

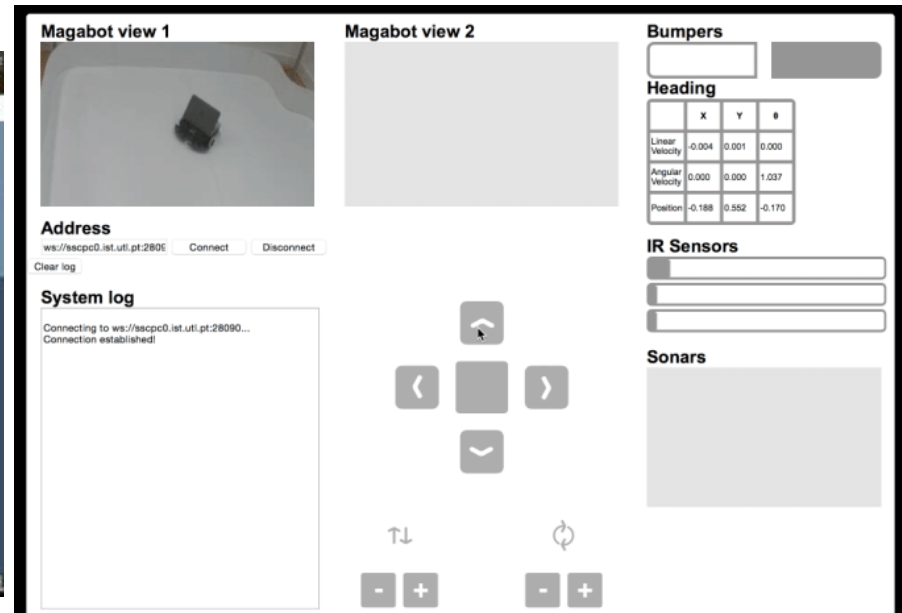
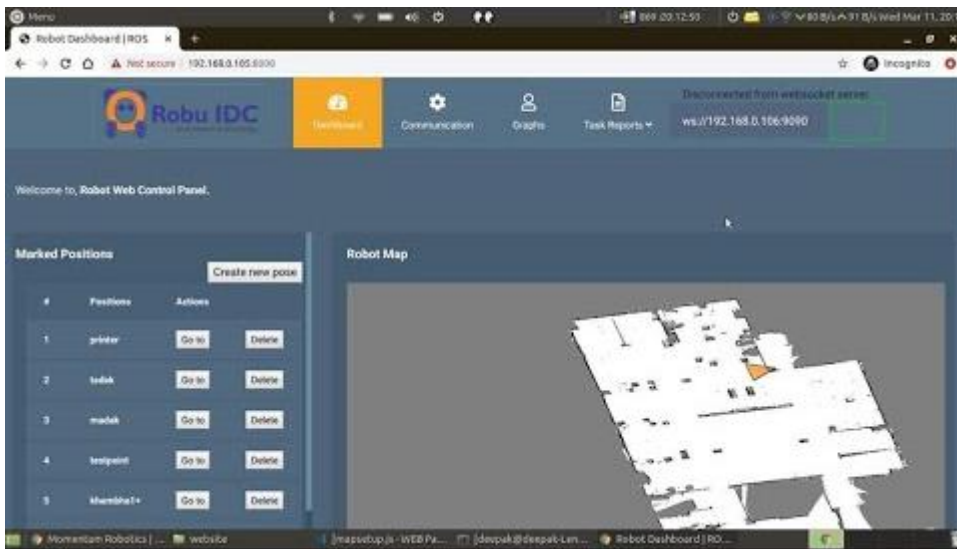
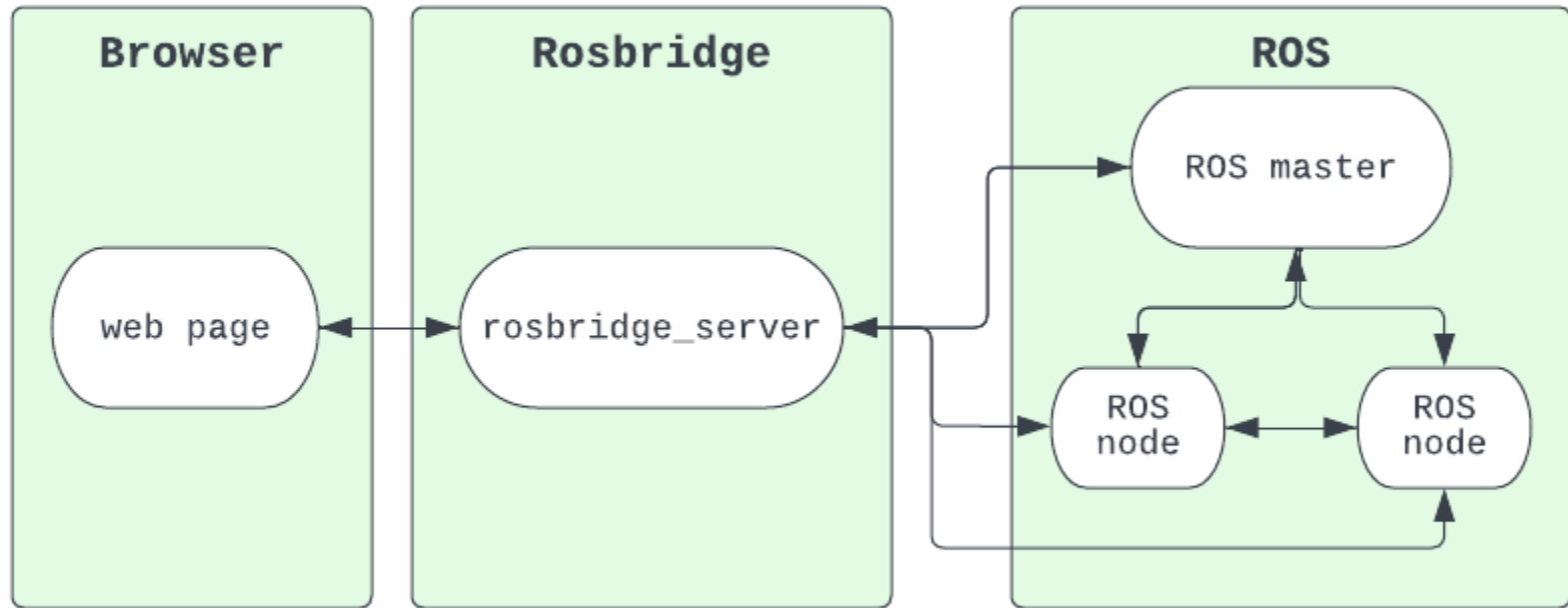
# 無人載具技術與應用

## ROS roslibjs II

徐瑋隆

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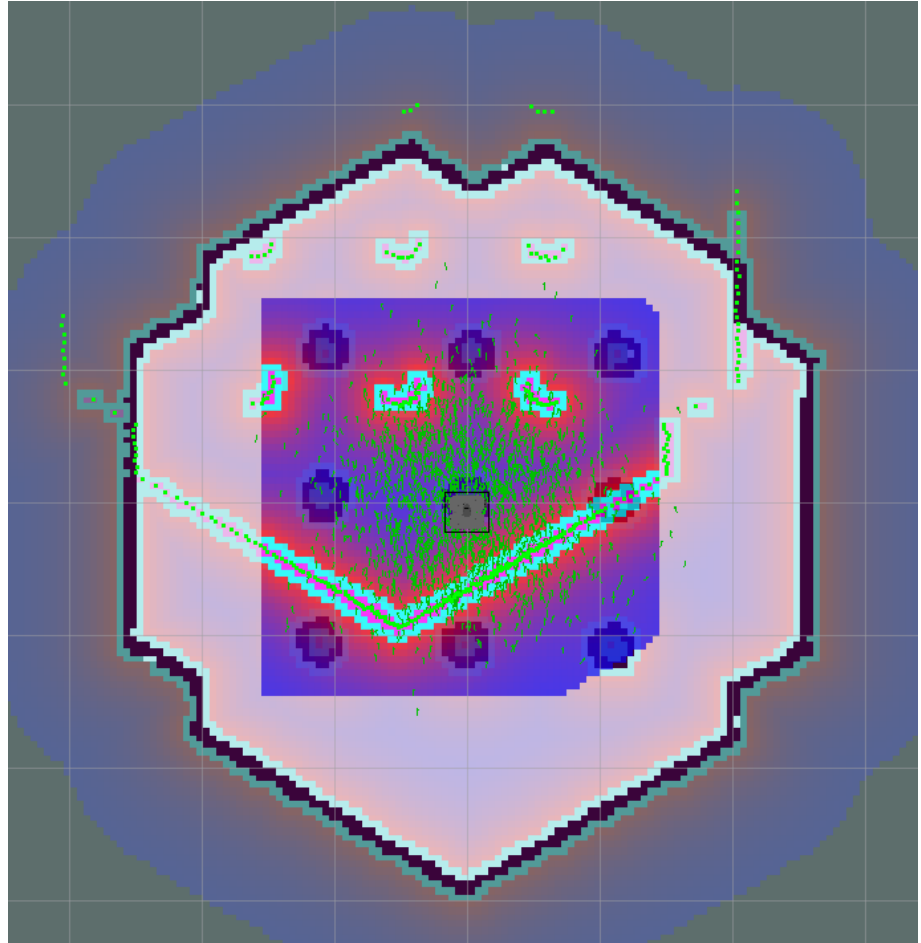
# rosbridge



