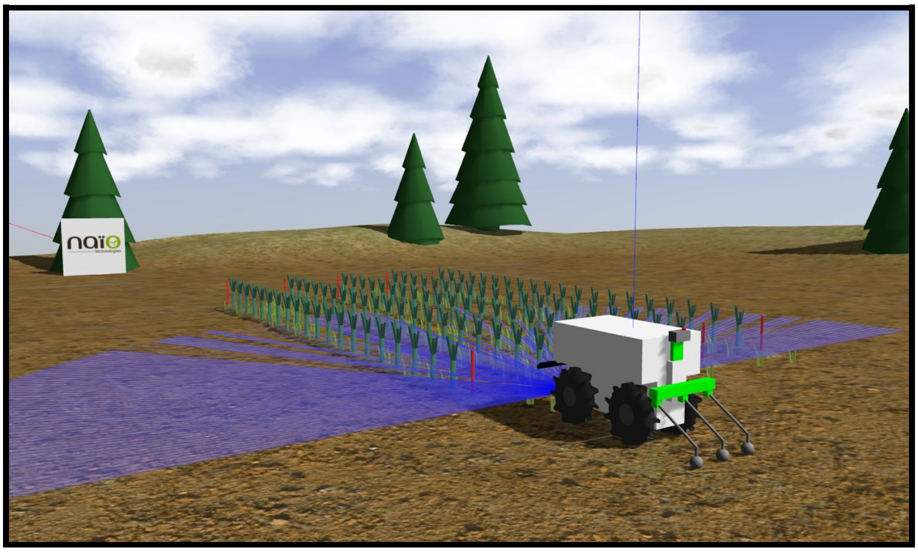
Simul'Oz
user manual

Naïo technologies



- Linux with Docker -

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1. Docker installation

https://docs.docker.com/engine/installation/

⚠ The deb command should not be executed but added in the following file : `/etc/apt/sources.list`
You can do it using (For Xenial):

```
echo "deb https://apt.dockerproject.org/repo ubuntu-xenial main" | sudo tee
/etc/apt/sources.list.d/docker.list
```

⚠ Do not forget to install and start docker after the prerequisites with the command lines :

```
sudo apt-get install docker-engine
sudo service docker start
```

NOTE on docker :

To use docker, you first have to pull the image of the container where gazebo and the simulator are installed (cf 2.1). You can then launch it, using the docker command “run” (cf 2.2). Iit will automatically start a vnc server and you will be able to visualize what’s happening inside the container using a vnc viewer of your choice (cd 2.3). You can then open new terminals inside the container with the docker command “exec” (cf 2.4). In those terminals, you will be able to launch the simulator, the test Viewer ApiClient, or to create new worlds (cf 2.5, 2.6, 2.7). If you want to exit a terminal, simply type “exit” in the command line of the container or use CTRL+C.

When you exit the container, or when it crashes, make sure that it is stopped properly with the docker command “stop” (cf 3.1) and then delete the container with the docker command “rm” (cf 3.2).

2.Simul'Oz launching

2.1 Pulling the image

You will start by pulling the image of the container where Gazebo, ROS, Simulatoz and the Test Viewer are installed :

```
sudo docker pull simulatoz/simulatozvnc:latest
```

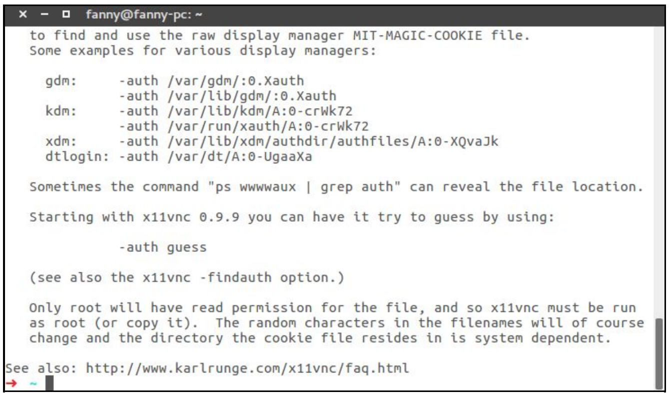
2.2 Launching the container

In order to launch this container and start the vnc server : (the ports 5900, 5555, 5556, 5557 and 5558 of your computer will be automatically connected to those of the container)

```
sudo docker run -p 5900:5900 -p 5555:5555 -p 5556:5556 -p 5557:5557 -p 5558:5558 -t
--name simulatoz simulatoz/simulatozvnc:latest
```

