



The New Architecture of Gazebo Wrappers for ROS 2

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#ROSCon2019



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open
robotics



gazebo_ros



gazebo_ros - handy APIs



gazebo_ros::Node

◆ gazebo_plugins::<class>



gazebo_ros - handy APIs



<<static>>

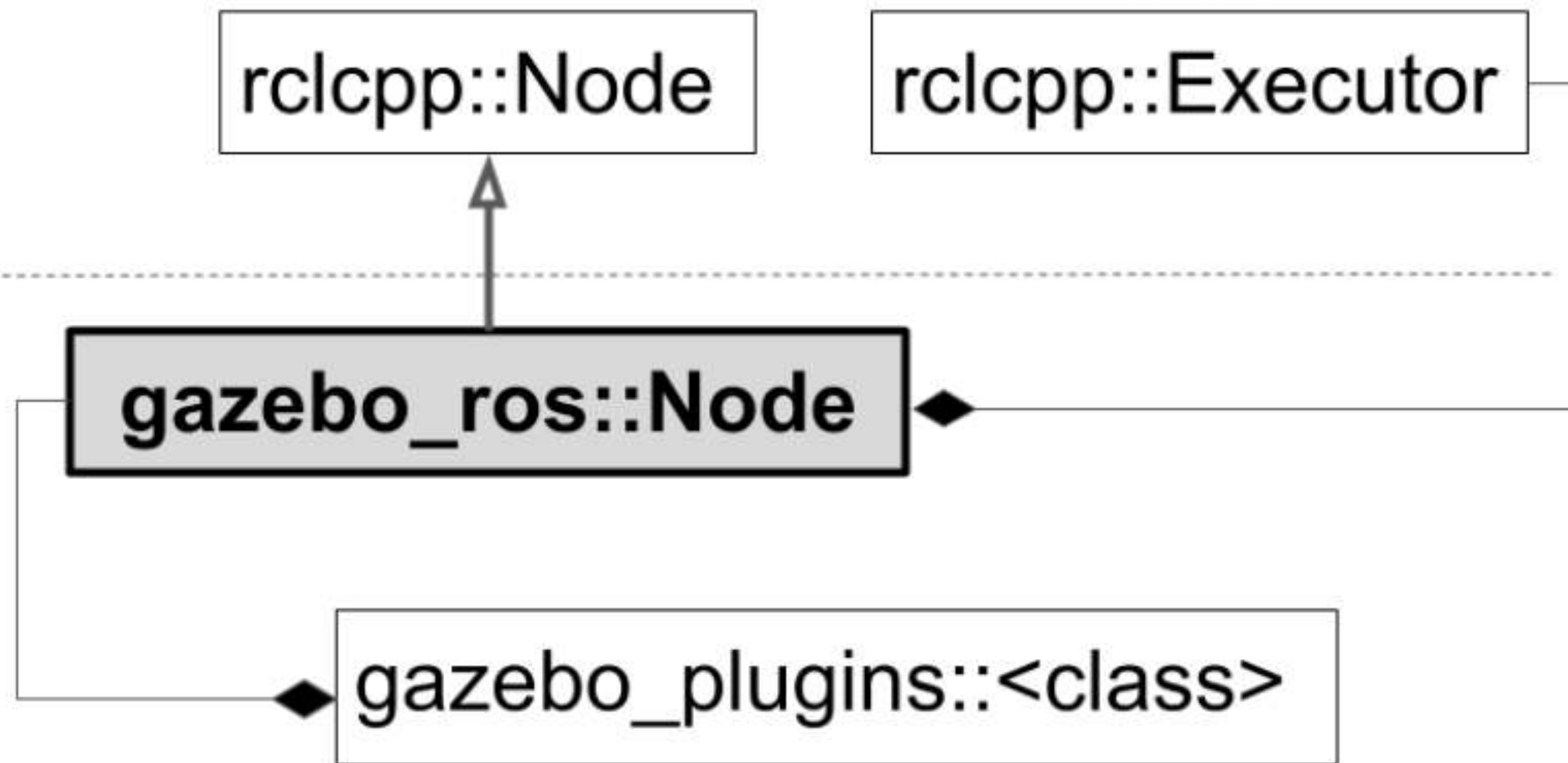
rclcpp::Node

rclcpp::Executor



gazebo_ros::Node

gazebo_plugins::<class>



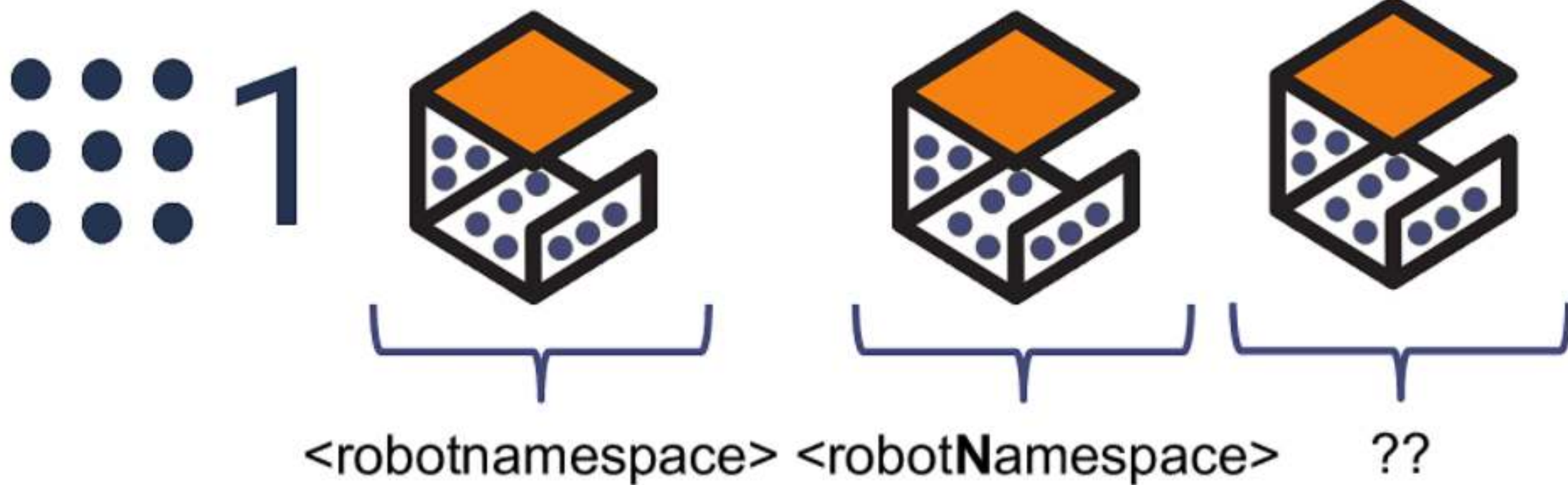


gazebo_ros - handy APIs

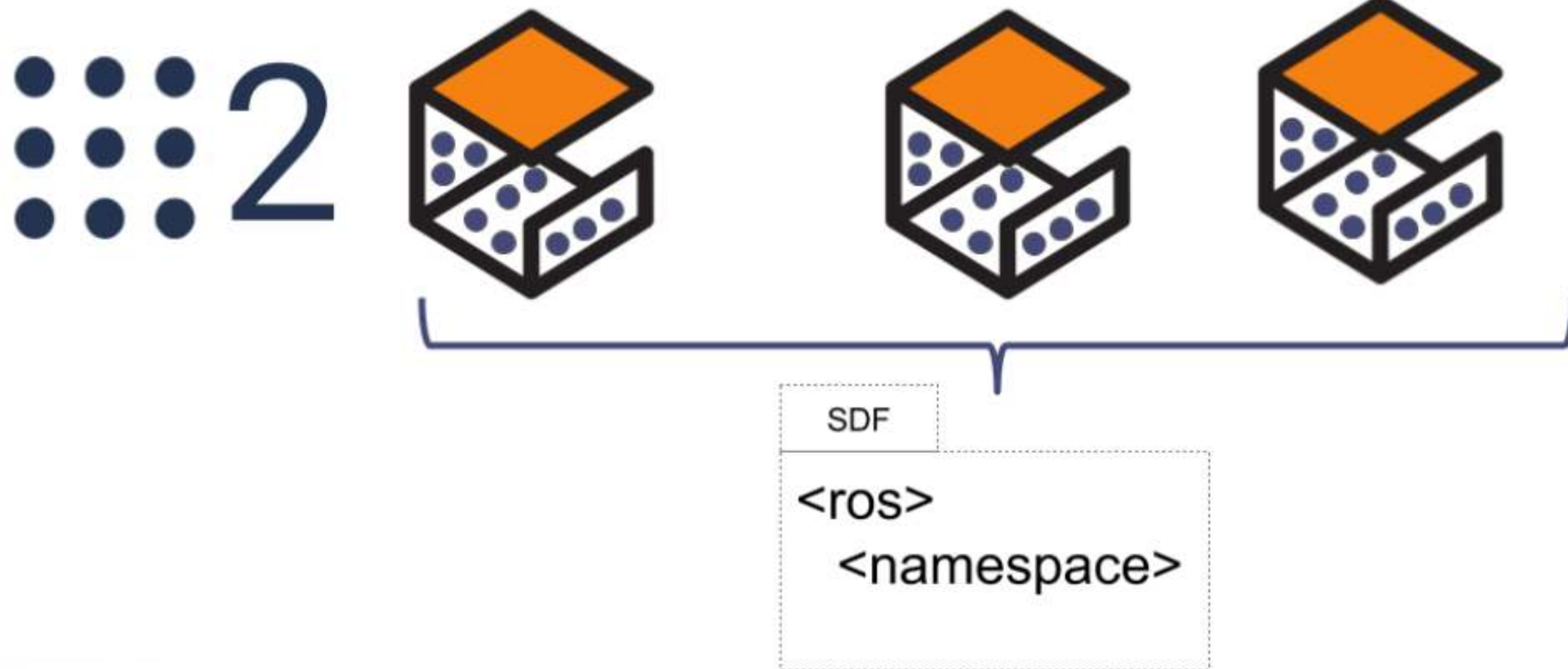
- gazebo_ros::Node
 - Parameters, arguments, remappings from SDF



gazebo_ros - namespaces



