VariantPixelBuffer pixels;
    reader.openBytes(plane, pixels);
  }
}
reader.close();
```

# Writing an OME-TIFF

```
shared_ptr<MetadataRetrieve> retrieve;
OMETIFFWriter writer;

writer.setMetadataRetrieve(retrieve);
writer.setInterleaved(interleaved);
writer.setId(filename);

for (dimension_size_type series = 0U; series <
    seriesCount; ++series) {
  writer.setSeries(series);
  for (dimension_size_type plane = 0U; plane <
      planeCount; ++plane) {
    VariantPixelBuffer pixels;
    writer.saveBytes(plane, pixels);
  }
}
writer.close();
```

# Tools for testing

`bf-test`

- `info`—display image metadata
- `view`—Qt/OpenGL image viewer

# In the pipeline

- Units
- 2015-01 data model
- `bfconvert`
- Windows support
- OME-XML model XSL transforms
- API improvements

# Feedback

Which features do *you* need?

- Readers
- Writers
- Documentation
- Tools
- Support
- Integration with other software

Any feedback would be welcome and will help set and prioritise features and goals for future releases.

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