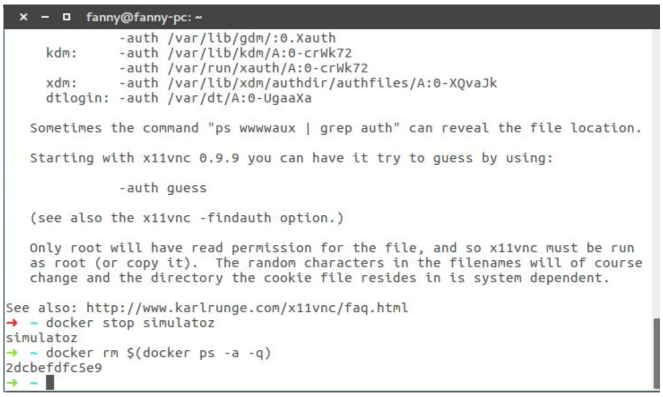
⚠ You won't be able to launch the container if you have not stopped and deleted your previous Simulatoz container (cf 3.1 and 3.2)

⚠ If the container crashes (your are back at the command line), stop and delete the container (cd 3.1 and 3.2) and try again.



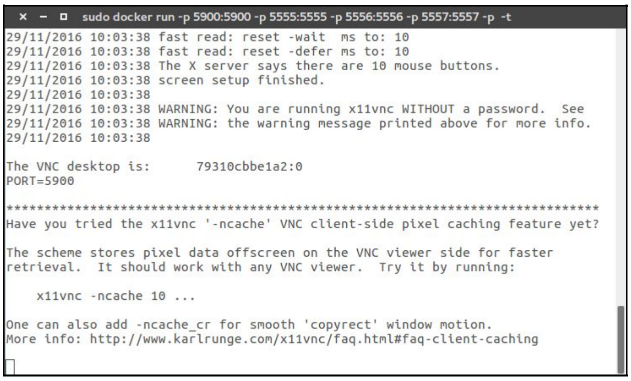
```
  to find and use the raw display manager MIT-MAGIC-COOKIE file.
  Some examples for various display managers:

    gdm:     -auth /var/gdm/:0.Xauth
             -auth /var/lib/gdm/:0.Xauth
    kdm:     -auth /var/lib/kdm/A:0-crWk72
             -auth /var/run/xauth/A:0-crWk72
    xdm:     -auth /var/lib/xdm/authdir/authfiles/A:0-XQvaJk
    dtlogin: -auth /var/dt/A:0-UgaaXa

  Sometimes the command "ps wwwwaux | grep auth" can reveal the file location.

  Starting with x11vnc 0.9.9 you can have it try to guess by using:

             -auth guess

  (see also the x11vnc -findauth option.)

  Only root will have read permission for the file, and so x11vnc must be run
  as root (or copy it).  The random characters in the filenames will of course
  change and the directory the cookie file resides in is system dependent.

See also: http://www.karlrunge.com/x11vnc/faq.html
→ ~
```

Docker run failed to launch the container



```
             -auth /var/lib/gdm/:0.Xauth
    kdm:     -auth /var/lib/kdm/A:0-crWk72
             -auth /var/run/xauth/A:0-crWk72
    xdm:     -auth /var/lib/xdm/authdir/authfiles/A:0-XQvaJk
    dtlogin: -auth /var/dt/A:0-UgaaXa

  Sometimes the command "ps wwwwaux | grep auth" can reveal the file location.

  Starting with x11vnc 0.9.9 you can have it try to guess by using:

             -auth guess

  (see also the x11vnc -findauth option.)

  Only root will have read permission for the file, and so x11vnc must be run
  as root (or copy it).  The random characters in the filenames will of course
  change and the directory the cookie file resides in is system dependent.

See also: http://www.karlrunge.com/x11vnc/faq.html
→ ~ docker stop simulatoz
simulatoz
→ ~ docker rm $(docker ps -a -q)
2dcbefdfc5e9
→ ~
```

