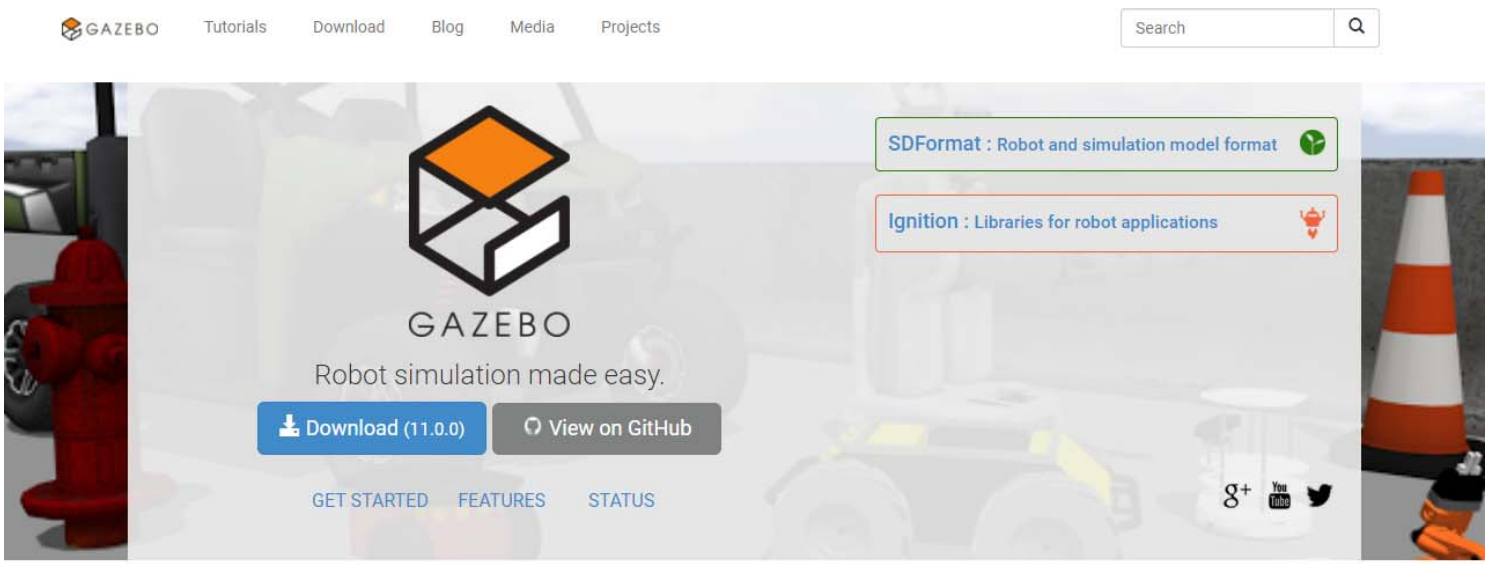
screenshot-gazebosim.org-2020.12.17-07_55_10
http://gazebosim.org/
17.12.2020



Why Gazebo?

Robot simulation is an essential tool in every roboticist's toolbox. A well-designed simulator makes it possible to rapidly test algorithms, design robots, perform regression testing, and train AI system using realistic scenarios. Gazebo offers the ability to accurately and efficiently simulate populations of robots in complex indoor and outdoor environments. At your fingertips is a robust physics engine, high-quality graphics, and convenient programmatic and graphical interfaces. Best of all, Gazebo is free with a vibrant community.

The Latest

Gazebo 11.0.0 release

2019-01-30

Download (11.0.0)

Changelog | Migration Guide

Release Highlights

- SDFormat 1.7 frame semantics, see the ROSCon 2019 talk

Useful Links

Answers
Find answers and ask questions.

Community
Join for discussions and announcements.

Simulation Models
Robots, objects, and other simulation models.

Source code
Get Gazebo's source code.

