CGAL

The Computational Geometry Algorithms Library

CGAL

- The CGAL Open Source Project
  - provides easy access to efficient and reliable geometric algorithms
  - C++ library
  - Has efficient, robust, easy to use geometric data structures and algorithms
  - Easy to integrate in existing software
- Standard libraries increases productivity, as it allows software developers to focus on the application layer

CGAL

- https://www.cgal.org
- Primary Developers:
  - INRIA: the French national research institute (https://www.inria.fr/en/)
  - Geometry Factory : company which provides robust *geometric software components* as well as *expertise* in geometric computing (https://geometryfactory.com/)
  - Tel-Aviv University

Examples of Packages available

https://doc.cgal.org/latest/Manual/packages.html

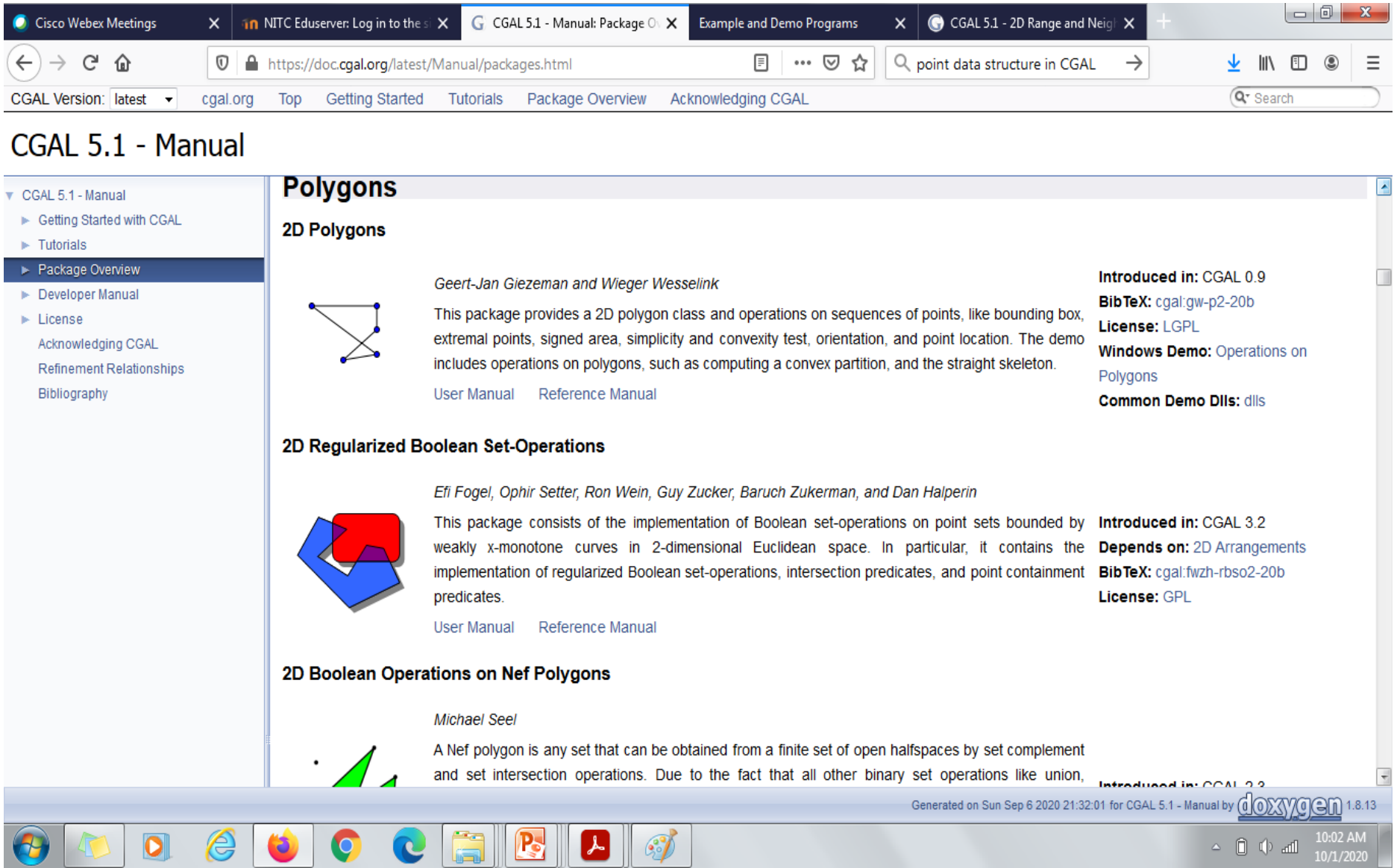
- Arithmetic and Algebra
  - Algebraic Foundations
  - Number Types
  - Modular Arithmetic
- Combinatorial Algorithms
  - Monotone and Sorted Matrix Search
  - Linear and Quadratic Programming Solver
- Geometry Kernels
  - 2D and 3D Linear Geometry Kernel
  - 2D Circular Geometry Kernel