topic

**ROS ROSLIBJS**

# ros roslibjs – topic 01

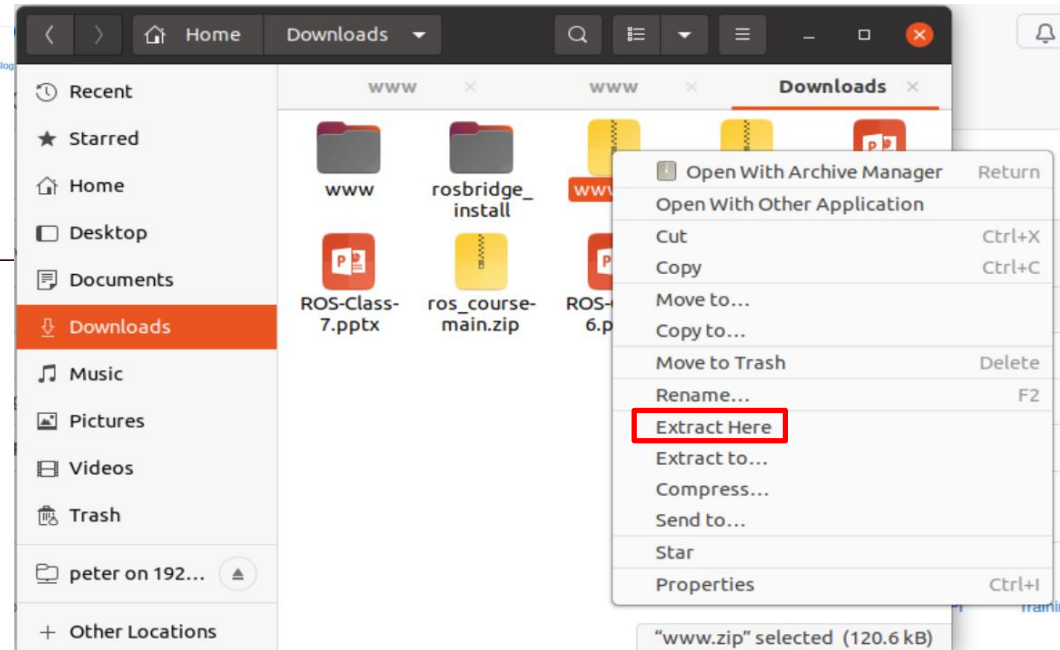
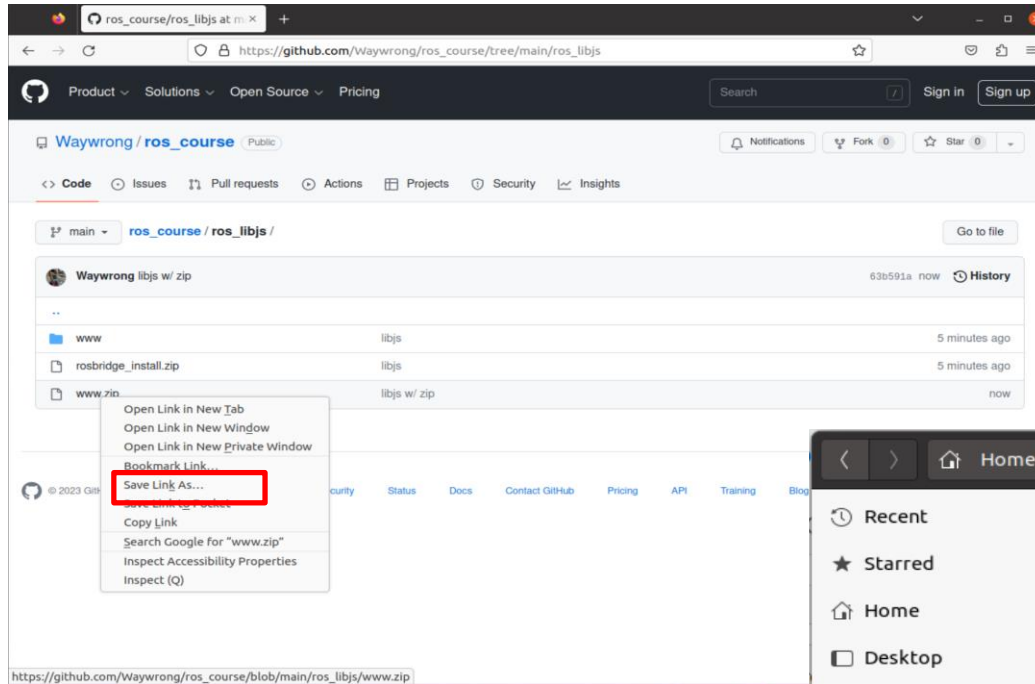


```
roslaunch turtlebot3_gazebo turtlebot3_world.launch  
roslaunch turtlebot3_navigation turtlebot3_navigation.launch  
roslaunch rosbridge_server rosbridge_websocket.launch
```

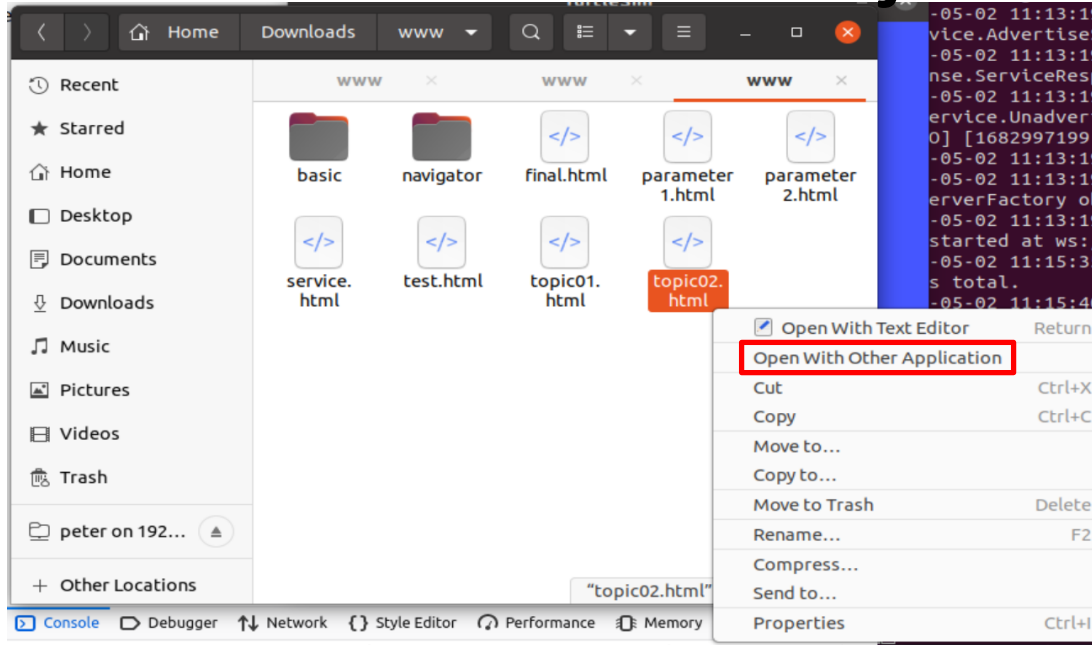
# ros roslibjs – topic 02

[https://github.com/Waywrong/ros\\_course/tree/main/ros\\_libjs](https://github.com/Waywrong/ros_course/tree/main/ros_libjs)

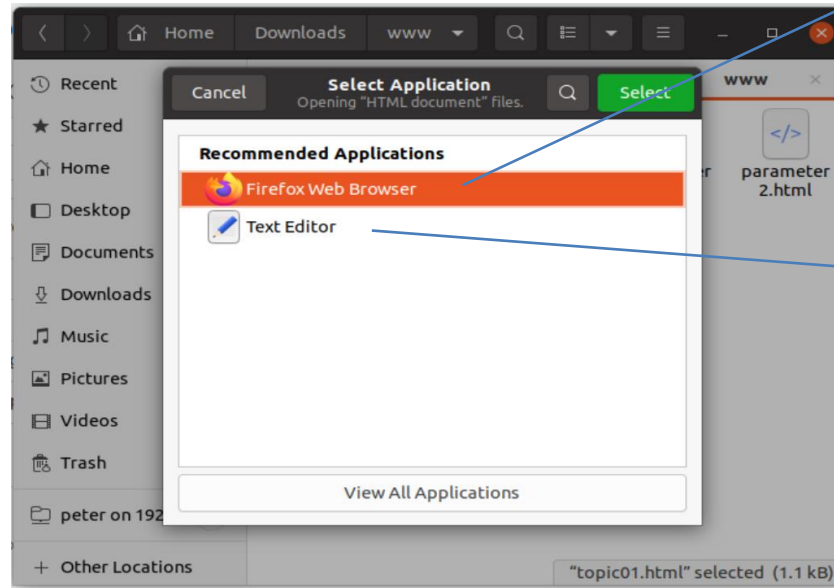
下載 www.zip 並解壓縮



# ros roslibjs – topic 03



用瀏覽器執行網頁



編輯網頁內容

# ros roslibis – topic 04

```
24 console.log('Connection to websocket server closed.');
```

```
25 });
```

```
26
```

```
27 // Publishing cmd_vel Topic
```

```
28 // -----
```

```
29 function cmd_vel_linear(idx_posminus){
```

```
30   var cmdVel = new ROSLIB.Topic({
```

```
31     ros : ros,
```

```
32     name : '/turtle1/cmd_vel',
```

```
33     messageType : 'geometry_msgs/Twist'
```

```
34   });
```

```
35   var twist = new ROSLIB.Message({
```

```
36     linear : {
```

```
37       x : 0.8*idx_posminus,
```

```
38       y : 0,
```

```
39       z : 0,
```

```
40     },
```

```
41     angular : {
```

```
42       x : 0,
```

```
43       y : 0,
```

```
44       z : 0,
```

```
45     }
```

```
46   });
```

```
47   cmdVel.publish(twist);
```

```
48 }
```

```
49
```

```
50 function cmd_vel_angular(idx_posminus){
```

```
51   var cmdVel = new ROSLIB.Topic({
```

```
52     ros : ros,
```

```
53     name : '/turtle1/cmd_vel',
```