gazebo_ros - namespaces





gazebo_ros::Node

SDF

```
<plugin name="my_node_name" filename="my_library.so">  
  <ros>  
    <namespace>/my_ns</namespace>  
    <argument>__log_level:=debug</argument>  
    <remapping>my_topic:=new_topic</remapping>  
    <parameter name="max_velocity" type="int">55</parameter>  
  </ros>  
</plugin>
```




gazebo_ros - handy APIs

- gazebo_ros::Node / Executor
 - Parameters, arguments, remappings from SDF
 - **Loading during runtime**





gazebo_ros - ros1

```
$ roslaunch gazebo_ros ...
```

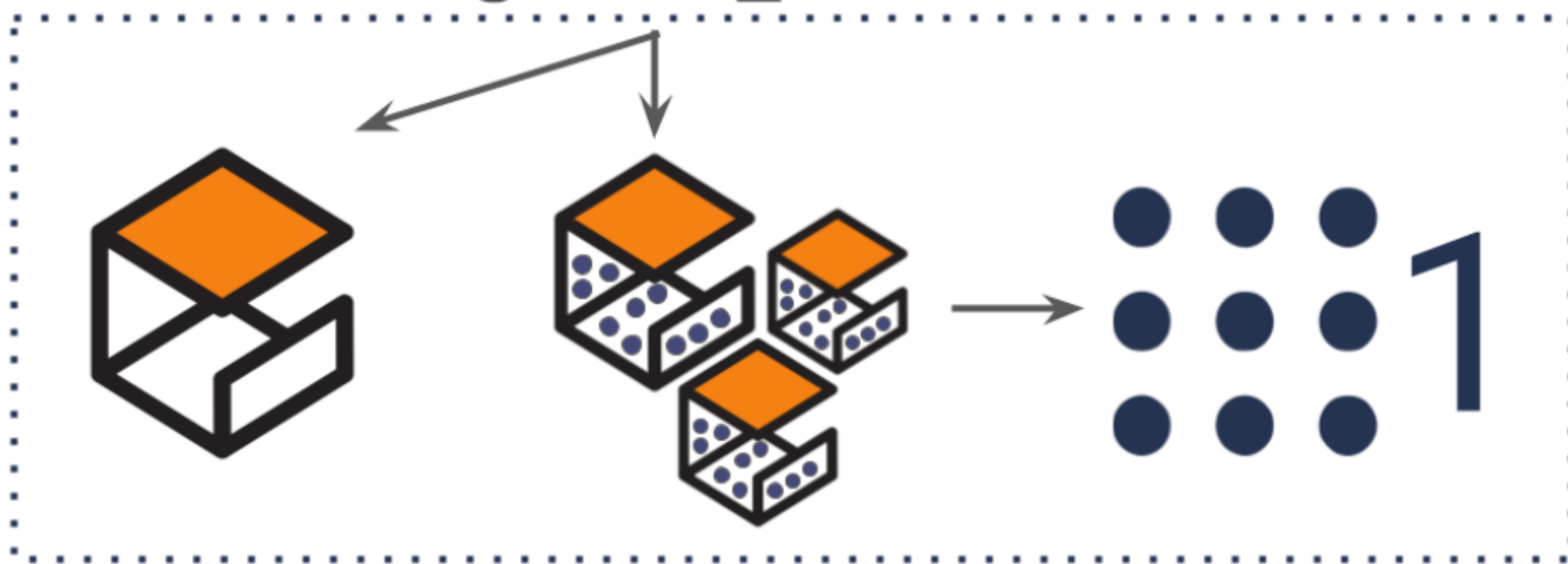


Loading time



gazebo_ros - ros1

\$ roslaunch gazebo_ros ...



