無人載具技術與應用
ROS roslibjs II

徐瑋隆

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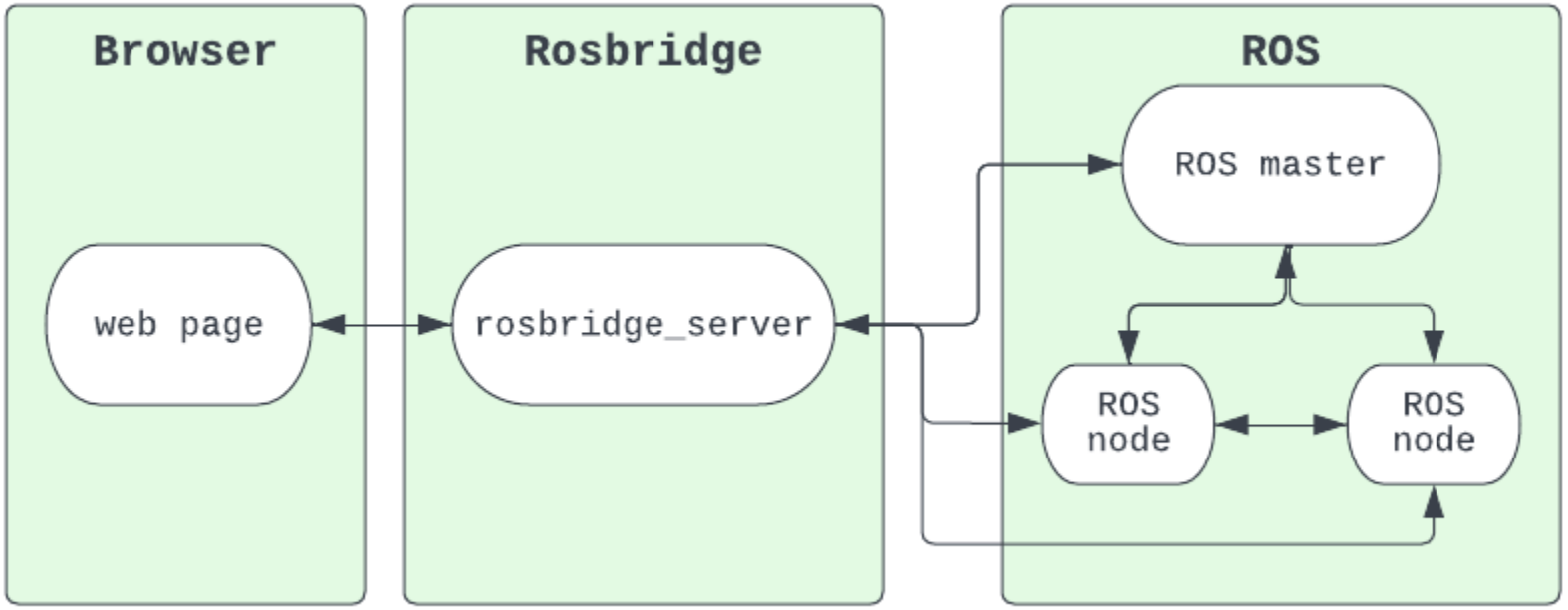