In that case, do not forget to stop and delete the container before you try to launch it again


sudo docker run -p 5900:5900 -p 5555:5555 -p 5556:5556 -p 5557:5557 -p -t

```
29/11/2016 10:03:38 fast read: reset -wait  ms to: 10
29/11/2016 10:03:38 fast read: reset -defer ms to: 10
29/11/2016 10:03:38 The X server says there are 10 mouse buttons.
29/11/2016 10:03:38 screen setup finished.
29/11/2016 10:03:38
29/11/2016 10:03:38 WARNING: You are running x11vnc WITHOUT a password.  See
29/11/2016 10:03:38 WARNING: the warning message printed above for more info.
29/11/2016 10:03:38

The VNC desktop is:      79310cbbe1a2:0
PORT=5900

******************************************************************************
Have you tried the x11vnc '-ncache' VNC client-side pixel caching feature yet?

The scheme stores pixel data offscreen on the VNC viewer side for faster
retrieval.  It should work with any VNC viewer.  Try it by running:

    x11vnc -ncache 10 ...

One can also add -ncache_cr for smooth 'copyrect' window motion.
More info: http://www.karlrunge.com/x11vnc/faq.html#faq-client-caching
```

Docker container successfully launched

2.3 Visualisation

To visualize your docker container you will need its IP address. It is usually 172.17.0.2 but might differ. In this case, you can find it using the command :

```
sudo docker inspect simulatoz
```

If you do not already have a vnc viewer installed on your computer you can get one and launch it using :

```
sudo apt-get install vncviewer
vncviewer <IP ADDRESS>
```

2.4 Launching a new terminal in the container

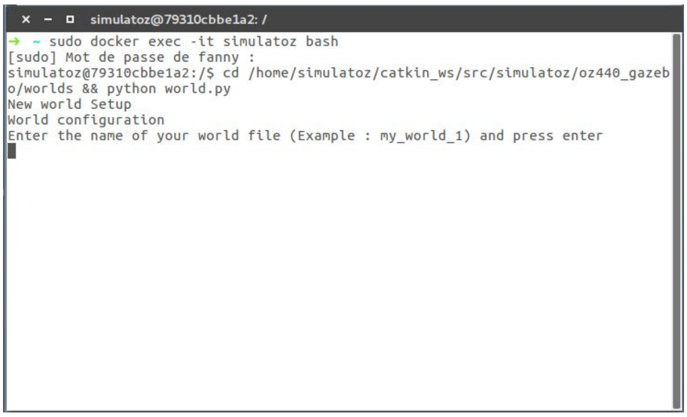
In order to launch a new terminal in the running container, you can use :

```
sudo docker exec -it simulatoz bash
```

2.5 Creating a new world

In a terminal inside the container :

```
cd /home/simulatoz/catkin_ws/src/simulatoz/oz440_gazebo/worlds && python world.py
```



```
➜  ~ sudo docker exec -it simulatoz bash
[sudo] Mot de passe de fanny :
simulatoz@79310cbbe1a2:/$ cd /home/simulatoz/catkin_ws/src/simulatoz/oz440_gazeb
o/worlds && python world.py
New world Setup
World configuration
Enter the name of your world file (Example : my_world_1) and press enter
```