Loading time



ROS and Gazebo



GAZEBO



gazebo_ros - flexible launch

\$ gzserver



Loading time



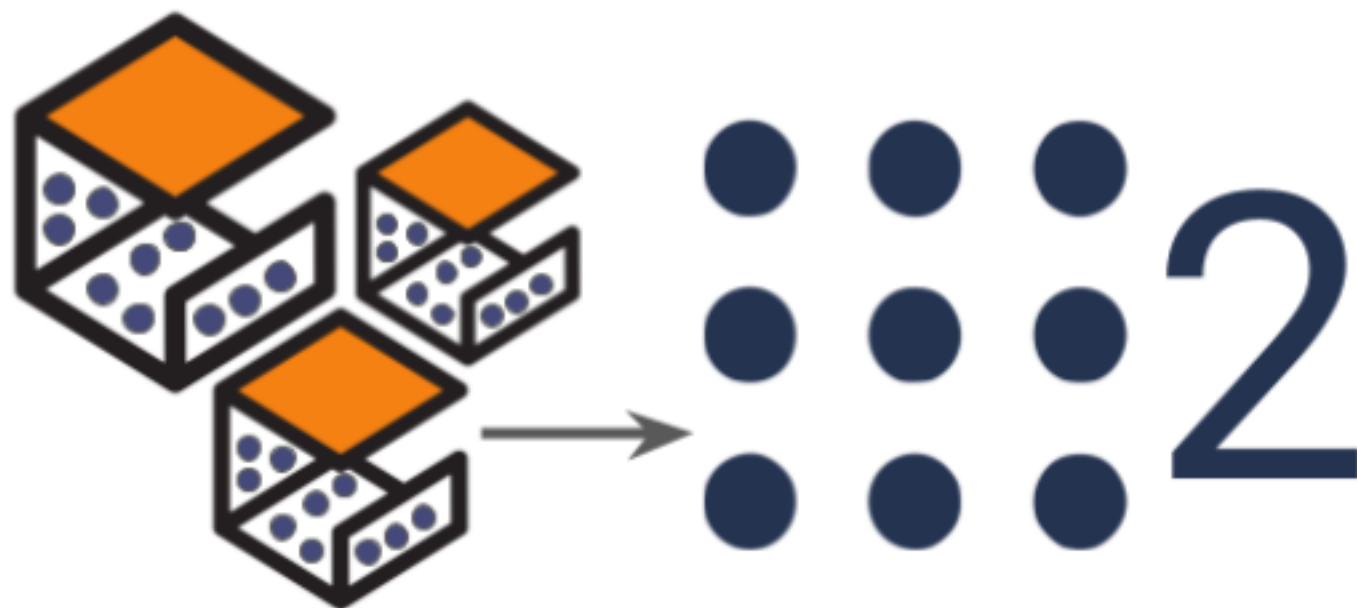
gazebo_ros - flexible launch

\$ gzserver



Loading time

Insert ros2-gazebo model



Loading / run time



gazebo_ros - handy APIs

- gazebo_ros::Node / Executor
 - Parameters, arguments, remappings from SDF
 - Loading during runtime
 - **Split gazebo_ros core into plugins**



gazebo_ros - opt-out



roslaunch
gazebo_ros



...

/clock

/factory

/set_link_state

/get_model_state

...



gazebo_ros - opt-out

2

**ros2 launch
gazebo_ros**



{ /clock

{ /factory

{ /set_link_state
/get_model_state



gazebo_ros - handy APIs

- **gazebo_ros::Node / Executor**
 - Parameters, arguments, remappings from SDF
 - Loading during runtime
 - Plugins also for gazebo_ros
- **gazebo_ros::Convert**
 - ROS, Gazebo, SDF, Ignition types
- **Testing utils**
 - Fork Gazebo process and more



gazebo_ros - handy stuff

- **Launch files**
 - Gazebo args, gdb...
- **spawn_entity.py**
 - SDF / URDF
 - Models, lights, actors...
- **gazebo_ros_paths.py**
 - Model, plugin and resource paths





gazebo_plugins



1

gazebo_ros_camera
gazebo_ros_triggered_camera
gazebo_ros_multicamera
gazebo_ros_triggered_multicamera
gazebo_ros_depth_camera
gazebo_ros_openni_kinect