Examples of Packages available

https://doc.cgal.org/latest/Manual/packages.html

- Convex Hull Algorithms
  - 2D Convex Hulls and Extreme Points
  - 3D Convex Hulls
  - dD Convex Hulls and Delaunay Triangulations
- Polygons
  - 2D Polygons
  - 2D Polygon Partitioning
- Cell Complexes and Polyhedra
  - 3D Polyhedral Surface
  - Half edge Data Structures

User manual and Reference manual & CGAL discuss forum



Demo and Example Folders

- The best way to illustrate the functionality provided by the library is through programs that users can compile, run, copy and modify.
- Thus every package should contain some of these programs.
- In CGAL we distinguish between two types of programs: those that provided graphical output (demos) and those that do not (examples).
- https://www.cgal.org/FAQ.html

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Chapter 19
Example and Demo Programs

The best way to illustrate the functionality provided by the library is through programs that users can compile, run, copy and modify to their hearts' content. Thus every package should contain some of these programs. In CGAL we distinguish between two types of programs: those that provided graphical output (demos) and those that do not (examples).

In this chapter we provide guidelines for the development of these programs and their inclusion in the documentation. See Sections 4.3 and 4.4 for a description of the directory structure required for example and demo programs, respectively. Note in particular that each directory should contain a README file that explains what the programs do and how one interacts with them.

19.1 Coding conventions

Remember that these programs are likely to be a user's first introduction to the library, so you should be careful to follow our coding conventions (Chapter 6) and good programming practice in these programs. In particular:

- Include a comment that gives the name of the file relative to the CGALROOT directory, such as:

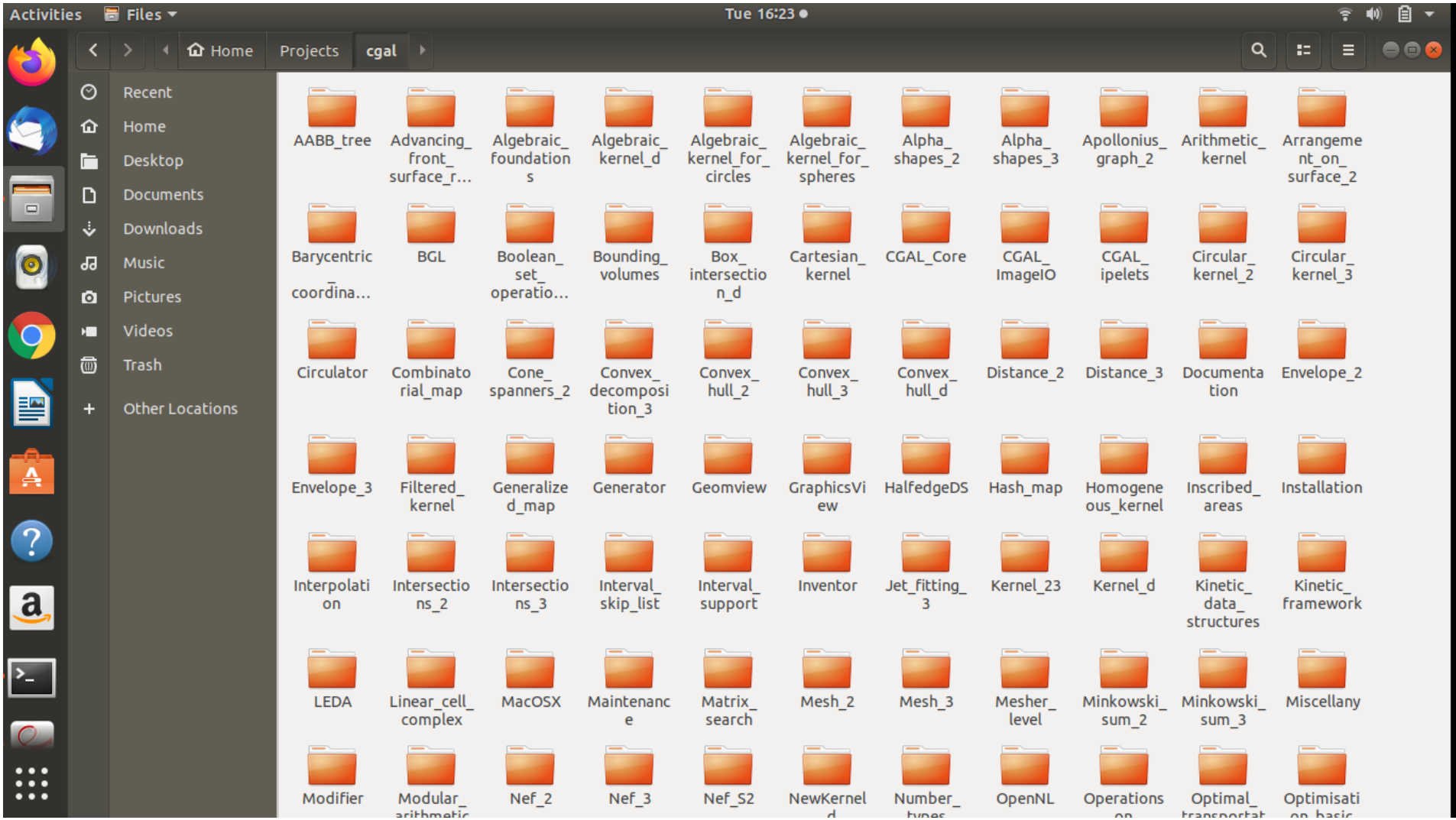
```
//
// file : examples/Generator/random_polygon_ex.C
//
```

- Do **not** use the commands

```
using namespace CGAL;
using namespace std;
```

  We discourage the use of these as they introduce more names than are necessary and may lead to more conflicts than are necessary.
- As of release 2.3, you can include only the kernel include file (*e.g.*, `Cartesian.h` or `Homogeneous.h`) to get all kernel classes as well as the `basic.h` file. All example and demo programs should do this. For exmaple, you should have simply:

CGAL examples Folder



Tools for display

- OpenGL
- QT
- QGLViewer

CGAL Installation

- https://www.cgal.org/FAQ.html#how_to_install
- Two script files
- cgal-depends.sh
- cgal.sh