Creating a new world

2.6 Launching the simulator

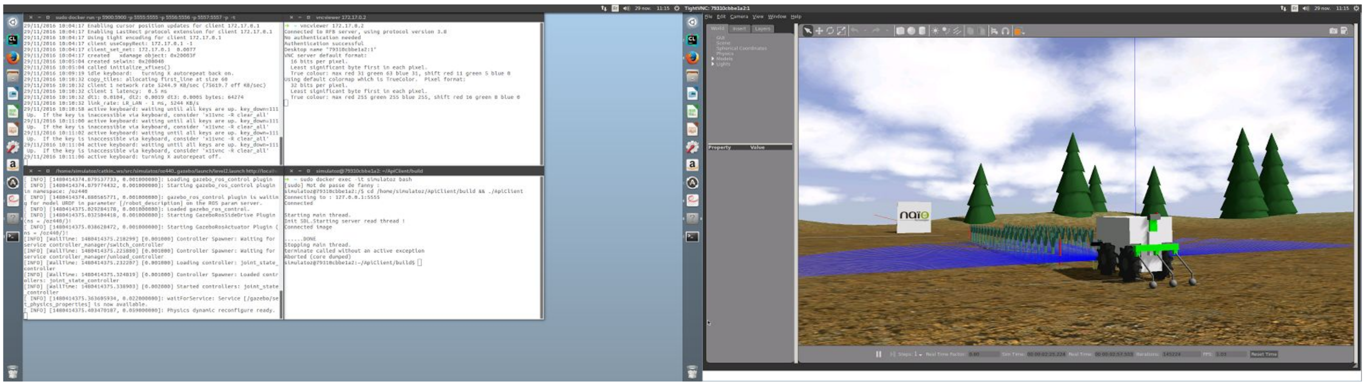
In a terminal inside the container :

```
roslaunch oz440_gazebo <your_world_name>.launch
```

If you didn't create a new world, a few one are already available in the container :

```
roslaunch oz440_gazebo level1.launch
roslaunch oz440_gazebo level2.launch
roslaunch oz440_gazebo level3.launch
roslaunch oz440_gazebo level1_no_gfx.launch
roslaunch oz440_gazebo level2_no_gfx.launch
roslaunch oz440_gazebo level3_no_gfx.launch
```

⚠ If Gazebo crashes (The world never loads), stop the process (CTRL+C) and try again.