2

gazebo_ros_camera



1

gazebo_ros_laser
gazebo_ros_gpu_laser
gazebo_ros_block_laser
gazebo_ros_range



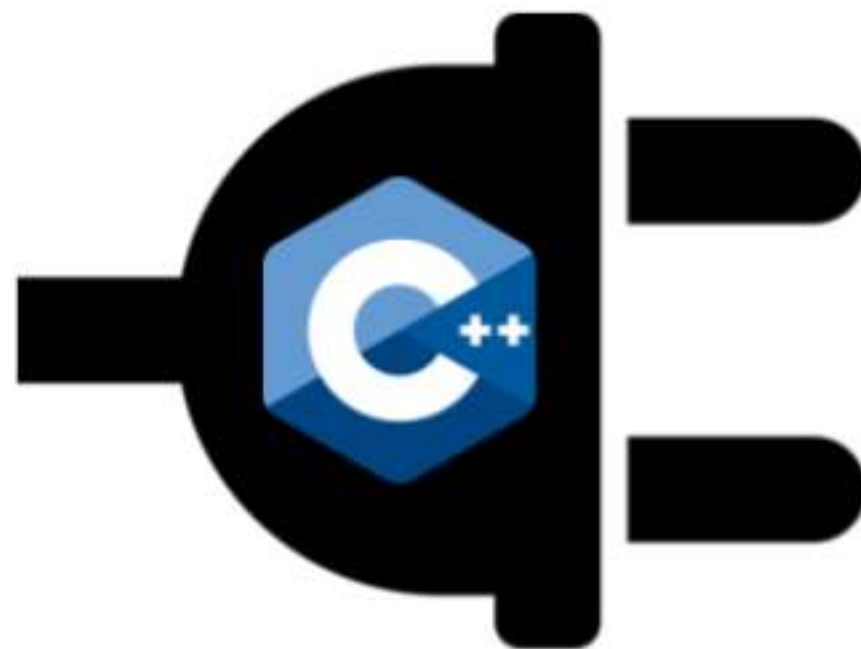
gazebo_ros_ray

2





gazebo_ros_pkgs

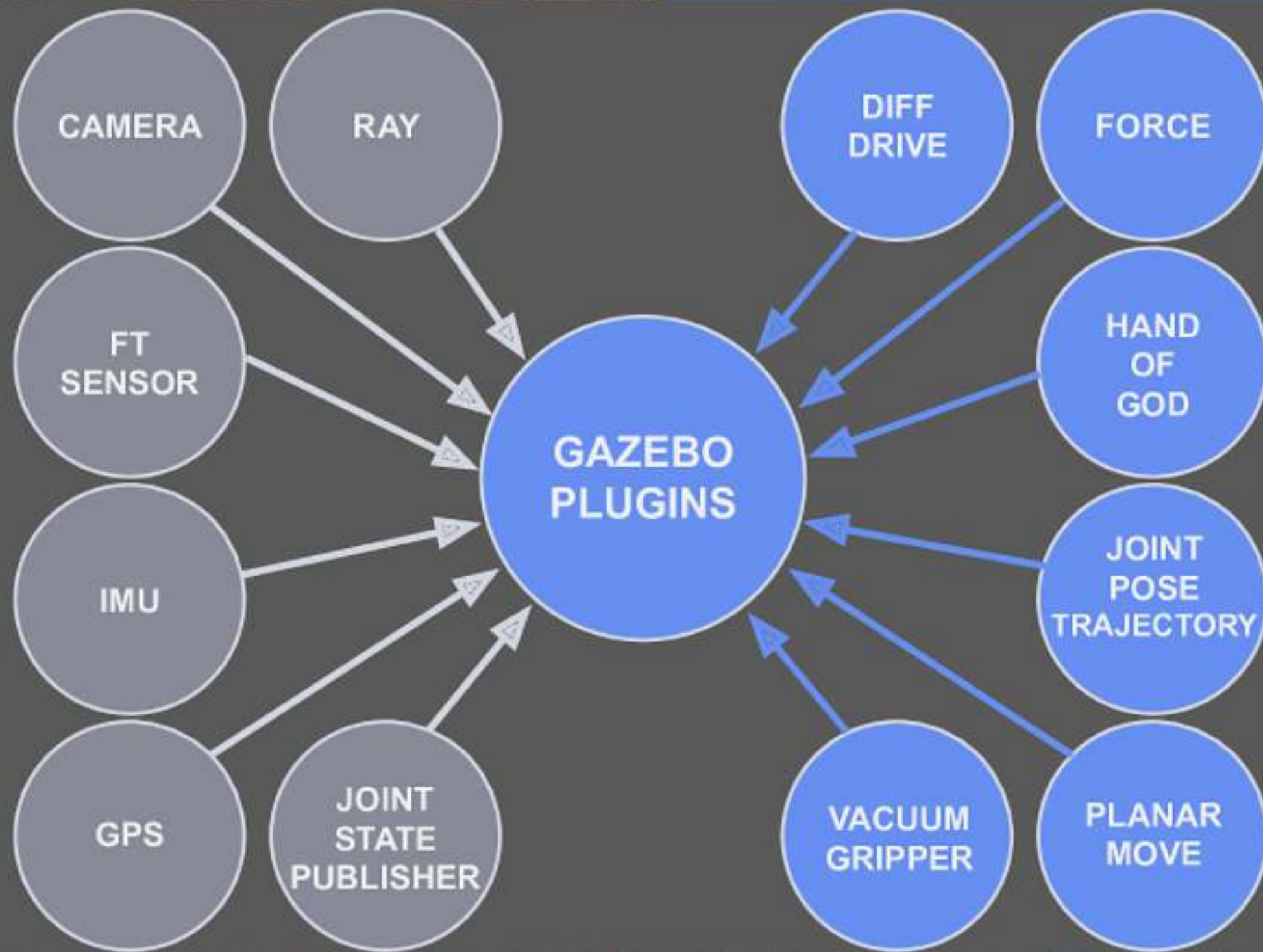


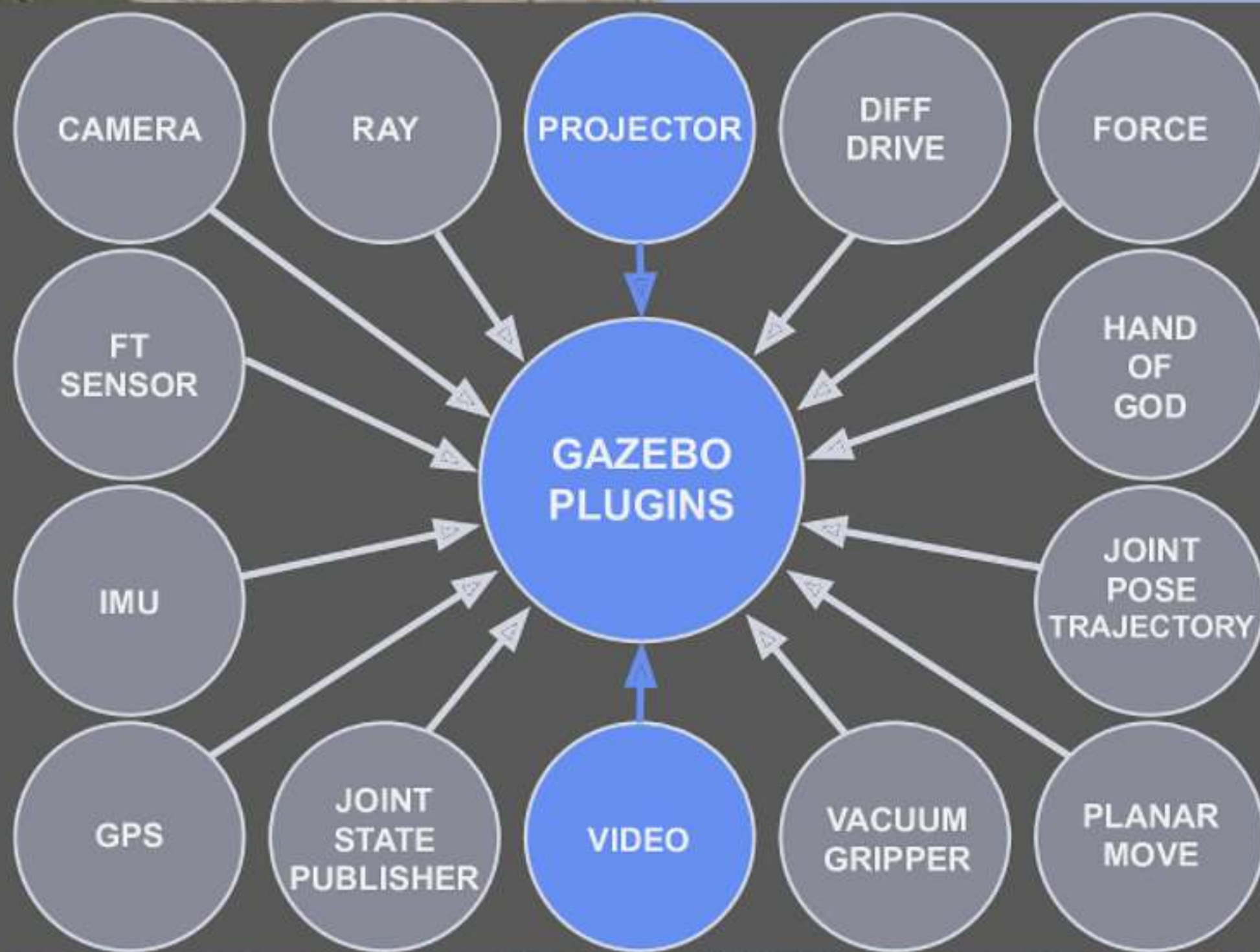
GAZEBO

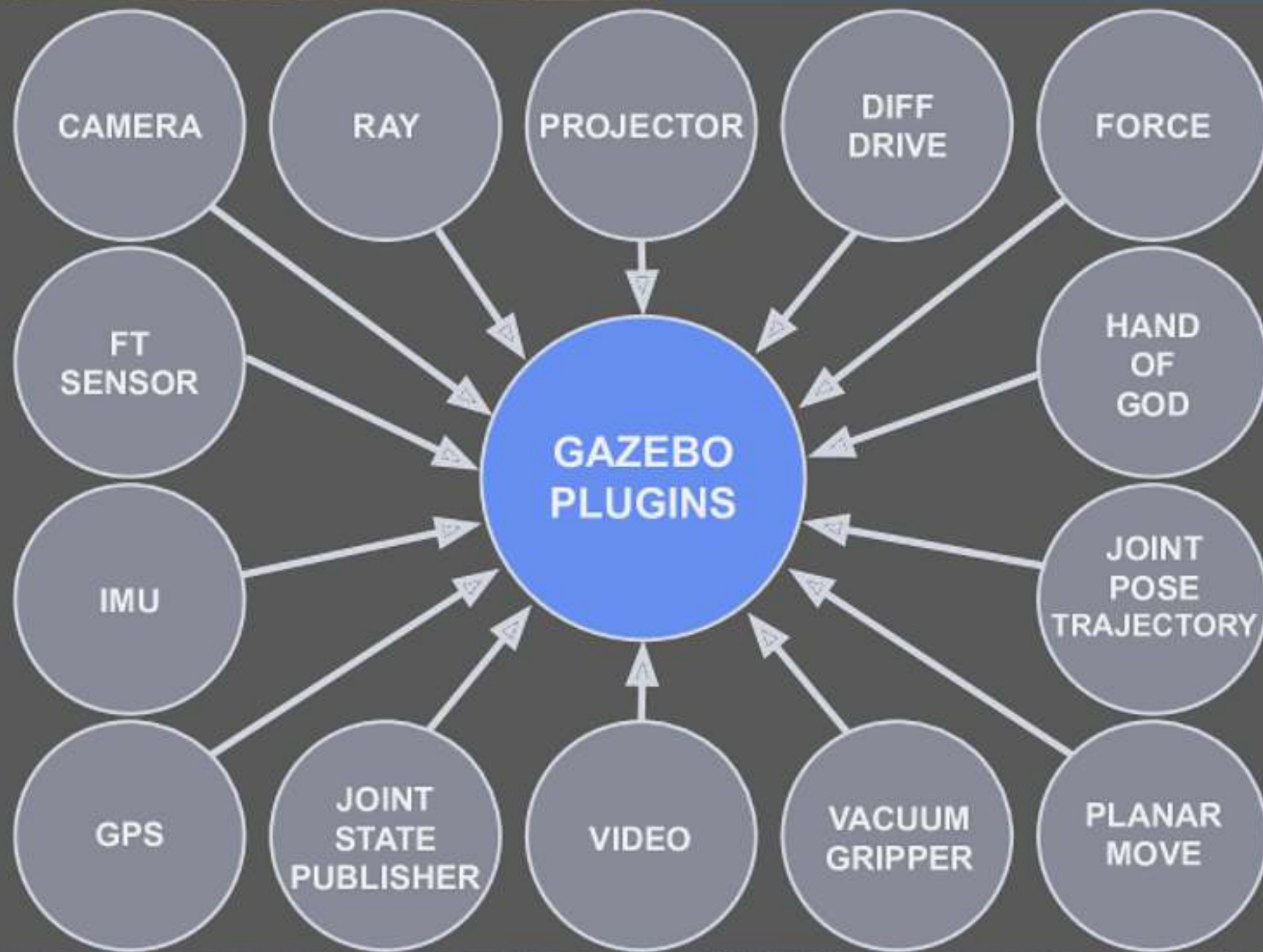


GAZEBO PLUGINS









SimSlide Text

Gazebo ROS camera plugin demo

Check camera info

```
ros2 topic echo /gazebo_ros_camera/camera/camera_info
```

Check camera images

```
ros2 run rqt_image_view rqt_image_view /gazebo_ros_camera/camera/image_raw
```

Sensor SDF

```
<sensor type="camera" name="camera">  
  <update_rate>5</update_rate>  
  <visualize>true</visualize>  
  <camera name="camera">  
    <horizontal_fov>0.927295218</horizontal_fov>
```

rqt_image_view__ImageView - rqt

Image View

/gazebo_ros_camera/camera/image_raw

0 10.00m

☐ a/image_raw_mouse_left ☐ Smooth scaling ☐ 0°



Gazebo

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gazebo
ros
camera

Real Time Factor: 0 Sim Time: 00 00:15:36.428 Real Time: 00 00:17:1



SimSlide Text

Gazebo ROS differential drive plugin demo

Send commands

```
ros2 topic pub /gazebo_ros_diff_drive/cmd_vel geometry_msgs/Twist "{linear: {x: 1.0}}" -1
```

```
ros2 topic pub /gazebo_ros_diff_drive/cmd_vel geometry_msgs/Twist "{angular: {z: 0.1}}" -1
```

Listen to odometry

```
ros2 topic echo /gazebo_ros_diff_drive/odom
```

Listen to TF

```
ros2 run tf2_ros tf2_echo odom chassis
```

```