↓

原本Topic

```
function cmd_vel_linear(idx_posminus){
```

```
  var cmdVel = new ROSLIB.Topic({
```

```
    ros : ros,
```

```
    name : '/cmd_vel',
```

```
    messageType : 'geometry_msgs/Twist'
```

```
  });
```

```
  var twist = new ROSLIB.Message({
```

```
    linear : {
```

```
      x : 0.8*idx_posminus,
```

```
      y : 0,
```

```
      z : 0,
```

```
    },
```

```
    angular : {
```

```
      x : 0,
```

```
      y : 0,
```

```
      z : 0,
```

```
    }
```

```
  });
```

```
  cmdVel.publish(twist);
```

```
}
```

新Topic

```
function cmd_vel_angular(idx_posminus){
```

```
  var cmdVel = new ROSLIB.Topic({
```

```
    ros : ros,
```

```
    name : '/cmd_vel',
```

```
    messageType : 'geometry_msgs/Twist'
```

```
  });
```

```
  var twist = new ROSLIB.Message({
```

```
    linear : {
```

```
      x : 0,
```

```
      y : 0,
```

```
      z : 0,
```

```
    },
```

```
    angular : {
```

```
      x : 0,
```

```
      y : 0,
```

```
      z : 0.5*idx_posminus,
```

```
    }
```

```
  });
```

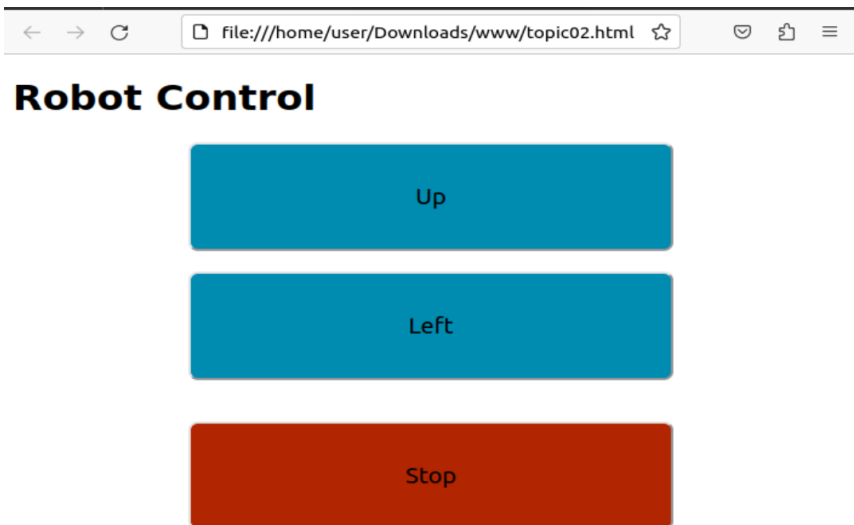
```
  cmdVel.publish(twist);
```

```
}
```

# ros roslibjs – topic 05

```
function cmd_up(){  
  cmd_vel_linear(1);  
}  
function cmd_left(){  
  cmd_vel_angular(1);  
}  
function cmd_stop(){  
  cmd_vel_linear(0);  
}
```

```
<body>  
<h1>Robot Control</h1>  
<center>  
  <input type="submit"  
    value="Up"  
    onclick="cmd_up()"  
    style="font-size : 20px; width: 400px; height: 100px;  
    background-color: #008CB1; border-radius: 8px;" />  
</br>  
</br>  
  <input type="submit"  
    value="Left"  
    onclick="cmd_left()"  
    style="font-size : 20px; width: 400px; height: 100px;  
    background-color: #008CB1; border-radius: 8px;" />  
</br>  
</br>  
  <input type="submit"  
    value="Stop"  
    onclick="cmd_stop()"  
    style="font-size : 20px; width: 400px; height: 100px;  
    background-color: #B12500; border-radius: 8px;" />  
</center>  
</body>  
</html>
```



```
<input type="submit"  
  value="Stop"  
  onclick="cmd_stop()"  
  style="font-size : 20px; width: 400px; height: 100px;  
  background-color: #B12500; border-radius: 8px;" />  
</center>  
</body>  
</html>
```

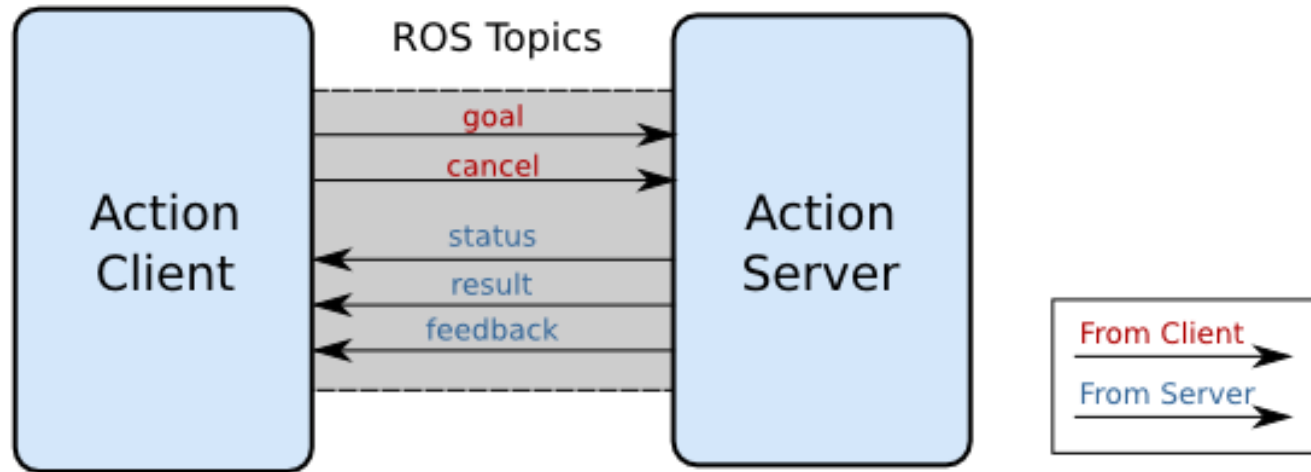


action

**ROS ROSLIBJS**

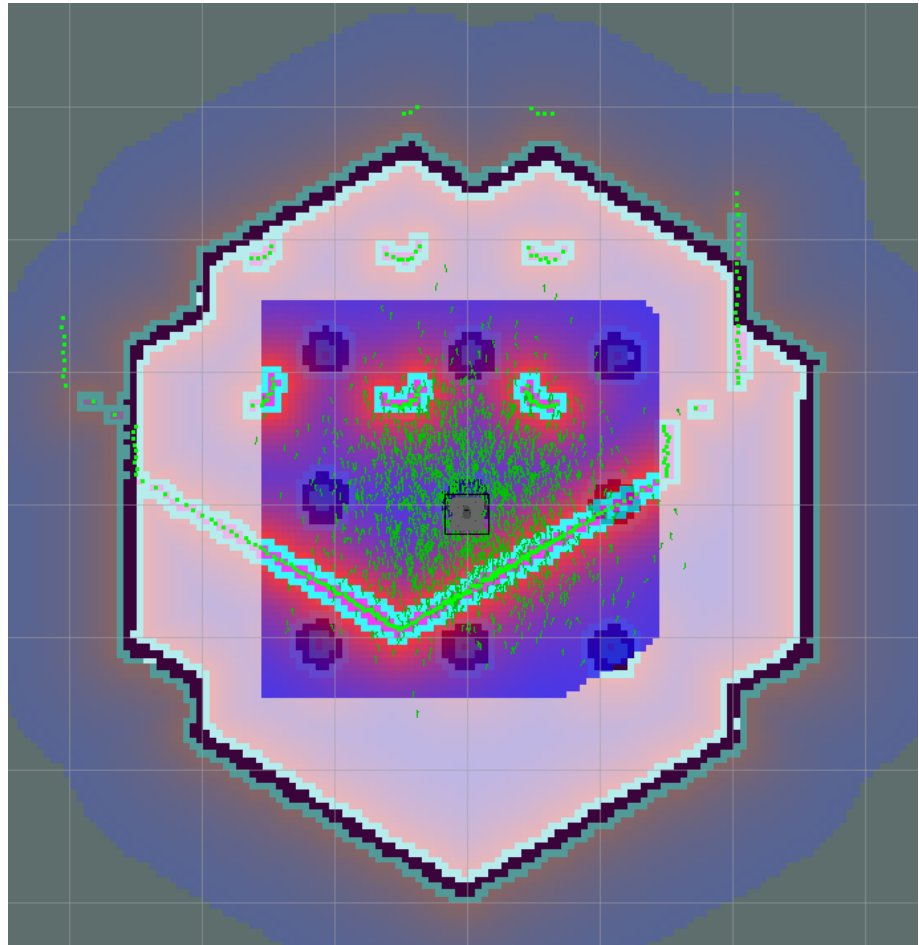
# ros roslibjs – action 01

## Action Interface



- goal - client端傳送給server端要執行的任務
- cancel - 若任務進行時間過長，可以傳送取消該任務的指令(由client端發送)
- status - server端發給client關於此server的狀態(pending, active, recalling等)
- feedback - server定期發給client任務的進行狀況
- result - server發給client端任務完成的結果

# ros roslibjs – action 02



```
roslaunch turtlebot3_gazebo turtlebot3_world.launch  
roslaunch turtlebot3_navigation turtlebot3_navigation.launch  
roslaunch rosbridge_server rosbridge_websocket.launch
```

