

CGAL

The Computational Geometry Algorithms Library

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Algorithmic Robotics and Motion Planning
March 14th, 2011

Outline

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CGAL

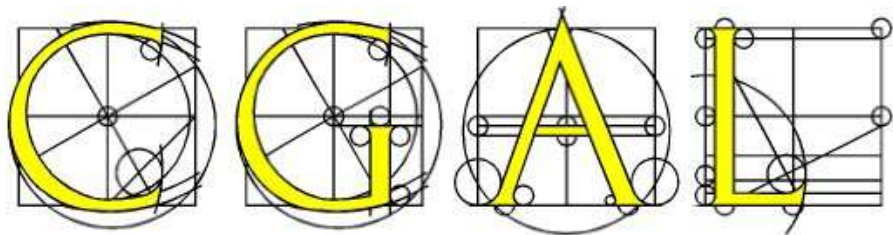
- Introduction
- Literature



CGAL: Mission

“Make the large body of geometric algorithms developed in the field of computational geometry available for industrial applications”

CGAL Project Proposal, 1996



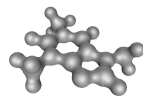
Some of CGAL Content



Bounding Volumes

Polyhedral Surfaces

Boolean Operations



Triangulations

Voronoi Diagrams

Mesh Generation



Subdivision

Simplification

Parametrisation

Streamlines

Ridge Detection

Neighbor Search

Kinetic Data Structures



Envelopes

Arrangements

Intersection Detection

Minkowski Sums

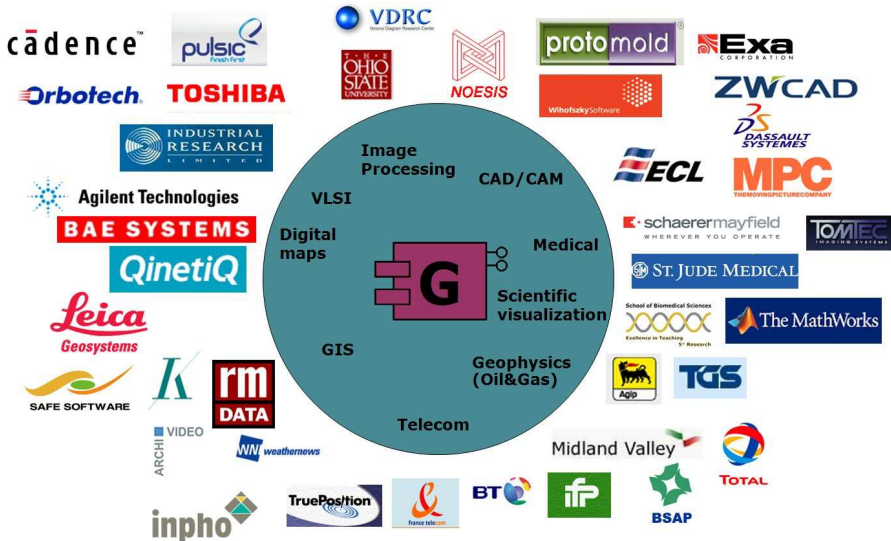
PCA

Polytope Distance

QP Solver



Some CGAL Commercial Users



CGAL Facts

- Written in C++
- Follows the *generic programming* paradigm
- Development started in 1995
- Active European sites:

- 1 INRIA Sophia Antipolis
- 2 MPII Saarbrücken
- 3 Tel Aviv University
- 4 ETH Zürich (Plageo)
- 5 University of Crete and FO.R.T.H.
- 6 INRIA Nancy
- 7 Université Claude Bernard de Lyon
- 8 ENS Paris
- 9 University of Eindhoven
- 10 University of California, San Francisco
- 11 University of Athens



CGAL History

Year	Version Released	Other Milestones
1996		CGAL founded
1998	July 1.1	
1999		Work continued after end of European support
2001	Aug 2.3	Editorial Board established
2002	May 2.4	
2003	Nov 3.0	GEOMETRY FACTORY founded
2004	Dec 3.1	
2006	May 3.2	
2007	Jun 3.3	
2009	Jan 3.4, Oct 3.5	
2010	Mar 3.6, Oct 3.7	CGAL participated in Google Summer of Code
2011		CGAL applies to participate in GSoC



CGAL in Numbers

- 900,000 lines of C++ code
- 10,000 downloads per year not including Linux distributions
- 3,500 pages manual
- 3,000 subscribers to cgal-announce list
- 1,000 subscribers to cgal-discuss list
- 120 packages
- 60 commercial users
- 25 active developers
- 6 months release cycle
- 7 Google's page rank for cgal.org.com
- 2 licenses: Open Source and commercial



CGAL Properties

- Reliability
 - Explicit degeneracy handling.
 - Exact Geometric Computation (EGC) adherence.
- Flexibility
 - Open library.
 - Depends on other libraries (e.g., [BOOST](#), [GMP](#), [MPFR](#), [QT](#), & [CORE](#))
 - Modular structure. Separation between to geometry and topology.
 - Adaptable to user code.
 - Extensible, e.g., data structures can be extended.
- Ease of Use
 - Didactic and exhaustive Manuals.
 - Follows standard concepts (e.g., C++ and STL).
 - Smooth learning-curve.
- Efficiency
 - Follows the generic-programming paradigm.
 - Polymorphism is resolved at compile time.



CGAL Structure

Basic Library

Algorithms and Data Structures

e.g., Triangulations, Surfaces, and Arrangements

Kernel

Elementary geometric objects

Elementary geometric computations on them

Support Library

Configurations, Assertions,...

Visualization

Files

I/O

Number Types

Generators

...



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CGAL Bibliography



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On the design of CGAL a computational geometry algorithms library.

Software — Practice and Experience, 30(11):1167–1202, 2000. Special Issue on Discrete Algorithm Engineering.



A. Fabri and S. Pion.

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In 2nd *Library-Centric Software Design Workshop*, 2006.



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