ros2 run tf2_ros tf2_echo chassis right_wheel
```

```
ros2 run tf2_ros tf2_echo chassis left_wheel
```

Model SDF

```
<model name="vehicle">
  <link name="chassis">
    <pose>-0.151427 -0 0.175 0 -0 0</pose>
    <inertial>
      <mass>1.14395</mass>
      <inertia>
        <ixx>0.126164</ixx>
        <ixy>0</ixy>
        <ixz>0</ixz>
        <iyy>0.416519</iyy>
        <iyz>0</iyz>
        <izz>0.481014</izz>
      </inertia>
    </inertial>
    <visual name="visual">
      <geometry>
        <box>
          <size>2.01142 1 0.568726</size>
        </box>
      </geometry>
    </visual>
  </link>
</model>
```

Gazebo

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gazebo
ros
diff drive



Real Time Factor: 0

Sim Time: 00 00:15:36.428

Real Time: 00 00:17:1



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Gazebo ROS video plugin demo

The visual on top of the box is displaying the images coming from a ROS 2 image topic.

Visual SDF

```
<visual name="visual">
  <geometry>
    <box>
      <size>0.5 0.5 0.5</size>
    </box>
  </geometry>
  <plugin name="node" filename="libgazebo_ros_video.so">
    <ros>
      <namespace>/gazebo_ros_video</namespace>
      <argument>~/image_raw:=/gazebo_ros_camera/camera/image_raw</argument>
    </ros>
    <height>120</height>
    <width>160</width>
  </plugin>
</visual>
```

Gazebo



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Real Time: 00 00:17:11



- Tutorials
- Demos
- Migration guides
- Developer guides
- ...