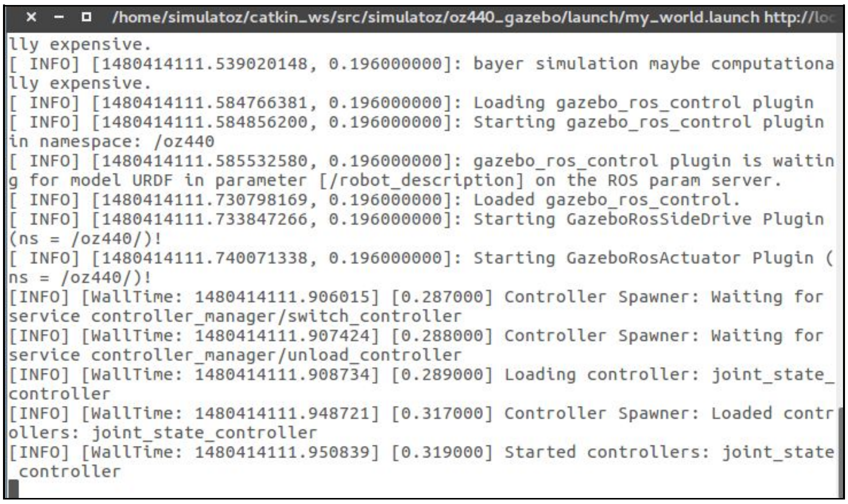
```
× − ▫ sudo docker run -p 5900:5900 -p 5555:5555 -p 5556:5556 -p 5557:5557 -p -t
29/11/2016 10:04:17 Enabling cursor position updates for client 172.17.0.1
29/11/2016 10:04:17 Enabling LastRect protocol extension for client 172.17.0.1
29/11/2016 10:04:17 Using tight encoding for client 172.17.0.1
29/11/2016 10:04:17 client useCopyRect: 172.17.0.1 -1
29/11/2016 10:04:17 client_set_net: 172.17.0.1  0.0077
29/11/2016 10:04:17 created   xdamage object: 0x20003f
29/11/2016 10:05:04 created selwin: 0x200040
29/11/2016 10:05:04 called initialize_xfixes()
29/11/2016 10:09:19 idle keyboard:   turning X autorepeat back on.
29/11/2016 10:10:32 copy_tiles: allocating first_line at size 60
29/11/2016 10:10:32 client 1 network rate 5244.9 KB/sec (75619.7 eff KB/sec)
29/11/2016 10:10:32 client 1 latency:  0.5 ms
29/11/2016 10:10:32 dt1: 0.0104, dt2: 0.0019 dt3: 0.0005 bytes: 64274
29/11/2016 10:10:32 link_rate: LR_LAN - 1 ms, 5244 KB/s
29/11/2016 10:10:58 active keyboard: waiting until all keys are up. key_down=111
 Up.  If the key is inaccessible via keyboard, consider 'x11vnc -R clear_all'
29/11/2016 10:11:00 active keyboard: waiting until all keys are up. key_down=111
 Up.  If the key is inaccessible via keyboard, consider 'x11vnc -R clear_all'
29/11/2016 10:11:02 active keyboard: waiting until all keys are up. key_down=111
 Up.  If the key is inaccessible via keyboard, consider 'x11vnc -R clear_all'
29/11/2016 10:11:04 active keyboard: waiting until all keys are up. key_down=111
 Up.  If the key is inaccessible via keyboard, consider 'x11vnc -R clear_all'
29/11/2016 10:11:06 active keyboard: turning X autorepeat off.
```

```
× − ▫ vncviewer 172.17.0.2
→ ~ vncviewer 172.17.0.2
Connected to RFB server, using protocol version 3.8
No authentication needed
Authentication successful
Desktop name "79310cbbe1a2:1"
VNC server default format:
  16 bits per pixel.
  Least significant byte first in each pixel.
  True colour: max red 31 green 63 blue 31, shift red 11 green 5 blue 0
Using default colormap which is TrueColor.  Pixel format:
  32 bits per pixel.
  Least significant byte first in each pixel.
  True colour: max red 255 green 255 blue 255, shift red 16 green 8 blue 0
```

```
× − ▫ /home/simulatoz/catkin_ws/src/simulatoz/oz440_gazebo/launch/level2.launch http://local
[ INFO] [1480414374.879537733, 0.001000000]: Loading gazebo_ros_control plugin
[ INFO] [1480414374.879774432, 0.001000000]: Starting gazebo_ros_control plugin
in namespace: /oz440
[ INFO] [1480414374.880565771, 0.001000000]: gazebo_ros_control plugin is waitin
g for model URDF in parameter [/robot_description] on the ROS param server.
[ INFO] [1480414375.029284178, 0.001000000]: Loaded gazebo_ros_control.
[ INFO] [1480414375.032504418, 0.001000000]: Starting GazeboRosSideDrive Plugin
(ns = /oz440/)!
[ INFO] [1480414375.038628472, 0.001000000]: Starting GazeboRosActuator Plugin (
ns = /oz440/)!
[INFO] [WallTime: 1480414375.218299] [0.001000] Controller Spawner: Waiting for
service controller_manager/switch_controller
[INFO] [WallTime: 1480414375.225880] [0.001000] Controller Spawner: Waiting for
service controller_manager/unload_controller
[INFO] [WallTime: 1480414375.232207] [0.001000] Loading controller: joint_state_
controller
[INFO] [WallTime: 1480414375.324019] [0.001000] Controller Spawner: Loaded contr
ollers: joint_state_controller
[INFO] [WallTime: 1480414375.338903] [0.002000] Started controllers: joint_state
_controller
[ INFO] [1480414375.363605934, 0.022000000]: waitForService: Service [/gazebo/se
t_physics_properties] is now available.
[ INFO] [1480414375.403470187, 0.059000000]: Physics dynamic reconfigure ready.
```

```
× − ▫ simulatoz@79310cbbe1a2: ~/ApiClient/build
→ ~ sudo docker exec -it simulatoz bash
[sudo] Mot de passe de fanny :
simulatoz@79310cbbe1a2:/$ cd /home/simulatoz/ApiClient/build && ./ApiClient
Connecting to : 127.0.0.1:5555
Connected

Starting main thread.
Init SDL.Starting server read thread !
Connected image

......DONE
Stopping main thread.
terminate called without an active exception
Aborted (core dumped)
simulatoz@79310cbbe1a2:~/ApiClient/build$
```