# ros roslibjs – action 03

rostopic list

rostopic pub /move\_base/goal



position: x: -2.0 y: 0.5 z: 0.0 orientation: x: 0.0 y: 0.0 z: 0.0 w: 1.0 “

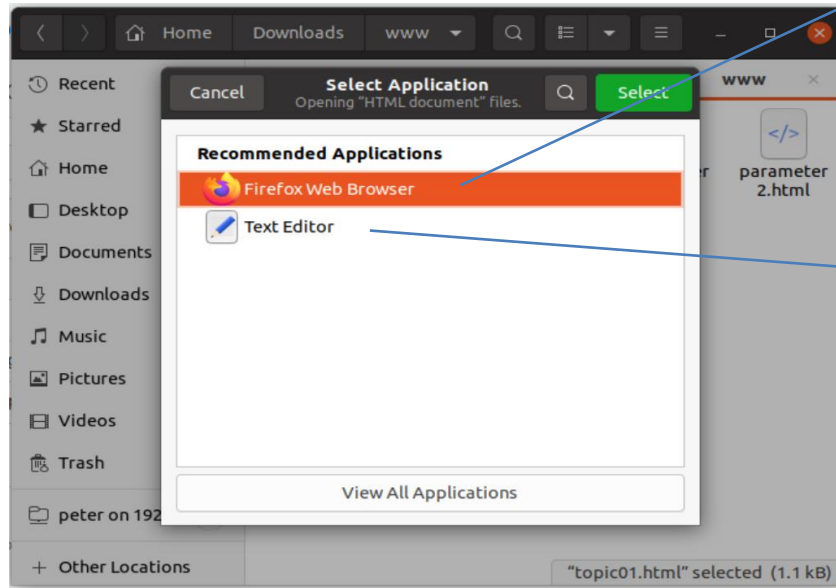
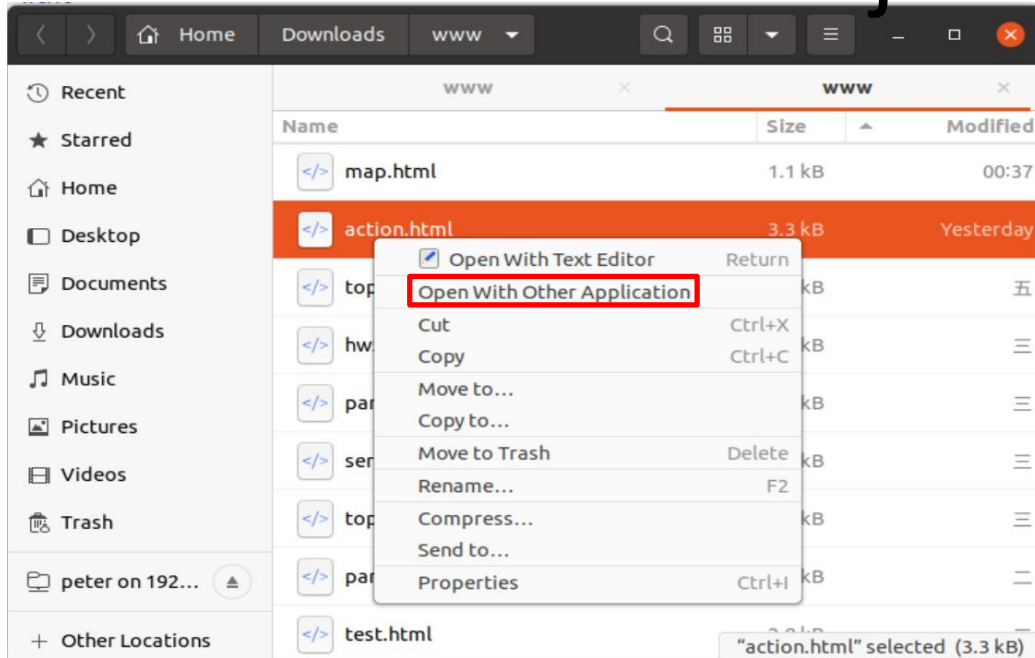


```
user@user-virtual-machine: ~  
/home/user/... x /opt/ros/noe... x user@user-vi... x user@u...  
user@user-virtual-machine:~$ rostopic pub /move_base/goal move_base  
eActionGoal "header:  
  seq: 0  
  stamp:  
    secs: 0  
    nsecs: 0  
  frame_id: ''  
goal_id:  
  stamp:  
    secs: 0  
    nsecs: 0  
  id: ''  
goal:  
  target_pose:  
    header:  
      seq: 0  
      stamp:  
        secs: 0  
        nsecs: 0  
      frame_id: 'map'  
    pose:  
      position:  
        x: -2.0  
        y: -1.0  
        z: 0.0  
      orientation:  
        x: 0.0  
        y: 0.0  
        z: 0.0  
        w: 1.0"  
publishing and latching message. Press ctrl-C to terminate  
^C
```

rostopic echo /move\_base/feedback 過程會回報

rostopic echo /move\_base/result 結束才會回報

# ros roslibjs – action 04



用瀏覽器執行網頁

編輯網頁內容

# ros roslibjs – action 05

```
function actionMoveBase(tarX,tarY){
  var actionClient = new ROSLIB.ActionClient({
    ros : ros,
    serverName : '/move_base',
    actionName : 'move_base_msgs/MoveBaseAction'
  });
  var positionVec3 = new ROSLIB.Vector3(null);
  var orientation = new ROSLIB.Quaternion({x:0, y:0, z:0, w:1.0});
  positionVec3.x = tarX;
  positionVec3.y = tarY;
  var pose = new ROSLIB.Pose({
    position : positionVec3,
    orientation : orientation
  });
  var goal = new ROSLIB.Goal({
    actionClient : actionClient,
    goalMessage : {
      target_pose : {
        header : {
          frame_id : 'map'
        },
        pose : pose
      }
    }
  });
  goal.on('feedback', function(feedback) {
    console.log('Feedback:' + feedback.base_position.pose.position.x + ','
      + feedback.base_position.pose.position.y);
    document.getElementById("id_movebase_feedback").innerHTML =
      'Feedback: ' + feedback.base_position.pose.position.x.toFixed(2)
      + ',' + feedback.base_position.pose.position.y.toFixed(2);
  });
  goal.send();
}
```

輸出印在網頁上，  
.toFixed(2)小數點  
後顯示位數

# ros roslibjs – action 06

```
var move_baseListener = new ROSLIB.Topic({
  ros : ros,
  name : '/move_base/result',
  messageType : 'move_base_msgs/MoveBaseActionResult'
});
move_baseListener.subscribe(function(actionResult) {
  console.log('Received message on ' + move_baseListener.name +
'status: '
          + actionResult.status.status);
  alert("in callback of /move_base/result");
  // actionResult.status.status == 2 (goal cancelled)
  // actionResult.status.status == 3 (goal reached)
});
function sendGoal() {
  var item_f01 = document.getElementById('item_f01').value;
  //var fResults01 = parseInt(item_f01, 10);
  var fResults01 = parseFloat(item_f01);
  var item_f02 = document.getElementById('item_f02').value;
  var fResults02 = parseFloat(item_f02);
  console.log('Total: '+(fResults01+fResults02))
  actionMoveBase(fResults01,fResults02);
}
</script>
</head>
```

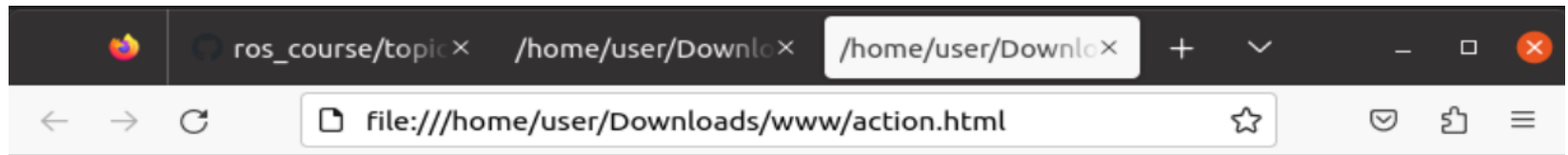
topic訂閱 result

int整數轉換 與 float浮點數轉換

輸出印在網頁上

```
<body>
<h1>Movebase ActionClient Example</h1>
<p>Check the Web Console for output</p>
<input type="submit"
  value="Send Goal X Y"
  onclick="sendGoal()" />
<input type="text" name="enter" class="enter" value="-2"
id="item_f01"
  style="font-size : 20px; height: 30px; width:50px;"/>
<input type="text" name="enter" class="enter" value="0.5"
id="item_f02"
  style="font-size : 20px; height: 30px; width:50px;"/>
<p id="id_movebase_feedback"></p>
</body>
</html>
```