github.com/ros-simulation/gazebo_ros_pkgs/wiki





gazebo_ros_pkgs



gazebo_ros_pkgs

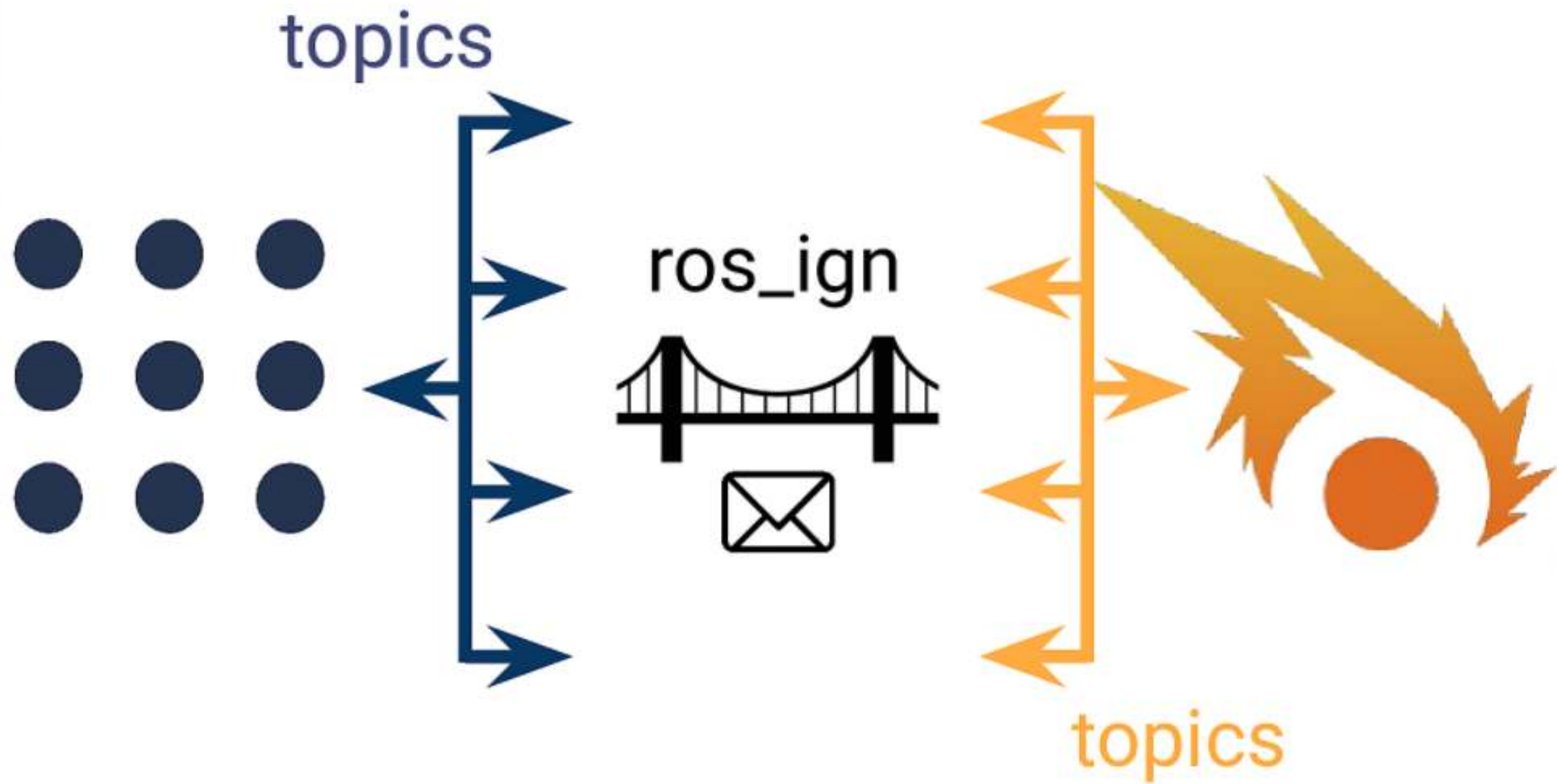


GAZEBO



topics / services







ros_ign





Try this out!



Questions?



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github.com/chapulina/roscon_gz_ros2



SimSlide Text



Gazebo ROS GPS plugin demo

Listen to data

```
ros2 topic echo /gazebo_ros_gps_sensor/node/out
```

Sensor SDF

```
<sensor name="vehicle_gps" type="gps">
  <always_on>true</always_on>
  <update_rate>5</update_rate>
  <gps>
    <position_sensing>
      <horizontal>
        <noise type="gaussian">
          <mean>0.0</mean>
          <stddev>2e-4</stddev>
        </noise>
      </horizontal>
      <vertical>
        <noise type="gaussian">
          <mean>0.0</mean>
          <stddev>2e-4</stddev>
        </noise>
      </vertical>
    </position_sensing>
  </gps>
  <plugin name="node" filename="libgazebo_ros_gps_sensor.so">
    <ros>
      <namespace>/gazebo_ros_gps_sensor</namespace>
    </ros>
  </plugin>
</sensor>
```

Spherical coordinates

```
<spherical_coordinates>
  <heading_deg>180</heading_deg>
</spherical_coordinates>
```

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gazebo
ros
gps sensor



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Sim Time: 00 00:15:36.428

Real Time: 00 00:17:11



SimSlide Text



Gazebo ROS IMU plugin demo

Listen to data

```
ros2 topic echo /gazebo_ros_imu_sensor/node/out
```

Sensor SDF

```
<sensor name="vehicle_imu" type="imu">
  <always_on>true</always_on>
  <update_rate>5</update_rate>
  <imu>
    <angular_velocity>
      <x>
        <noise type="gaussian">
          <mean>0.0</mean>
          <stddev>2e-4</stddev>
        </noise>
      </x>
      <y>
        <noise type="gaussian">
          <mean>0.0</mean>
          <stddev>2e-4</stddev>
        </noise>
      </y>
      <z>
        <noise type="gaussian">
          <mean>0.0</mean>
          <stddev>2e-4</stddev>
        </noise>
      </z>
    </angular_velocity>
    <linear_acceleration>
      <x>
        <noise type="gaussian">
          <mean>0.0</mean>
          <stddev>1.7e-2</stddev>
        </noise>
      </x>
      <y>
        <noise type="gaussian">
          <mean>0.0</mean>

```

Gazebo



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Real Time Factor: 0

Sim Time: 00 00:15:36.428

Real Time: 00 00:17:1



SimSlide Text



Gazebo ROS force plugin demo

Apply force

```
ros2 topic pub -1 /gazebo_ros_force/gazebo_ros_force geometry_msgs/Wrench  
"force: {x: 10.0, z: 100.0}"
```

Model SDF

```
<model name="vehicle">  
  <link name="chassis">  
    <pose>-0.151427 -0 0.175 0 -0 0</pose>  
    <inertial>  
      <mass>1.14395</mass>  
      <inertia>  
        <ixx>0.126164</ixx>  
        <ixy>0</ixy>  
        <ixz>0</ixz>  
        <iyy>0.416519</iyy>  
        <iyz>0</iyz>  
        <izz>0.481014</izz>  
      </inertia>  
    </inertial>  
    <visual name="visual">  
      <geometry>  
        <box>  
          <size>2.01142 1 0.568726</size>  
        </box>  
      </geometry>  
    </visual>  
    <collision name="collision">  
      <geometry>  
        <box>  
          <size>2.01142 1 0.568726</size>  
        </box>  
      </geometry>  
    </collision>  
    <!-- omitting sensors -->  
  </link>  
  
  <!-- omitting other plugins, joints and plugins -->  
</model>
```

Gazebo



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gazebo
ros
force



Real Time Factor: 0

Sim Time: 00 00:15:36.428

Real Time: 00 00:17:11



SimSlide Text



Gazebo ROS bumper plugin demo

Get state updates

```
ros2 topic echo /gazebo_ros_bumper/bumper_states
```

Sensor SDF

```
<sensor type="contact" name="bumper">
  <update_rate>5</update_rate>
  <contact>
    <collision>collision</collision>
  </contact>
  <plugin name="node" filename="libgazebo_ros_bumper.so">
    <ros>
      <namespace>/gazebo_ros_bumper</namespace>
    </ros>
    <frame_name>world</frame_name>
  </plugin>
</sensor>
```

Gazebo



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Real Time Factor: 0

Sim Time: 00 00:15:36.428

Real Time: 00 00:17:11



SimSlide Text



Gazebo ROS ray plugin demo

View data

```
ros2 run rviz2 rviz2
```

Inside RViz:

- Add the topic **/gazebo_ros_ray/node/out**
- Make sure the fixed frame is **map**
- Make sure the **unreliable** box is checked