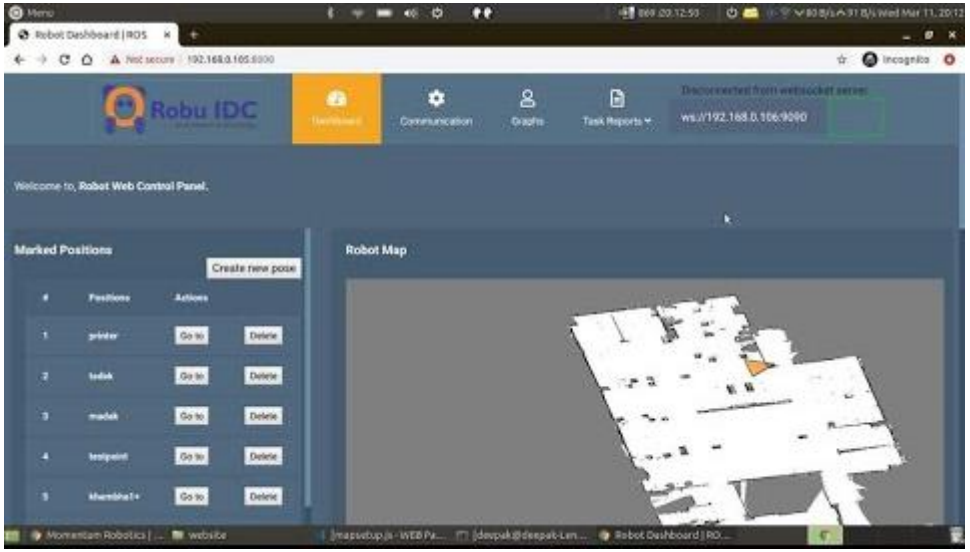
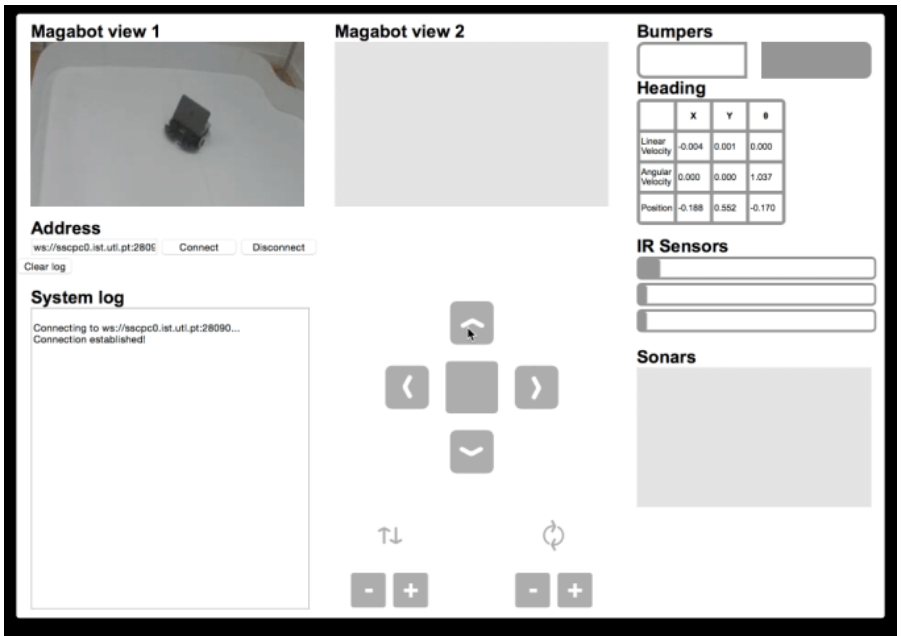
rosbridge