Simulatoz launched in the container with graphics



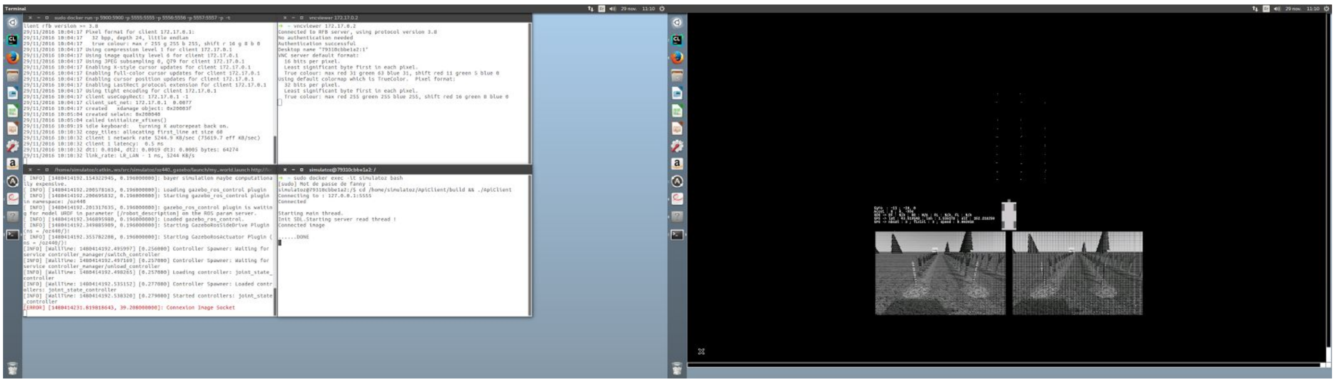
```
× − ▫ /home/simulatoz/catkin_ws/src/simulatoz/oz440_gazebo/launch/my_world.launch http://loc
lly expensive.
[ INFO] [1480414111.539020148, 0.196000000]: bayer simulation maybe computationa
lly expensive.
[ INFO] [1480414111.584766381, 0.196000000]: Loading gazebo_ros_control plugin
[ INFO] [1480414111.584856200, 0.196000000]: Starting gazebo_ros_control plugin
in namespace: /oz440
[ INFO] [1480414111.585532580, 0.196000000]: gazebo_ros_control plugin is waitin
g for model URDF in parameter [/robot_description] on the ROS param server.
[ INFO] [1480414111.730798169, 0.196000000]: Loaded gazebo_ros_control.
[ INFO] [1480414111.733847266, 0.196000000]: Starting GazeboRosSideDrive Plugin
(ns = /oz440/)!
[ INFO] [1480414111.740071338, 0.196000000]: Starting GazeboRosActuator Plugin (
ns = /oz440/)!
[INFO] [WallTime: 1480414111.906015] [0.287000] Controller Spawner: Waiting for
service controller_manager/switch_controller
[INFO] [WallTime: 1480414111.907424] [0.288000] Controller Spawner: Waiting for
service controller_manager/unload_controller
[INFO] [WallTime: 1480414111.908734] [0.289000] Loading controller: joint_state_
controller
[INFO] [WallTime: 1480414111.948721] [0.317000] Controller Spawner: Loaded contr
ollers: joint_state_controller
[INFO] [WallTime: 1480414111.950839] [0.319000] Started controllers: joint_state
_controller
```