Sensor SDF

```
<sensor name="sensor_gpu_ray" type="gpu_ray">
  <pose>0.5 0 0 0 0 0</pose>
  <ray>
    <scan>
      <horizontal>
        <samples>100</samples>
        <resolution>1.0</resolution>
        <min_angle>-1.0</min_angle>
        <max_angle>1.0</max_angle>
      </horizontal>
    </scan>
    <range>
      <min>0.05</min>
      <max>13.0</max>
    </range>
  </ray>
  <always_on>true</always_on>
  <visualize>true</visualize>
  <update_rate>10.0</update_rate>
  <plugin name="node" filename="libgazebo_ros_ray_sensor.so">
    <ros>
      <namespace>/gazebo_ros_ray</namespace>
    </ros>
    <output_type>sensor_msgs/LaserScan</output_type>
    <frame_name>map</frame_name>
  </plugin>
</sensor>
```

Gazebo



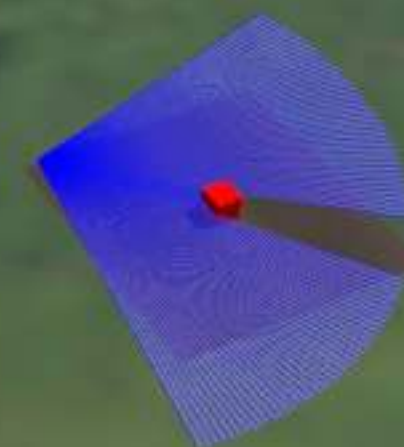
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gazebo
ros
ray



Real Time Factor: 0

Sim Time: 00 00:15:36.428

Real Time: 00 00:17:1



SimSlide Text



Gazebo ROS planar move plugin demo

Send commands

```
ros2 topic pub /gazebo_ros_planar_move/cmd_vel geometry_msgs/Twist "{angular: {z: 0.3}}" -1
```

Model SDF

```
<model name="model_to_move">
  <pose>
    1643 1662 15 0 0 0
  </pose>
  <link name="link">
    <collision name="collision">
      <geometry>
        <box>
          <size>1 1 1</size>
        </box>
      </geometry>
    </collision>
    <visual name="visual">
      <geometry>
        <box>
          <size>1 1 1</size>
        </box>
      </geometry>
      <material>
        <script>
          <uri>file://media/materials/scripts/gazebo.material</uri>
          <name>Gazebo/Red</name>
        </script>
      </material>
    </visual>
  </link>

  <plugin name="node" filename="libgazebo_ros_planar_move.so">
    <ros>
      <namespace>/gazebo_ros_planar_move</namespace>
    </ros>

    <update rate>50</update rate>
  </plugin>
</model>
```

Gazebo



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ROS topics/services





SimSlide Text



Gazebo ROS joint state publisher plugin demo

Listen to joint states

```
ros2 topic echo /gazebo_ros_joint_state_publisher/joint_states
```

Model SDF

```
<model name="pendulum">
  <pose>
    732.69
    687.57
    484.66
    0
    0
    0
  </pose>
  <link name="canonical">
  </link>
  <link name="upper_link">
    <pose>0 0 0 -1.5708 0 0</pose>
    <inertial>
      <pose>0 0 0.5 0 0 0</pose>
    </inertial>
    <visual name="vis_cylinder">
      <pose>0 0 0.5 0 0 0</pose>
      <geometry>
        <cylinder>
          <radius>0.1</radius>
          <length>0.9</length>
        </cylinder>
      </geometry>
      <material>
        <script>
          <uri>file://media/materials/scripts/gazebo.material</uri>
          <name>Gazebo/Yellow</name>
        </script>
      </material>
    </visual>
  </link>
  <link name="lower_link">
    <pose>0.2 0.9 0 -2 0 0</pose>
```

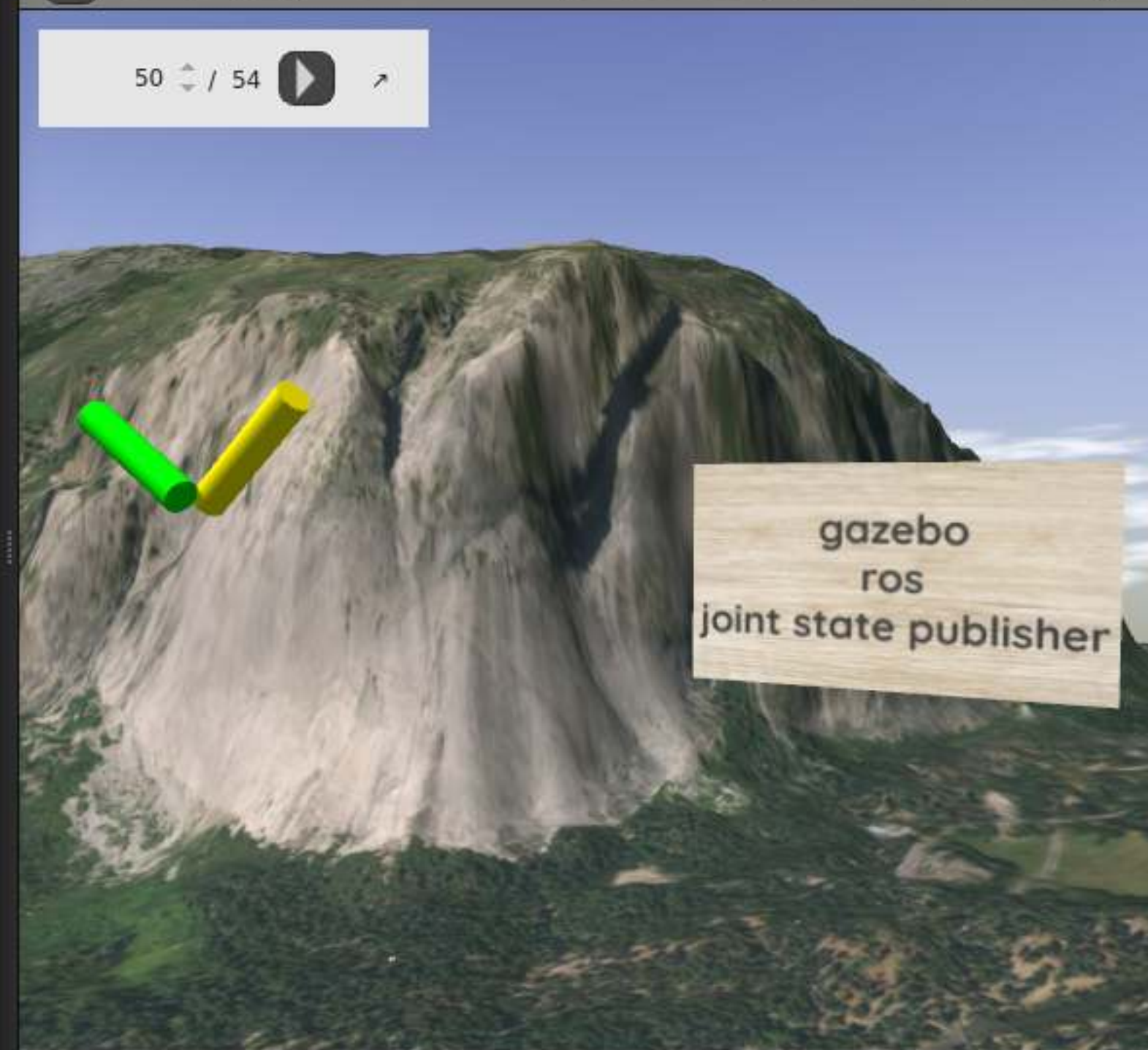
Gazebo



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▶ Real Time Factor: 0 Sim Time: 00 00:15:36.428 Real Time: 00 00:17:11