Browser
Rosbridge
ROS
web page
rosbridge_server
ROS master
ROS node
ROS node

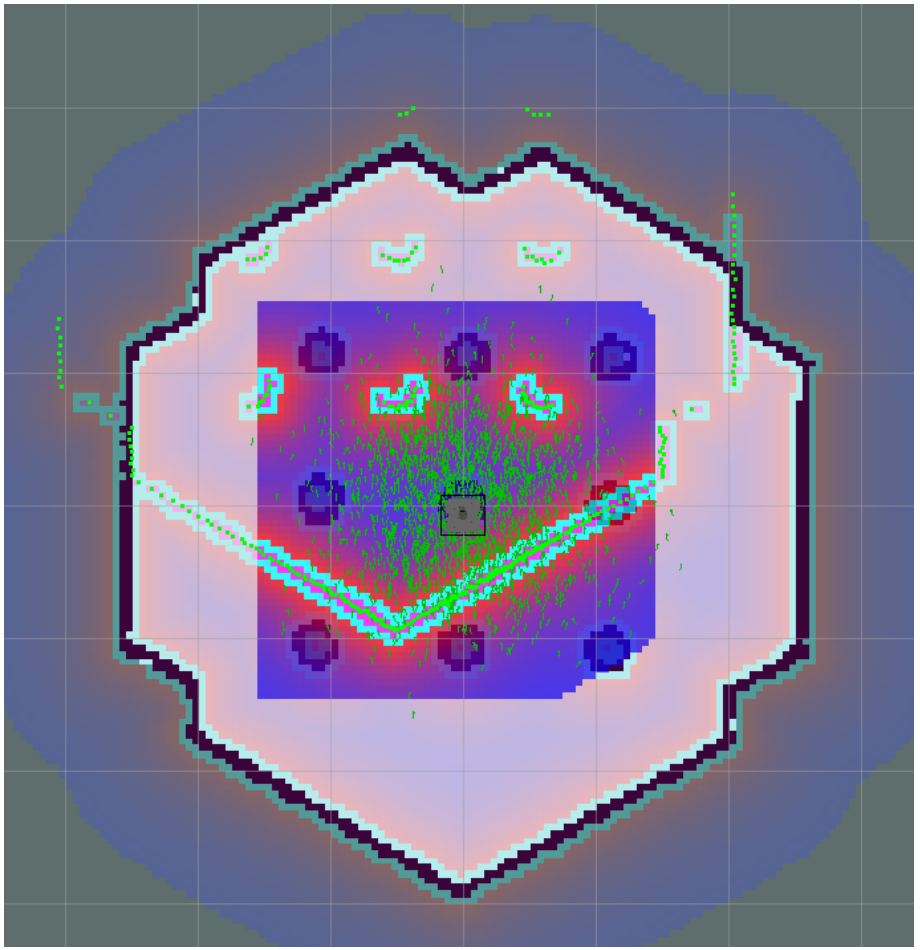

Robu IDC
Communication
Graphs
Task Reports
Welcome to, Robot Web Control Panel.
Marked Positions
Create new pose
Robot Map


Magabot view 1
Magabot view 2
Bumpers
Heading
Address
Connect
Disconnect
Clear log
System log
Connecting to ws://sscpc0.ist.utl.pt:28090...
Connection established!
IR Sensors
Sonars

topic

ROS ROSLIBJS

ros roslibjs – topic 01



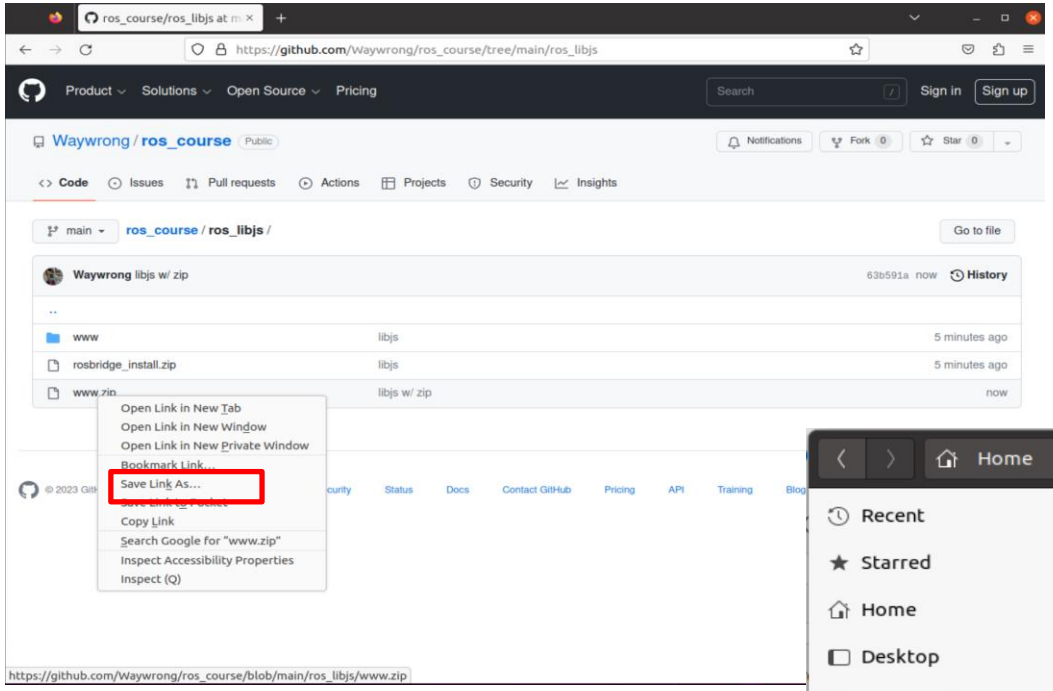
roslaunch turtlebot3_gazebo turtlebot3_world.launch