cgal-depends.sh

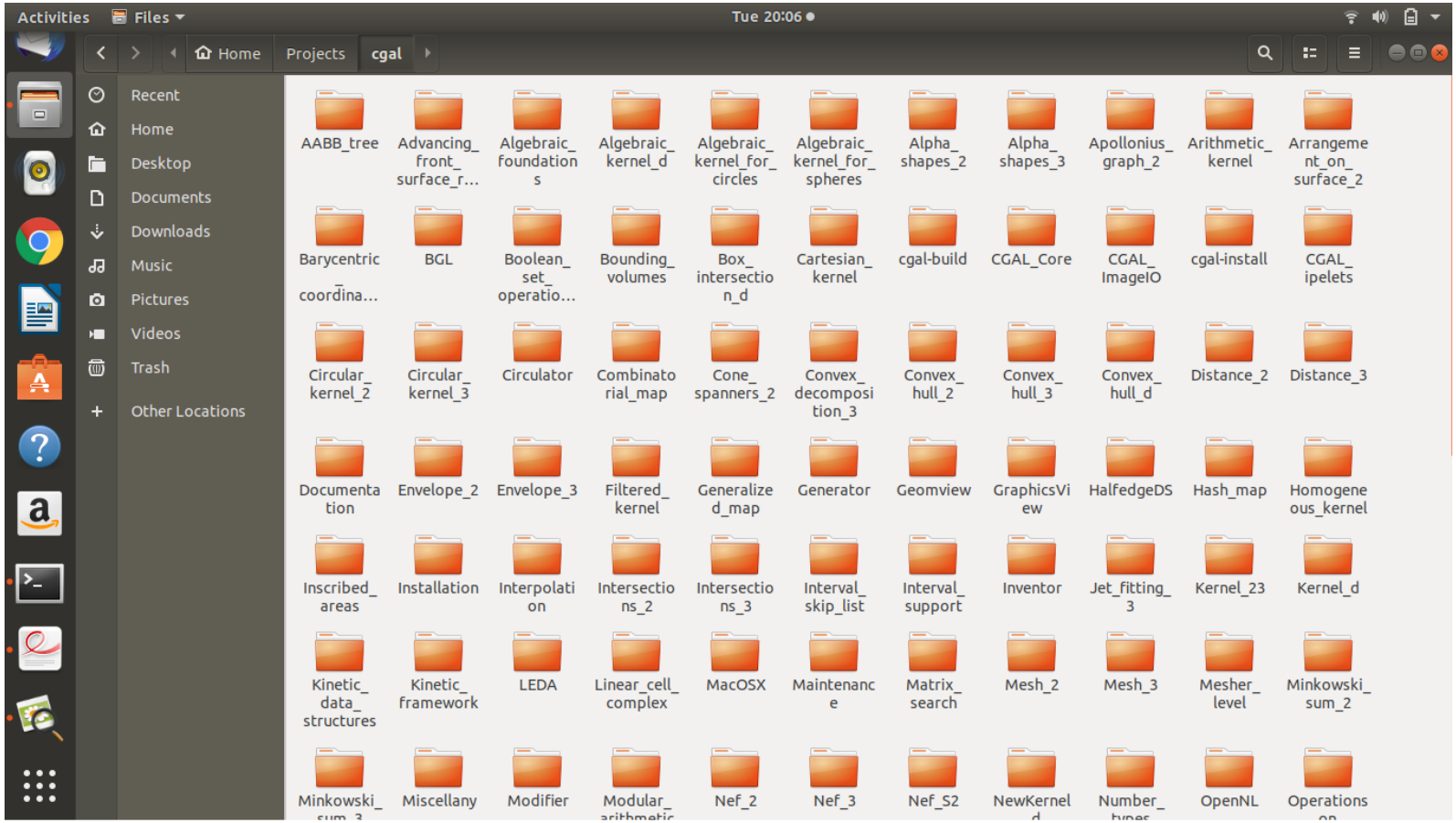
- #!/bin/bash
- sudo apt install -y libcgal-dev libcgal-qt5-dev
- sudo apt install -y libgmp-dev libmpfr-dev libeigen3-dev
- sudo apt install -y qtbase5-dev unzip
- sudo apt install -y mesa-utils
- sudo apt install -y cmake cmake-gui gcc gdb build-essential

cgal.sh

- #!/bin/bash
- #Download CGAL from this link
- wget https://github.com/CGAL/cgal/releases/download/v5.6/CGAL-5.6.zip
- unzip CGAL-5.6.zip
- #extract the archive
- cd CGAL-5.6
- mkdir build
- cd build
- cmake .. -DCMAKE_BUILD_TYPE="Release" -DWITH_examples=ON -DWITH_demos=ON -DCMAKE_INSTALL_PREFIX="$HOME/.local"
- make install
- #make examples -j$(nproc)
- #make demos -j$(nproc)
- # wayland fix, ask students to use Xorg
- echo "QT_QPA_PLATFORM=xcb" >> ~/.bashrc