SimSlide Text



Gazebo ROS joint pose trajectory plugin demo

Send trajectory

```
ros2 topic pub /gazebo_ros_joint_pose_trajectory/set_joint_trajectory  
trajectory_msgs/msg/JointTrajectory "{header: {frame_id: world}, joint_names:  
{upper_joint}, points: [{positions: {0, 0.1, 0.2, 0.3, 0.4, 0.5}}]}"
```

Model SDF

```
<model name="pendulum">  
  <pose>  
    732.69  
    687.57  
    484.66  
    0  
    0  
    0  
  </pose>  
  <link name="canonical">  
  </link>  
  <link name="upper_link">  
    <pose>0 0 0 -1.5708 0 0</pose>  
    <inertial>  
      <pose>0 0 0.5 0 0 0</pose>  
    </inertial>  
    <visual name="vis_cylinder">  
      <pose>0 0 0.5 0 0 0</pose>  
      <geometry>  
        <cylinder>  
          <radius>0.1</radius>  
          <length>0.9</length>  
        </cylinder>  
      </geometry>  
      <material>  
        <script>  
          <uri>file://media/materials/scripts/gazebo.material</uri>  
          <name>Gazebo/Yellow</name>  
        </script>  
      </material>  
    </visual>  
  </link>
```

Gazebo



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gazebo
ros
joint pose trajectory



▶ Real Time Factor: 0 Sim Time: 00 00:15:36.428 Real Time: 00 00:17:11



SimSlide Text



Gazebo ROS projector plugin demo

Switch projector

```
ros2 topic pub /gazebo_ros_projector/switch std_msgs/msg/Bool "data: false" -1
```

Model SDF

```
<model name="projector_model">
  <pose>-1.326927 -0.038119 1.261517 1.570796 0 -0.551969</pose>
  <static>true</static>
  <link name="projector_link">
    <collision name="collision">
      <geometry>
        <sphere>
          <radius>0.1</radius>
        </sphere>
      </geometry>
    </collision>
    <visual name="visual">
      <geometry>
        <sphere>
          <radius>0.1</radius>
        </sphere>
      </geometry>
      <material>
        <script>Gazebo/Grey</script>
      </material>
    </visual>
    <projector name="texture_projector">
      <pose>0 0 0 0 0 0</pose>
      <texture>gazebo_ros_projector/materials/textures/gazebo_ros_projector.png</texture>
      <fov>0.959931088597</fov>
      <near_clip>0.1</near_clip>
      <far_clip>10</far_clip>
    </projector>
  </link>
  <plugin name="node" filename="libgazebo_ros_projector.so">
    <ros>
      <namespace>/gazebo_ros_projector</namespace>
    </ros>
  </plugin>
</model>
```

Gazebo



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▶ Real Time Factor: 0 Sim Time: 00 00:15:36.428 Real Time: 00 00:17:11



SimSlide Text



Gazebo ROS hand of god plugin demo

Send commands

```
ros2 run tf2_ros static_transform_publisher 2497 954.6 1418 1 0 0 0 world  
link1_desired
```

```
ros2 run tf2_ros tf2_echo world link1_actual
```

Model SDF

```
<model name="chain_of_god">  
  <pose>  
    2497 954.6 1416 0 0 0  
  </pose>  
  <link name="canonical">  
  </link>  
  <link name="link1">  
    <pose>0 0 0 -1.5708 0 0</pose>  
    <inertial>  
      <pose>0 0 0.5 0 0 0</pose>  
    </inertial>  
    <visual name="visual">  
      <pose>0 0 0.5 0 0 0</pose>  
      <geometry>  
        <cylinder>  
          <radius>0.1</radius>  
          <length>1.0</length>  
        </cylinder>  
      </geometry>  
      <material>  
        <script>  
          <uri>file://media/materials/scripts/gazebo.material</uri>  
          <name>Gazebo/Yellow</name>  
        </script>  
      </material>  
    </visual>  
    <collision name="collision">  
      <pose>0 0 0.5 0 0 0</pose>  
      <geometry>  
        <cylinder>  
          <radius>0.1</radius>
```

Gazebo



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gazebo
ros
hand of god

▶ Real Time Factor: 0 Sim Time: 00 00:15:36.428 Real Time: 00 00:17:1



SimSlide Text

Gazebo ROS vacuum gripper plugin demo

Switch gripper

```
ros2 service call /gazebo_ros_vacuum_gripper/switch std_srvs/srv/SetBool  
"{data: True}"
```

```
ros2 topic echo /gazebo_ros_vacuum_gripper/grasping
```

Model SDF

```
<model name="vacuum_gripper">  
  <static>true</static>  
  <pose>  
    -752 500 -30 0 0 0  
  </pose>  
  <link name="link">  
    <collision name="collision">  
      <geometry>  
        <cylinder>  
          <radius>0.3</radius>  
          <length>1</length>  
        </cylinder>  
      </geometry>  
    </collision>  
    <visual name="visual">  
      <geometry>  
        <cylinder>  
          <radius>0.3</radius>  
          <length>1</length>  
        </cylinder>  
      </geometry>  
      <material>  
        <script>  
          <uri>file://media/materials/scripts/gazebo.material</uri>  
          <name>Gazebo/Orange</name>  
        </script>  
      </material>  
    </visual>  
  </link>  
  
  <plugin name="node" filename="libgazebo_ros_vacuum_gripper.so">
```

Gazebo

File Edit Camera View Window Help Simslides



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▶ Real Time Factor: 0 Sim Time: 00 00:15:36.428 Real Time: 00 00:17:11



gazebo_ros_pkgs

Port gazebo_ros_pkgs to ROS 2.0 #512

**Open**

j-rivero opened this issue on Nov 29, 2016 · 25 comments



j-rivero commented on Nov 29, 2016 · edited by chapulina ▾

Member



Interest into porting `gazebo_ros_pkgs` to ROS 2.0 is [starting to appear within the ROS Community](#), this post tries to server a tracker for suggestion, status and discussions on how to do it.

Update 29 Nov 2016

The ROS team currently warns about implementations at this point since the API is still unstable an future changes could require a big amount of work to update the code. Even with API instability a possible suggestion to start the works could be some time [after the Beta1 \(release planned in the next weeks\)](#), late January if the feedback regarding to the Beta1 is good at that moment.

Update 2nd Jun 2018

The branch `ros2` is ready in this repository to start merging changes related to port the code to ROS2.

Update 19 July 2018

Written by [@ironmig](#)





Versions



GAZEBO 9



Packages



-  gazebo_dev
-  gazebo_msgs
-  gazebo_ros
-  gazebo_plugins
-  gazebo_ros_pkgs
-  gazebo_ros_control



Packages

2



gazebo_dev



gazebo_msgs



gazebo_ros



gazebo_plugins



gazebo_ros_pkgs



gazebo_ros_control