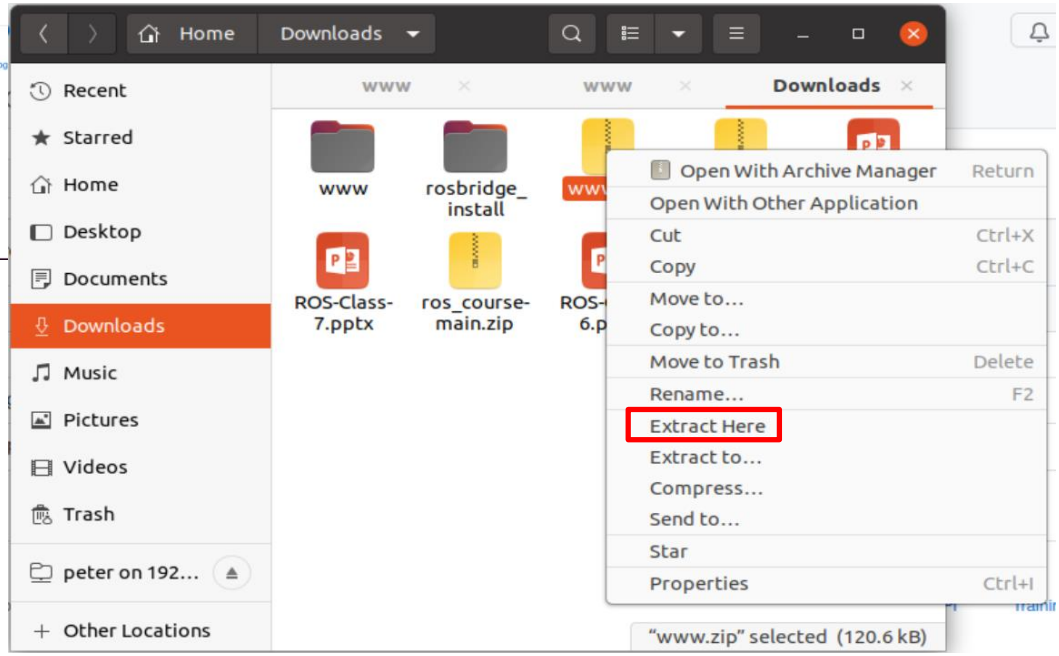
roslaunch turtlebot3_navigation turtlebot3_navigation.launch