# ros roslibjs – action 07

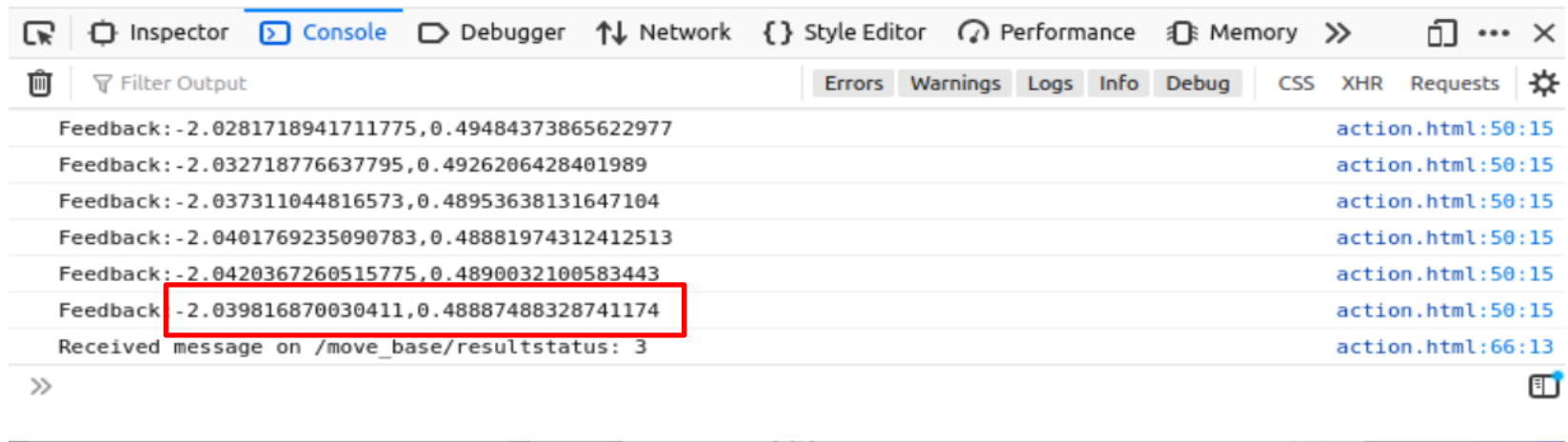


## Movebase ActionClient Example

Check the Web Console for output

Send Goal X Y

Feedback: -2.04,0.49





map

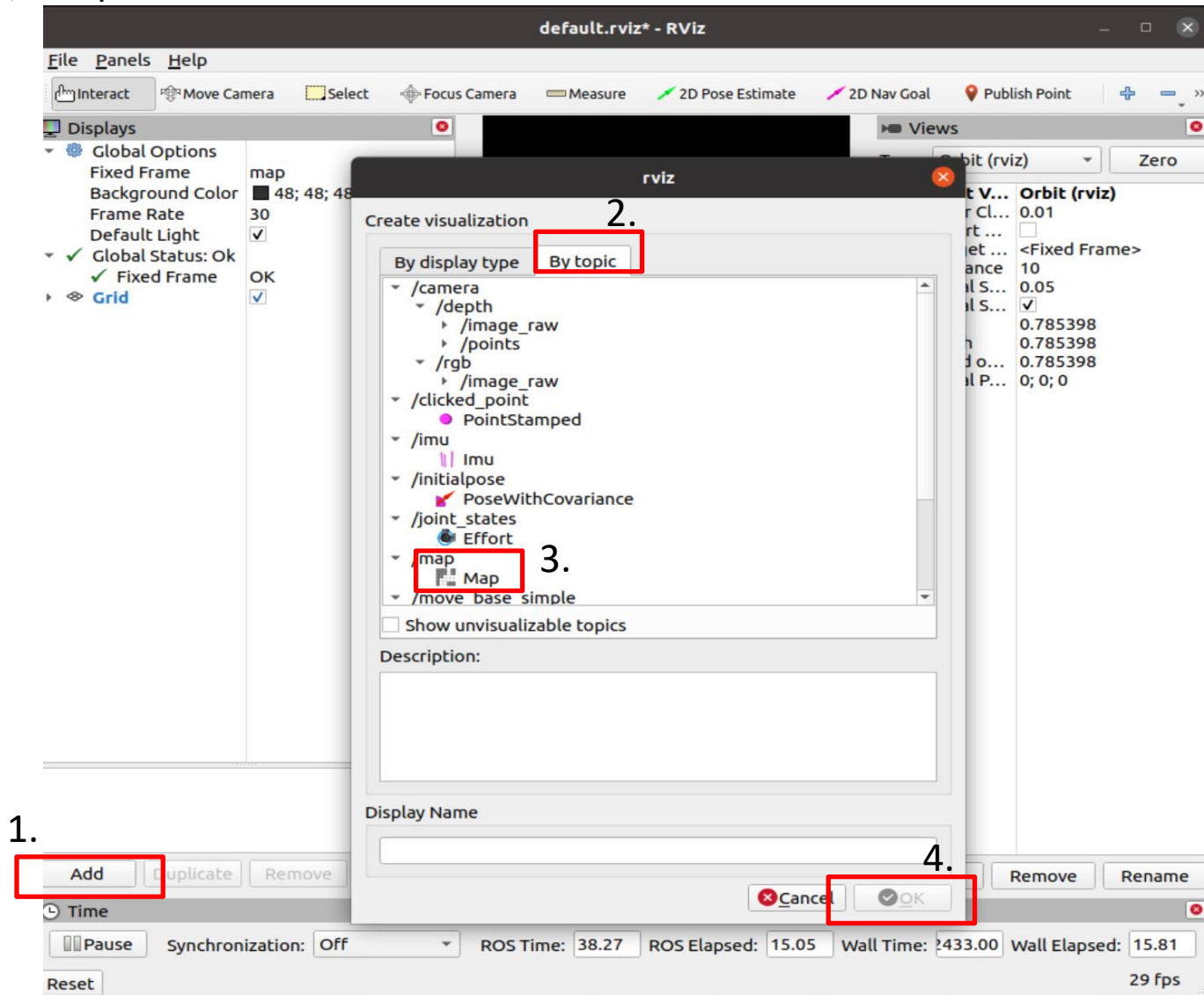
**ROS ROSLIBJS**

# ros roslibjs – map 01

```
roslaunch turtlebot3_gazebo turtlebot3_world.launch  
roslaunch turtlebot3_slam turtlebot3_gmapping.launch  
roslaunch robot_state_publisher robot_state_publisher  
roslaunch teleop_twist_keyboard teleop_twist_keyboard.py  
Rviz  
roslaunch rosbridge_server rosbridge_websocket.launch
```