No graphics world launched

2.7 Launching the test Viewer ApiClient

In a terminal inside the container :

```
cd /home/simulatoz/ApiClient/build && ./ApiClient
```



```
× − ▫ sudo docker run -p 5900:5900 -p 5555:5555 -p 5556:5556 -p 5557:5557 -p -t
lient rfb version >= 3.8
29/11/2016 10:04:17 Pixel format for client 172.17.0.1:
29/11/2016 10:04:17   32 bpp, depth 24, little endian
29/11/2016 10:04:17   true colour: max r 255 g 255 b 255, shift r 16 g 8 b 0
29/11/2016 10:04:17 Using compression level 1 for client 172.17.0.1
29/11/2016 10:04:17 Using image quality level 6 for client 172.17.0.1
29/11/2016 10:04:17 Using JPEG subsampling 0, Q79 for client 172.17.0.1
29/11/2016 10:04:17 Enabling X-style cursor updates for client 172.17.0.1
29/11/2016 10:04:17 Enabling full-color cursor updates for client 172.17.0.1
29/11/2016 10:04:17 Enabling cursor position updates for client 172.17.0.1
29/11/2016 10:04:17 Enabling LastRect protocol extension for client 172.17.0.1
29/11/2016 10:04:17 Using tight encoding for client 172.17.0.1
29/11/2016 10:04:17 client useCopyRect: 172.17.0.1 -1
29/11/2016 10:04:17 client_set_net: 172.17.0.1  0.0077
29/11/2016 10:04:17 created   xdamage object: 0x20003f
29/11/2016 10:05:04 created selwin: 0x200040
29/11/2016 10:05:04 called initialize_xfixes()
29/11/2016 10:09:19 idle keyboard:   turning X autorepeat back on.
29/11/2016 10:10:32 copy_tiles: allocating first_line at size 60
29/11/2016 10:10:32 client 1 network rate 5244.9 KB/sec (75619.7 eff KB/sec)
29/11/2016 10:10:32 client 1 latency:  0.5 ms
29/11/2016 10:10:32 dt1: 0.0104, dt2: 0.0019 dt3: 0.0005 bytes: 64274
29/11/2016 10:10:32 link_rate: LR_LAN - 1 ms, 5244 KB/s
```

```
× − ▫ vncviewer 172.17.0.2
→ ~ vncviewer 172.17.0.2
Connected to RFB server, using protocol version 3.8
No authentication needed
Authentication successful
Desktop name "79310cbbe1a2:1"
VNC server default format:
  16 bits per pixel.
  Least significant byte first in each pixel.
  True colour: max red 31 green 63 blue 31, shift red 11 green 5 blue 0
Using default colormap which is TrueColor.  Pixel format:
  32 bits per pixel.
  Least significant byte first in each pixel.
  True colour: max red 255 green 255 blue 255, shift red 16 green 8 blue 0
```

```
× − ▫ /home/simulatoz/catkin_ws/src/simulatoz/oz440_gazebo/launch/my_world.launch http://lo
[ INFO] [1480414192.154322945, 0.196000000]: bayer simulation maybe computationa
lly expensive.
[ INFO] [1480414192.200578163, 0.196000000]: Loading gazebo_ros_control plugin
[ INFO] [1480414192.200695832, 0.196000000]: Starting gazebo_ros_control plugin
in namespace: /oz440
[ INFO] [1480414192.201317635, 0.196000000]: gazebo_ros_control plugin is waitin
g for model URDF in parameter [/robot_description] on the ROS param server.
[ INFO] [1480414192.346895980, 0.196000000]: Loaded gazebo_ros_control.
[ INFO] [1480414192.349885909, 0.196000000]: Starting GazeboRosSideDrive Plugin
(ns = /oz440/)!
[ INFO] [1480414192.355782208, 0.196000000]: Starting GazeboRosActuator Plugin (
ns = /oz440/)!
[INFO] [WallTime: 1480414192.495997] [0.256000] Controller Spawner: Waiting for
service controller_manager/switch_controller
[INFO] [WallTime: 1480414192.497169] [0.257000] Controller Spawner: Waiting for
service controller_manager/unload_controller
[INFO] [WallTime: 1480414192.498265] [0.257000] Loading controller: joint_state_
controller
[INFO] [WallTime: 1480414192.535152] [0.277000] Controller Spawner: Loaded contr
ollers: joint_state_controller
[INFO] [WallTime: 1480414192.538320] [0.279000] Started controllers: joint_state
_controller
[ERROR] [1480414231.819818643, 39.208000000]: Connexion Image Socket
```

```
× − ▫ simulatoz@79310cbbe1a2: /
→ ~ sudo docker exec -it simulatoz bash
[sudo] Mot de passe de fanny :
simulatoz@79310cbbe1a2:/$ cd /home/simulatoz/ApiClient/build && ./ApiClient
Connecting to : 127.0.0.1:5555
Connected

Starting main thread.
Init SDL.Starting server read thread !
Connected image

......DONE
```

ApiClient launched with a no graphics world

3. Closing the container

3.1 Stopping the container

When you have exited the container, stop it :

```
sudo docker stop simulatoz
```

3.1 Deleting the container

When you have stopped the container, delete it :

```
sudo docker rm $(docker ps -a -q)
```

⚠ If a problem occurs, find the simulatoz container ID with : `sudo docker ps -a`
Use the Id to delete the container : `sudo docker rm <CONTAINER ID>`

⚠ Be careful, the container id changes every time you start it.