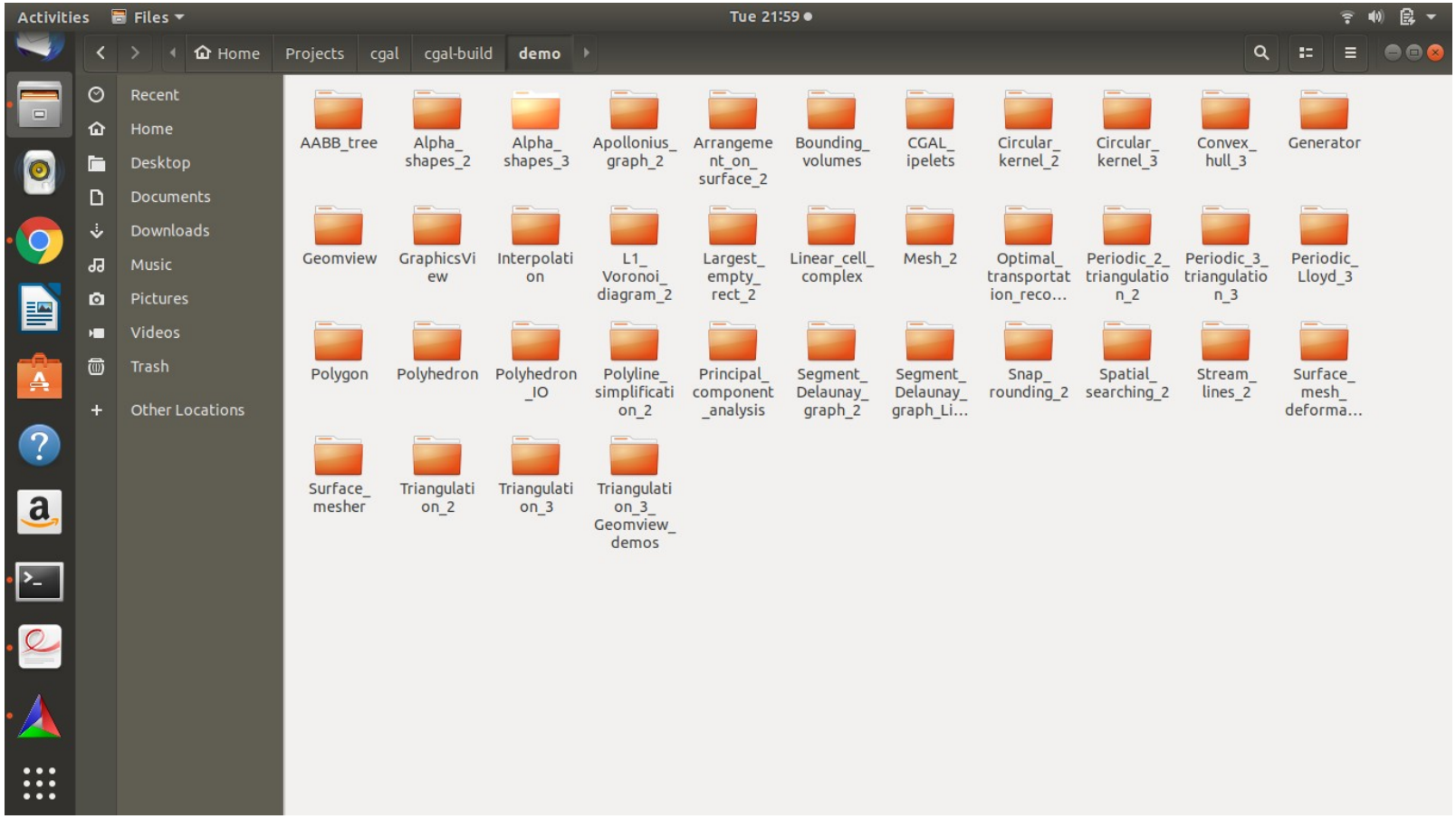
Run a CGAL demo - GraphicsView

1. Open your CGAL folder



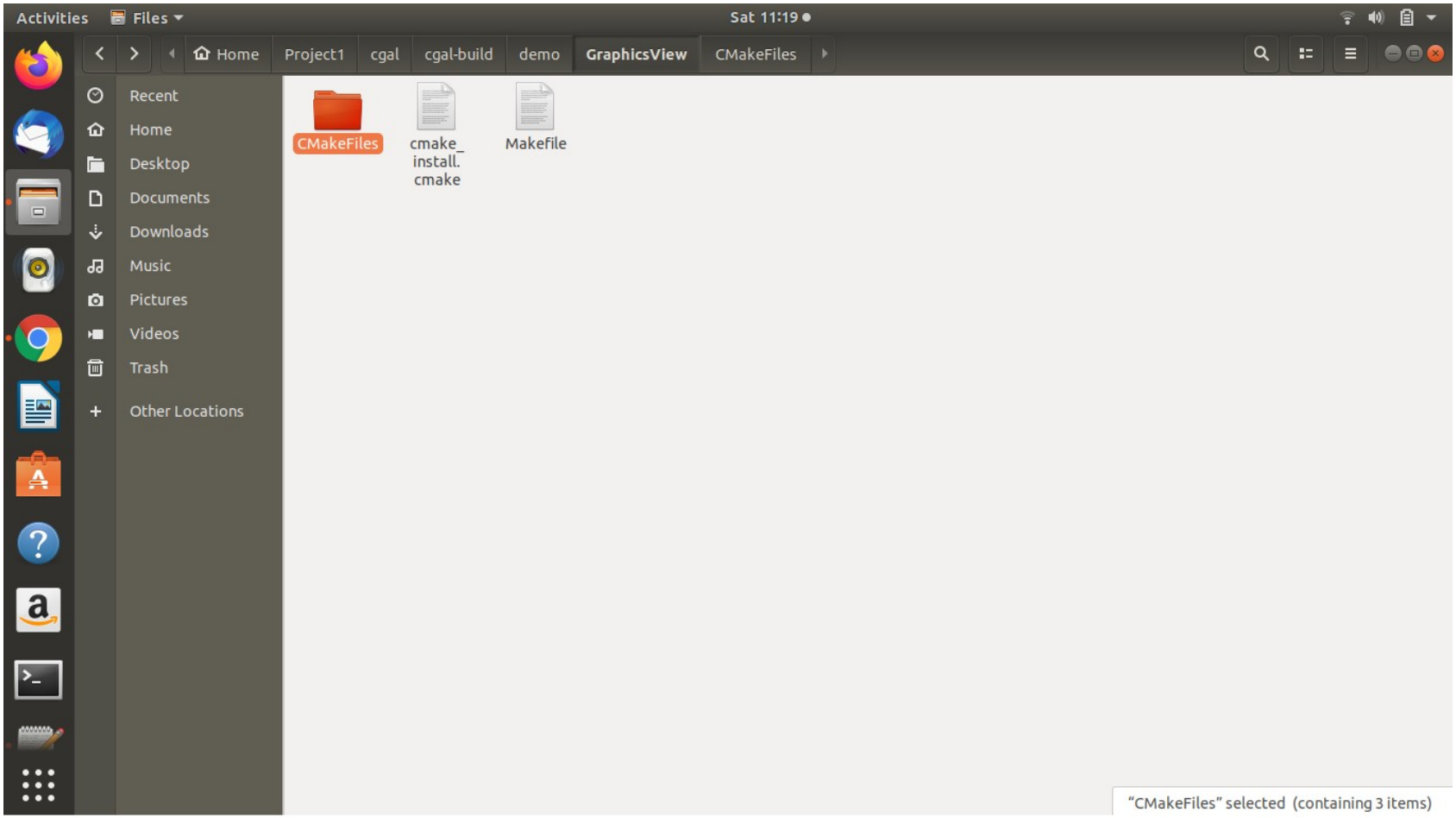
Run a CGAL demo - GraphicsView