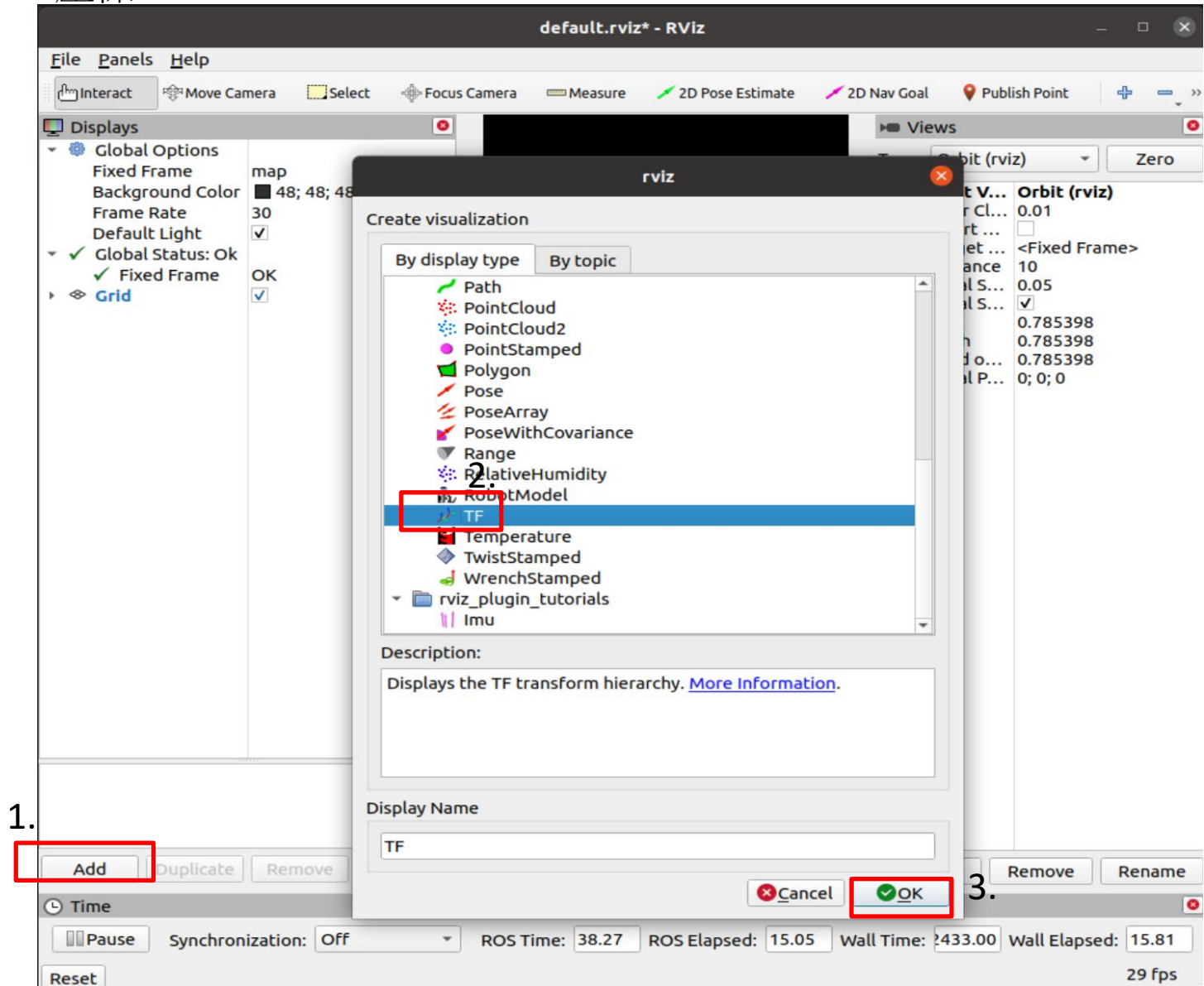
# ros roslibjs – map 02

rviz 增加顯示 map

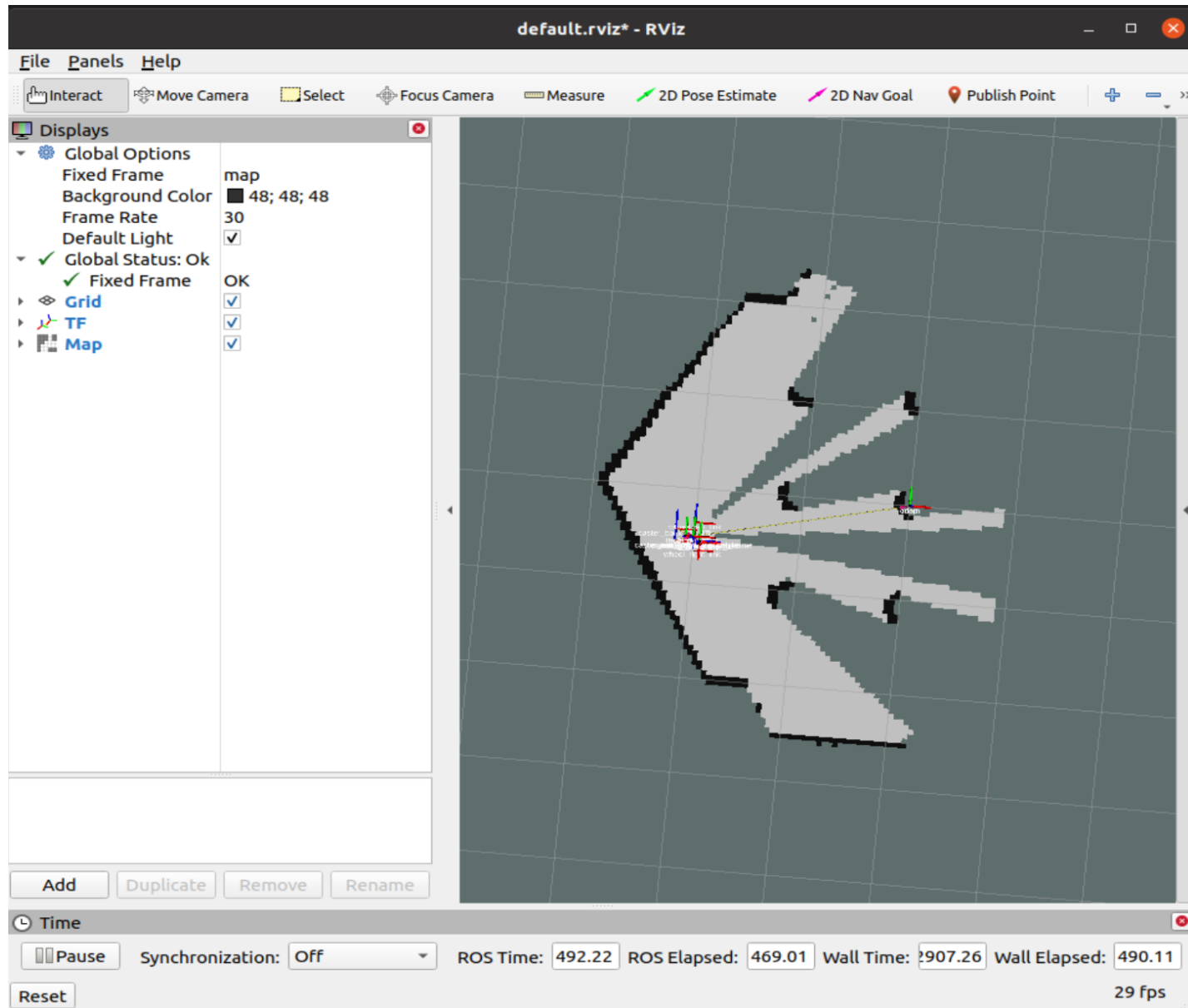


# ros roslibjs – map 03

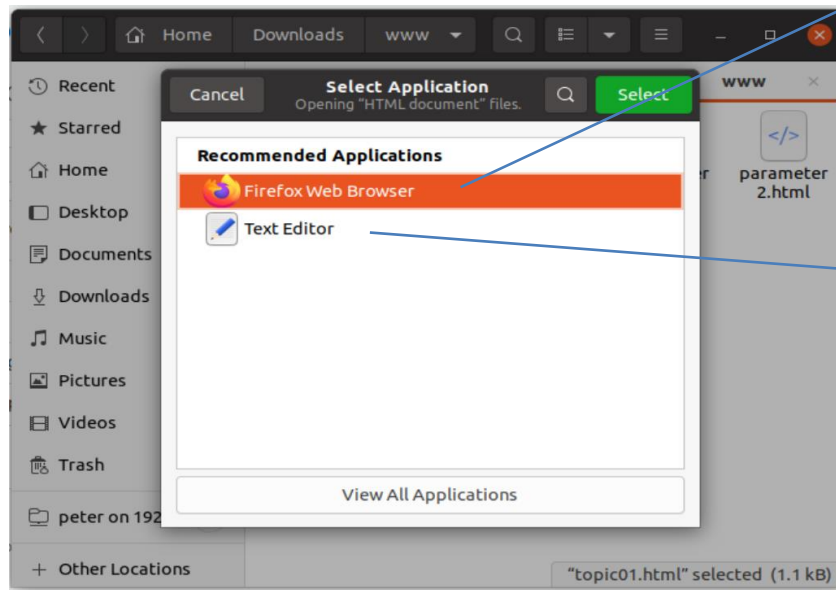
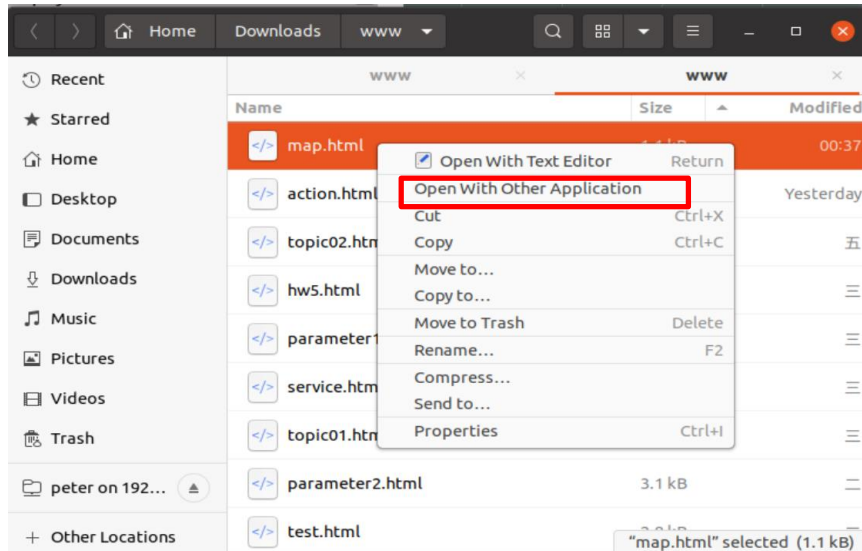
rviz 增加顯示 tf 座標



# ros roslibjs – map 04



# ros roslibjs – map 05



用瀏覽器執行網頁

編輯網頁內容

# ros roslibjs – map 06

```
1 <!DOCTYPE html>
2 <html>
3 <head>
4 <meta charset="utf-8" />
5 <script type="text/javascript" src="basic/easeljs.js"></script>
6 <script type="text/javascript" src="basic/eventemitter2.js"></script>
7 <script type="text/javascript" src="basic/roslib.js"></script>
8 <script type="text/javascript" src="basic/ros2d.js"></script>
9 <script>
10   function init() {
11     var ros = new ROSLIB.Ros({
12       url : 'ws://localhost:9090'
13     });
14     // Create the main viewer.
15     var viewer = new ROS2D.Viewer({
16       divID : 'map',
17       width : 640,
18       height : 480
19     });
20
21     // Setup the map client.
22     var gridClient = new ROS2D.OccupancyGridClient({
23       ros : ros,
24       rootObject : viewer.scene,
25       //continuous: true
26     });
27
28     // Scale the canvas to fit to the map
29     gridClient.on('change', function() {
30       viewer.scaleToDimensions(gridClient.currentGrid.width, gridClient.currentGrid.height);
31       viewer.shift(gridClient.currentGrid.pose.position.x, gridClient.currentGrid.pose.position.y);
32     });
33   }
34 </script>
35 </head>
36
37 <body onload="init()">
38   <h1>Simple Map Example</h1>
39   <p>Turtle Robot</p>
40   <div id="map"></div>
41 </body>
42 </html>
```