Top

Features

Dynamics Simulation
Access multiple high-performance physics engines including ODE, Bullet, Simbody, and DART.

Advanced 3D Graphics
Utilizing OGRE, Gazebo provides realistic rendering of environments including high-quality lighting, shadows, and textures.

Sensors and Noise
Generate sensor data, optionally with noise, from laser range finders, 2D/3D cameras, Kinect style sensors, contact sensors, force-torque, and more.

Plugins
Develop custom plugins for robot, sensor, and environmental control. Plugins provide direct access to Gazebo's API.

Robot Models
Many robots are provided including PR2, Pioneer2 DX, iRobot Create, and TurtleBot. Or build your own using SDF.

TCP/IP Transport
Run simulation on remote servers, and interface to Gazebo through socket-based message passing using Google Protobufs.

Cloud Simulation
Use CloudSim to run Gazebo on Amazon AWS and GzWeb to interact with the simulation through a browser.

Command Line Tools
Extensive command line tools facilitate simulation introspection and control.

Top

Get Started

Get your feet wet

1. **Quick Start**
   A simple set of steps to get Gazebo up and running rapidly.
2. **GUI Hotkeys**
   Description of Gazebo's hotkeys and mouse interactions.
3. **Tutorials**
   The best way to start using Gazebo is to run through the tutorials. These tutorials cover both basic and simple concepts through a series of exercises.
4. **Examples**
   Check out the example worlds and programs that are in the source code.
5. **answers.gazebosim.org**
   If you can't find what you are looking for, try our askbot help forum located at answers.gazebosim.org.
6. **community.gazebosim.org**
   Want to exchange ideas with the rest of the community? Come to community.gazebosim.org.

Information Sources

1. **Gazebo Overview**
   A high-level description of Gazebo and its various components.
2. **Gazebo API**
   Doxygen generated documentation for the Gazebo libraries.
3. **Protobuf Messages**
   A complete list of all the protobuf messages used by Gazebo
4. **SDFormat Specification**
   SDFormat is an XML file format that defines environments and models. This specification defines all the XML elements for describing world and models.

Top

Project Status

Release Schedule and Roadmap

Gazebo 11 is the last major release of Gazebo. All currently supported Gazebo versions are still being maintained and may receive new backwards-compatible features and bug fixes until their end-of-life.

Gazebo is being refactored into the new Ignition Gazebo simulator. Check out Ignition Robotics to learn all about it.

Refer documentation in downstream applications, such as ROS, for version compatiblilty.

Gazebo 1.9 2013-07-24		EOL 2015-07-27
Gazebo 2.2 2013-11-07	Ubuntu P,Q,R,S	EOL 2016-01-25
Gazebo 3.0 2014-04-11	Ubuntu P,R,S,T	EOL 2015-07-27
Gazebo 4.0 2014-07-28	Ubuntu P,S,T	EOL 2016-01-25
Gazebo 5.0 2015-01-26	Ubuntu T,U,V	EOL 2017-01-25
Gazebo 6.0 2015-07-27	Ubuntu T,U,V	EOL 2017-01-25
Gazebo 7.1 2016-01-25	Ubuntu T,V,W,X	EOL 2021-01-25
Gazebo 8.2 2017-12-10	Ubuntu X,Y	EOL 2019-01-25
Gazebo 9.0 2018-01-25	Debian St, Ubuntu X,A,B	EOL 2023-01-25
Gazebo 10.0 2019-01-24	Ubuntu X,B	EOL 2021-01-24
Gazebo 11.0 2020-01-30	Ubuntu B,F	EOL 2025-01-29

Versioning

Gazebo uses semantic versioning, a package numbering scheme that specifies ABI/API compatibility between releases. A version consists of three numbers separated by decimal points: MAJOR.MINOR.PATCH:

- MAJOR version changed when incompatible ABI/API changes are made
- MINOR version changed when functionality has been added in a backwards-compatible manne
- PATCH version changed when backwards-compatible bug fixes are released

Tick-tock Release Cycle

A tick-tock release cycle allows easy migration to new software versions. Obsolete Gazebo code is marked as deprecated for one major release. Deprecated code produces compile-time warnings. These warning serve as notification to users that their code should be upgraded. The next major release will remove the deprecated code.