2. Go to cgal-build/demo



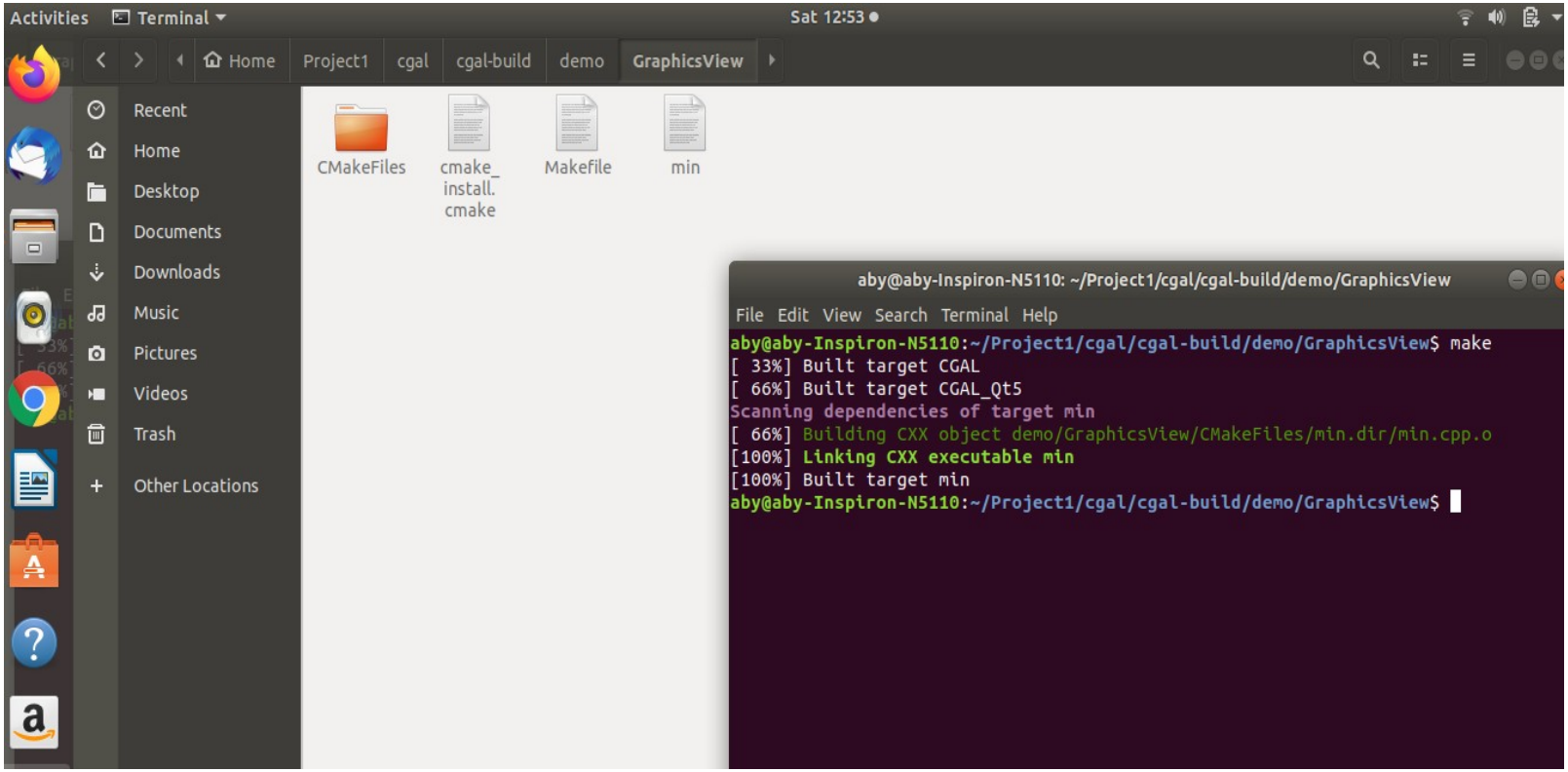
Run a CGAL demo - GraphicsView

3. Open folder GraphicsView



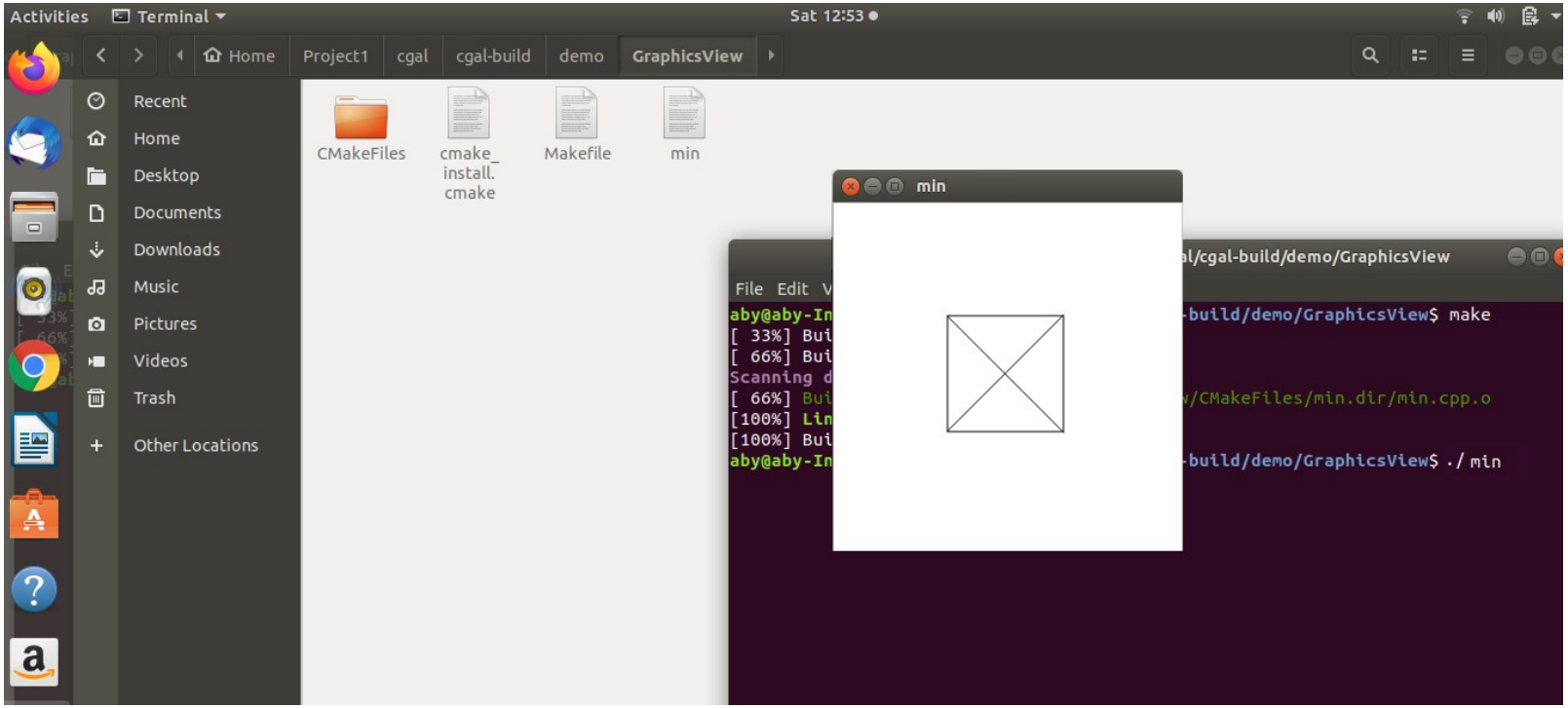
Run a CGAL demo - GraphicsView

4. Open terminal inside this folder and create the executable by make command.
   - An executable file named `min` will be created inside the folder



Run a CGAL demo - GraphicsView

5. Run the executable either by clicking it or by typing ./min in the terminal



-This demo draws a rectangle and two diagonals of it in a QT window.

THANK YOU