持續隨著地圖更新，於網頁上重畫

Apache 網頁伺服器

**ROS ROSLIBJS**



# apache - 離線安裝

下載並解壓縮  
apache2.zip

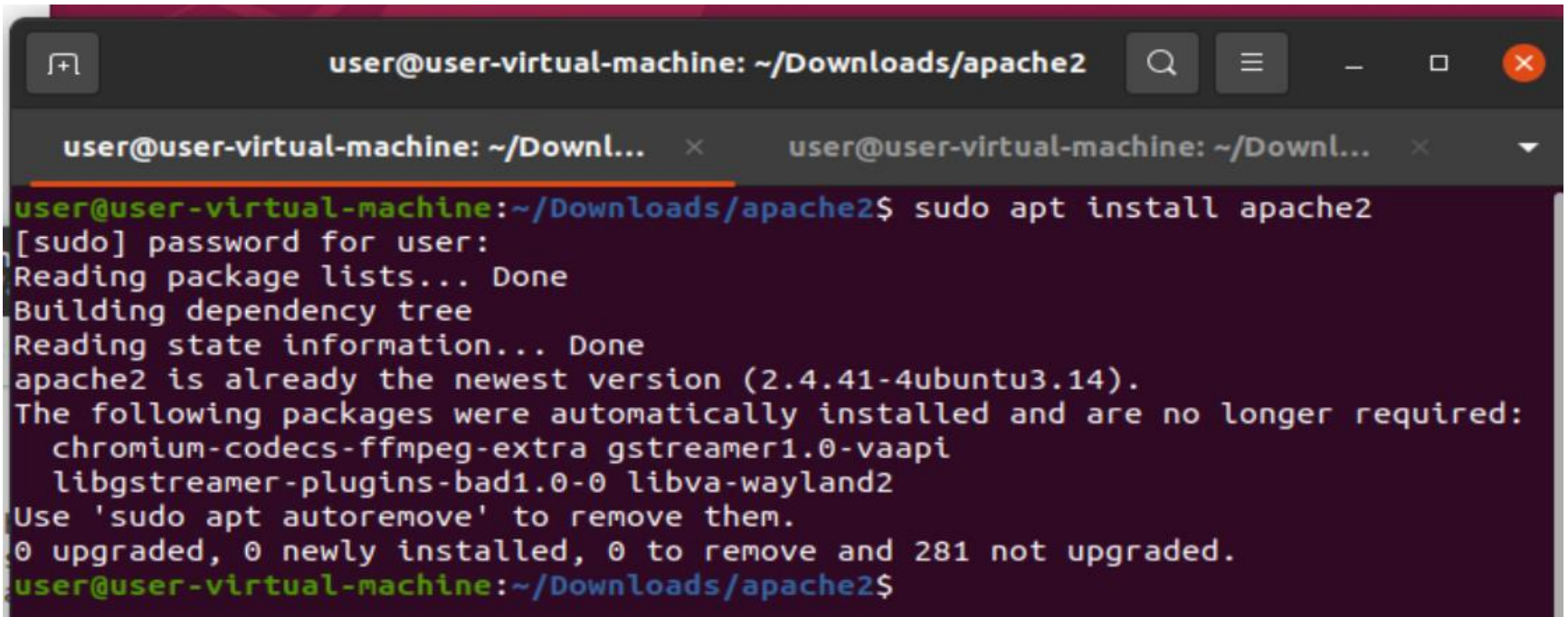
cd ~/Downloads/  
cd apache2/  
./apache2\_install.sh

```
user@user-virtual-machine: ~/Downloads/apache2
user@user-virtual-machine: ~/Downloads/apache2$ ls
apache2_2.4.41-4ubuntu3.14_amd64.deb
apache2-bin_2.4.41-4ubuntu3.14_amd64.deb
apache2-data_2.4.41-4ubuntu3.14_all.deb
apache2_install.sh
apache2-utils_2.4.41-4ubuntu3.14_amd64.deb
libaprutil1-dbd-mysql_1.6.1-4ubuntu2.1_amd64.deb
libaprutil1-dbd-odbc_1.6.1-4ubuntu2.1_amd64.deb
libaprutil1-dbd-pgsql_1.6.1-4ubuntu2.1_amd64.deb
libaprutil1-dbd-sqlite3_1.6.1-4ubuntu2.1_amd64.deb
libaprutil1-ldap_1.6.1-4ubuntu2.1_amd64.deb
liblua5.2-0_5.2.4-1.1build3_amd64.deb
user@user-virtual-machine: ~/Downloads/apache2$ sudo ./apache2_install.sh
[sudo] password for user:
Selecting previously unselected package apache2-utils.
(Reading database ... 279507 files and directories currently installed.)
Preparing to unpack apache2-utils_2.4.41-4ubuntu3.14_amd64.deb ...
Unpacking apache2-utils (2.4.41-4ubuntu3.14) ...
Setting up apache2-utils (2.4.41-4ubuntu3.14) ...
Processing triggers for man-db (2.9.1-1) ...
Selecting previously unselected package apache2-data.
(Reading database ... 279534 files and directories currently installed.)
Preparing to unpack apache2-data_2.4.41-4ubuntu3.14_all.deb ...
Unpacking apache2-data (2.4.41-4ubuntu3.14) ...
Setting up apache2-data (2.4.41-4ubuntu3.14) ...
Selecting previously unselected package libaprutil1-dbd-sqlite3:amd64.
(Reading database ... 279825 files and directories currently installed.)
Preparing to unpack libaprutil1-dbd-sqlite3_1.6.1-4ubuntu2.1_amd64.deb ...
Unpacking libaprutil1-dbd-sqlite3:amd64 (1.6.1-4ubuntu2.1) ...
Setting up libaprutil1-dbd-sqlite3:amd64 (1.6.1-4ubuntu2.1) ...
```

# apache -網路安裝

在有網路的環境下 用以下指令安裝

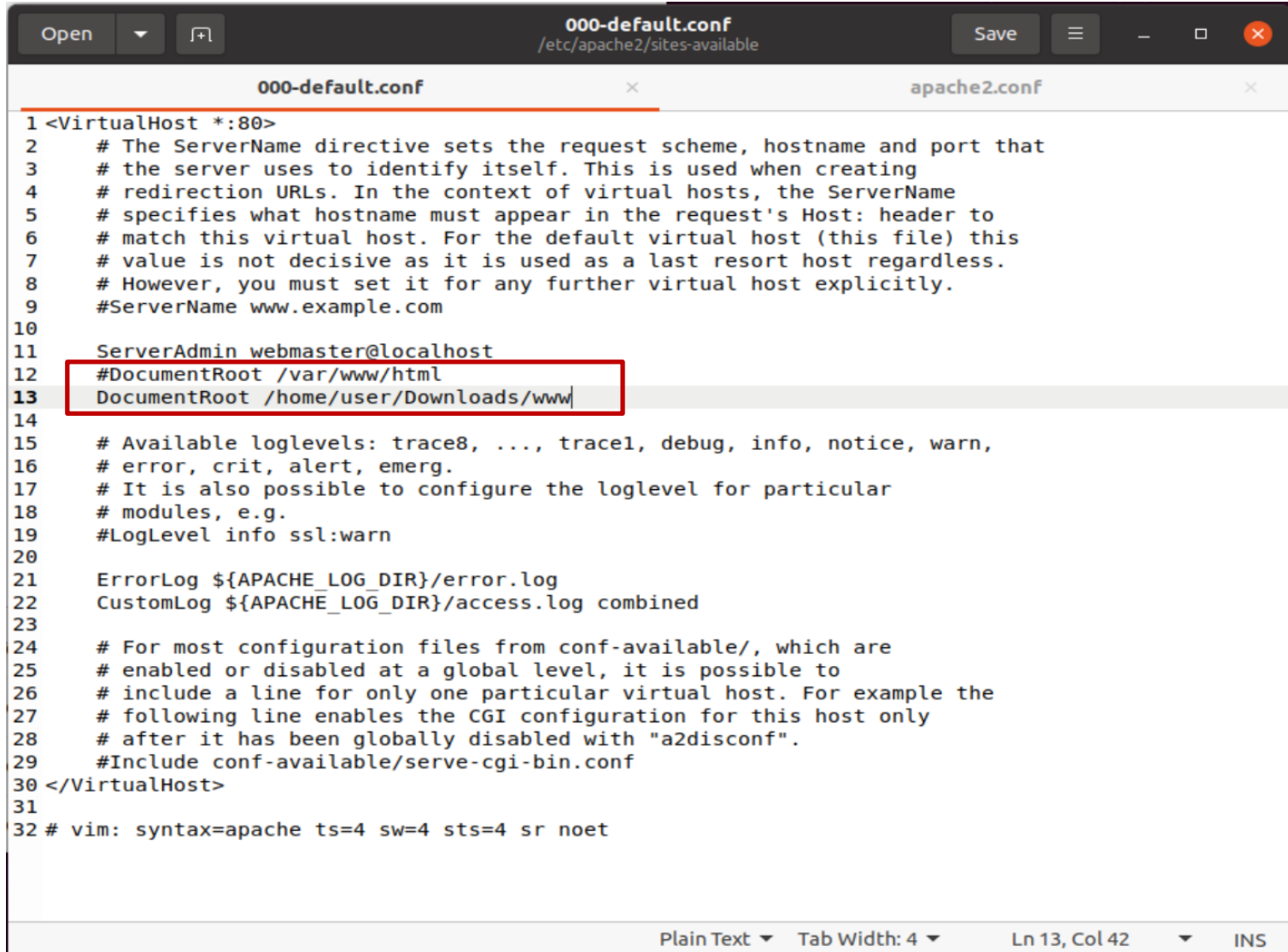
```
sudo apt install apache2
```



```
user@user-virtual-machine: ~/Downloads/apache2
user@user-virtual-machine: ~/Downl... x user@user-virtual-machine: ~/Downl... x
user@user-virtual-machine:~/Downloads/apache2$ sudo apt install apache2
[sudo] password for user:
Reading package lists... Done
Building dependency tree
Reading state information... Done
apache2 is already the newest version (2.4.41-4ubuntu3.14).
The following packages were automatically installed and are no longer required:
 chromium-codecs-ffmpeg-extra gstreamer1.0-vaapi
 libgstreamer-plugins-bad1.0-0 libva-wayland2
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 281 not upgraded.
user@user-virtual-machine:~/Downloads/apache2$
```