Example where function *foo* is deprecated and replaced by function *bar*:

Gazebo v1.0	Gazebo v2.0	Gazebo v3.0
void foo();	*// Deprecated, see void bar()* void foo() GAZEBO_DEPRECATED(2.0); void bar();	*void bar();*

Statistics

Physics Engine Support

Gazebo supports the ODE, Bullet, Simbody and DART physics engines. By default Gazebo is compiled with support for ODE. In order to use the other engines, first make sure they are installed and then compile Gazebo from source.

Physics Engine	Gazebo Version	Availability	Notes
ODE	1.9+	Binary,Source	Default engine. Gazebo maintains a fork of ODE which has diverged from the upstream package.
Bullet	3.0+	Source	Gazebo requires libbullet2.82, available in the OSRF repository and to be included in Ubuntu Utopic.
Simbody	3.0+	Source	Simbody packages are hosted in the OSRF repository. Expected to appear in Ubuntu Utopic official repositories.
DART	3.0+	Source	DART packages are hosted in dartsim PPA. DART is in the process of moving toward inclusion in Ubuntu.

The new Ignition simulator uses a physics plugin framework to resolve dependency issues. Each physics engine is interfaced to Ignition Gazebo through a plugin, avoiding the need to compile the simulator with support for each engine.

Top

History

Gazebo development began in the fall of 2002 at the University of Southern California. The original creators were Dr. Andrew Howard and his student Nate Koenig. The concept of a high-fidelity simulator stemmed from the need to simulate robots in outdoor environments under various conditions. As a complementary simulator to Stage, the name Gazebo was

high-fidelity simulator stemmed from the need to simulate robots in outdoor environments under various conditions. As a complementary simulator to Stage, the name Gazebo was chosen as the closest structure to an outdoor stage. The name has stuck despite the fact that most users of Gazebo simulate indoor environments.

Over the years, Nate continued development of Gazebo while completing his PhD. In 2009, John Hsu, a Senior Research Engineer at Willow, integrated ROS and the PR2 into Gazebo, which has since become one the primary tools used in the ROS community. A few years later in the Spring of 2011, Willow Garage started providing financial support for the development of Gazebo. In 2012, Open Source Robotics Foundation (OSRF) spun out of Willow Garage and became the steward of the Gazebo project. After significant development effort by a team of talented individuals, OSRF used Gazebo to run the Virtual Robotics Challenge, a component in the DARPA Robotics Challenge, in July of 2013.

OSRF continues development of Gazebo with support from a diverse and active community. Stay tuned for more exciting developments related to robot simulation.

screenshot-gazebosim.org-2020.12.17-07_57_25
http://gazebosim.org/download
17.12.2020

GAZEBO Tutorials Download Blog Media Projects Search

Latest version: 11.0.0 (30 Jan 2020)

Debian (.deb) Source (.tar.bz2)

Change Log | Migration Guide | Install | Roadmap

Get the Source

If you'd like the full source, you can check it out from our GitHub repository, or clone it with this command:

```
git clone https://github.com/osrf/gazebo
```

Want to contribute? Fork the Gazebo repository, and learn more about contributing.

Past Releases

This is a curated list of releases. Visit here (the page loads slowly, please wait some minutes) for a complete list.

Version	Date	Tarball
11.0	2020-01-30	
10.0	2019-01-24	
9.0	2018-01-25	
8.2	2017-12-10	
7.1	2016-01-25	
6.0	2015-07-27	
5.0	2015-01-26	
4.0	2014-07-28	
3.0	2014-04-11	
2.2	2013-11-07	
1.9	2013-07-24	