# apache - 設定

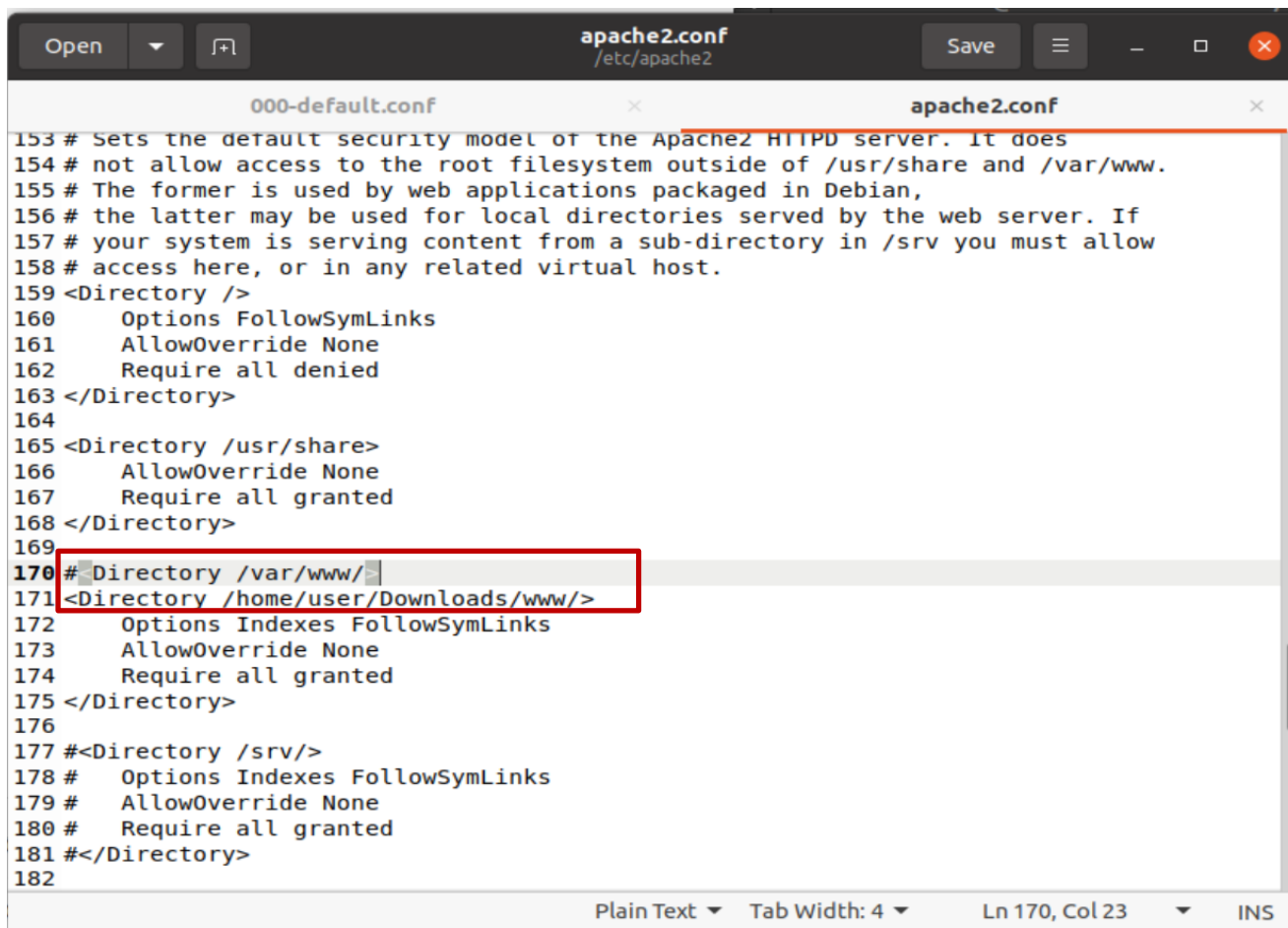
sudo gedit /etc/apache2/sites-available/000-default.conf &



```
1 <VirtualHost *:80>
2     # The ServerName directive sets the request scheme, hostname and port that
3     # the server uses to identify itself. This is used when creating
4     # redirection URLs. In the context of virtual hosts, the ServerName
5     # specifies what hostname must appear in the request's Host: header to
6     # match this virtual host. For the default virtual host (this file) this
7     # value is not decisive as it is used as a last resort host regardless.
8     # However, you must set it for any further virtual host explicitly.
9     #ServerName www.example.com
10
11     ServerAdmin webmaster@localhost
12     #DocumentRoot /var/www/html
13     DocumentRoot /home/user/Downloads/www|
14
15     # Available loglevels: trace8, ..., trace1, debug, info, notice, warn,
16     # error, crit, alert, emerg.
17     # It is also possible to configure the loglevel for particular
18     # modules, e.g.
19     #LogLevel info ssl:warn
20
21     ErrorLog ${APACHE_LOG_DIR}/error.log
22     CustomLog ${APACHE_LOG_DIR}/access.log combined
23
24     # For most configuration files from conf-available/, which are
25     # enabled or disabled at a global level, it is possible to
26     # include a line for only one particular virtual host. For example the
27     # following line enables the CGI configuration for this host only
28     # after it has been globally disabled with "a2disconf".
29     #Include conf-available/serve-cgi-bin.conf
30 </VirtualHost>
31
32 # vim: syntax=apache ts=4 sw=4 sts=4 sr noet
```

# apache - 設定

`sudo gedit /etc/apache2/apache2.conf &`



```
000-default.conf x apache2.conf x
153 # Sets the default security model of the Apache2 HTTPD server. It does
154 # not allow access to the root filesystem outside of /usr/share and /var/www.
155 # The former is used by web applications packaged in Debian,
156 # the latter may be used for local directories served by the web server. If
157 # your system is serving content from a sub-directory in /srv you must allow
158 # access here, or in any related virtual host.
159 <Directory />
160     Options FollowSymLinks
161     AllowOverride None
162     Require all denied
163 </Directory>
164
165 <Directory /usr/share>
166     AllowOverride None
167     Require all granted
168 </Directory>
169
170 #<Directory /var/www/>
171 <Directory /home/user/Downloads/www/>
172     Options Indexes FollowSymLinks
173     AllowOverride None
174     Require all granted
175 </Directory>
176
177 #<Directory /srv/>
178 #     Options Indexes FollowSymLinks
179 #     AllowOverride None
180 #     Require all granted
181 #</Directory>
182
```

Plain Text ▾ Tab Width: 4 ▾ Ln 170, Col 23 ▾ INS

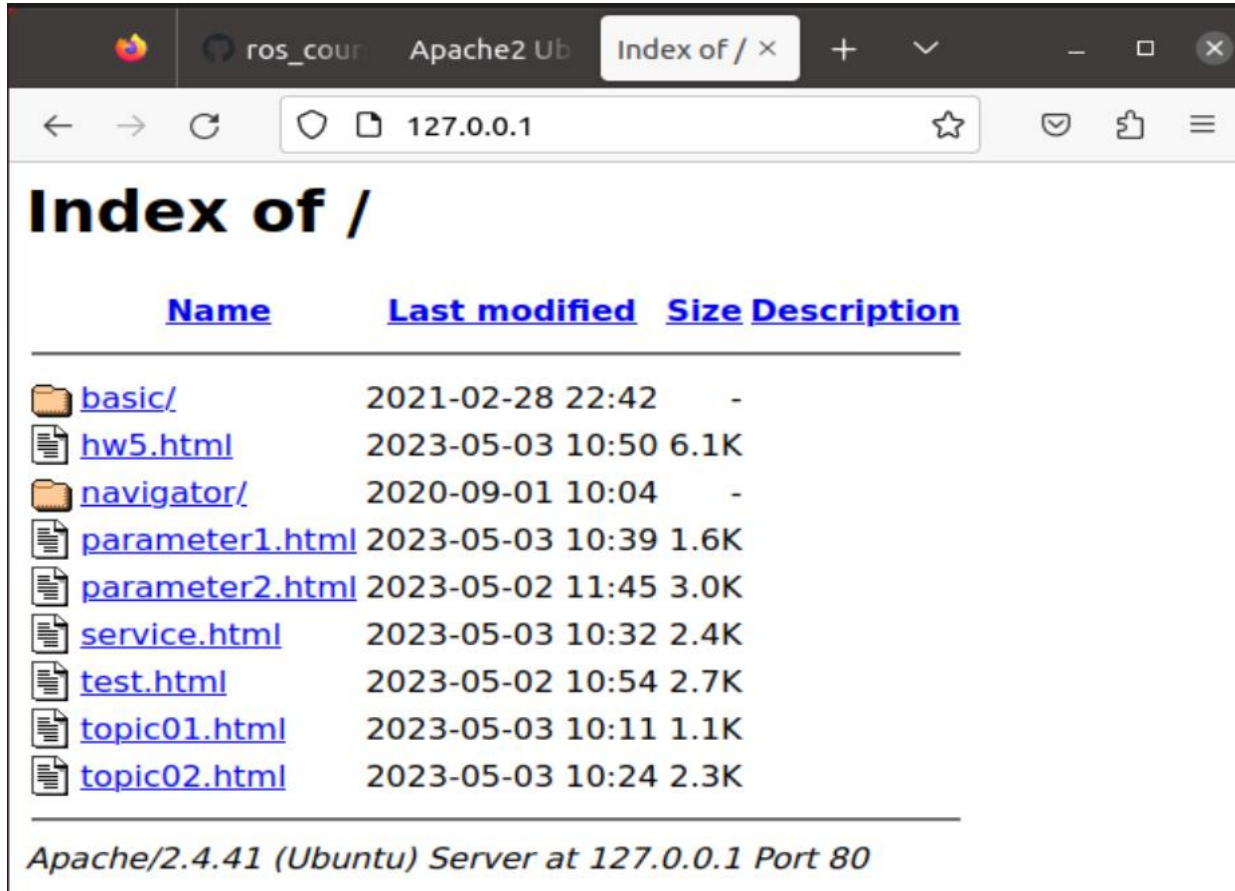
```
user@user-virtual-machine:~/Downloads/www$ sudo service apache2 restart
user@user-virtual-machine:~/Downloads/www$
```










`sudo service apache2 restart` 重啟apache，讀取新設定



# ros roslibjs – apache

127.0.0.1



<u>Name</u>	<u>Last modified</u>	<u>Size</u>	<u>Description</u>
 <a href="#">basic/</a>	2021-02-28 22:42	-	
 <a href="#">hw5.html</a>	2023-05-03 10:50	6.1K	
 <a href="#">navigator/</a>	2020-09-01 10:04	-	
 <a href="#">parameter1.html</a>	2023-05-03 10:39	1.6K	
 <a href="#">parameter2.html</a>	2023-05-02 11:45	3.0K	
 <a href="#">service.html</a>	2023-05-03 10:32	2.4K	
 <a href="#">test.html</a>	2023-05-02 10:54	2.7K	
 <a href="#">topic01.html</a>	2023-05-03 10:11	1.1K	
 <a href="#">topic02.html</a>	2023-05-03 10:24	2.3K	

Apache/2.4.41 (Ubuntu) Server at 127.0.0.1 Port 80

```
user@user-virtual-machine:~/Downloads/www$ ip r
default via 192.168.35.2 dev ens33 proto dhcp metric 100
169.254.0.0/16 dev ens33 scope link metric 1000
192.168.35.0/24 dev ens33 proto kernel scope link src 192.168.35.131 metric 100
```

# 作業6

- 將本週課程與建圖gmapping有關的網頁程式整合，目的為在網頁控制機器人完成地圖建立，並上傳相關檔案
- 參考5/09上課內容，“ROS-Class-10.pdf”
- [https://github.com/Waywrong/ros\\_course/tree/main/ros\\_libjs/www](https://github.com/Waywrong/ros_course/tree/main/ros_libjs/www)
- 計分部分包含
  - 1. 完整性
  - 2. 紀錄實驗過程於word檔，紀錄所下的命令與回應，可多利用截圖(圖文並茂加分)
    - rosnodet list
    - rostopic list
    - rqt\_graph
- 上傳作業包含 (期末前上傳):
- 1. html檔
- 2. 實驗紀錄word檔