roslaunch rosbridge_server rosbridge_websocket.launch

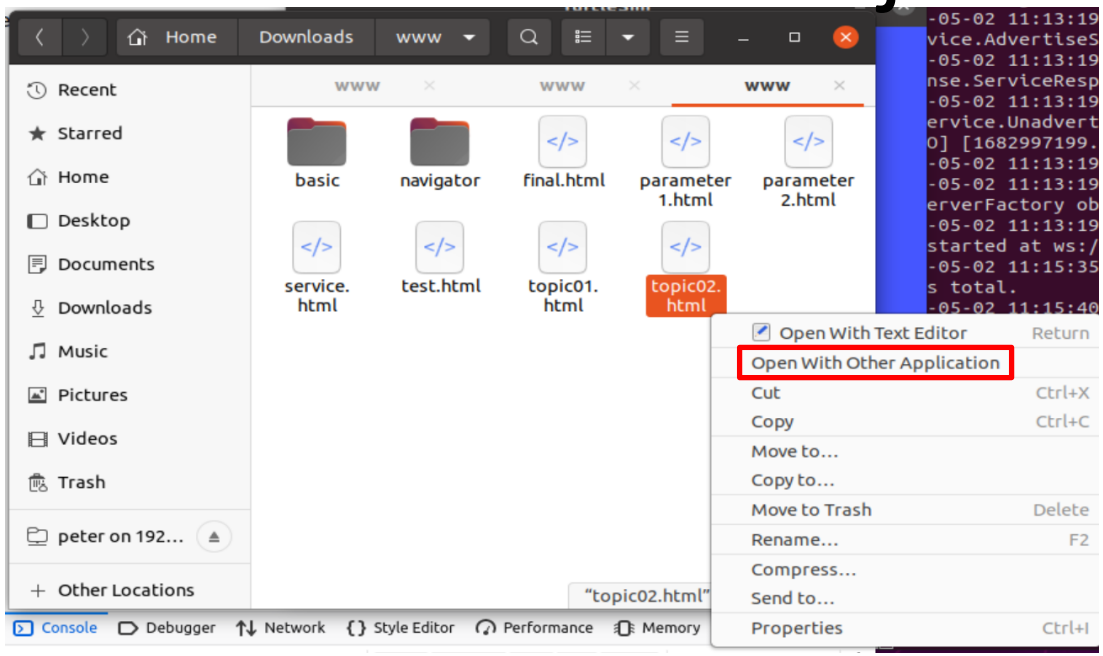
ros roslibjs – topic 02

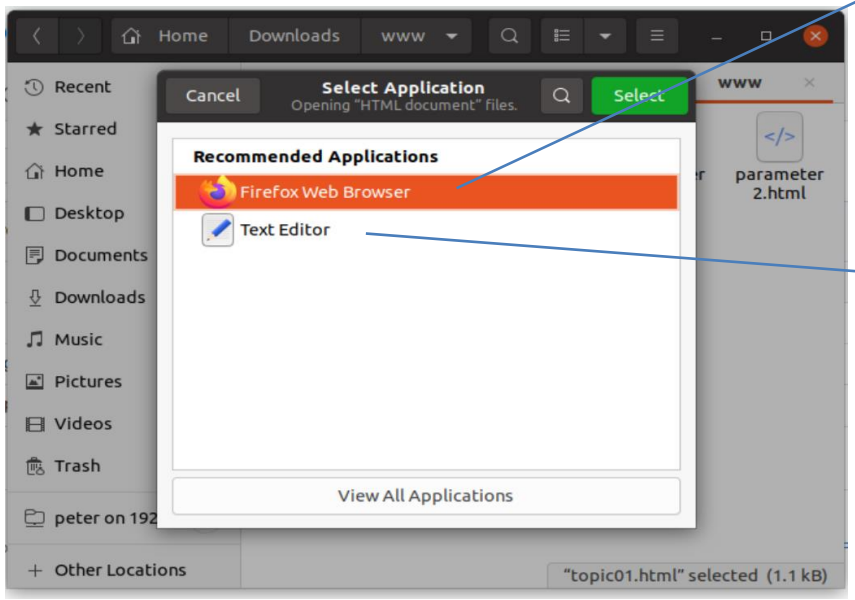
https://github.com/Waywrong/ros_course/tree/main/ros_libjs
下載 www.zip 並解壓縮





ros roslibjs – topic 03





用瀏覽器執行網頁

編輯網頁內容

ros roslibjs – topic 04

https://github.com/Waywrong/ros_course/blc

```
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

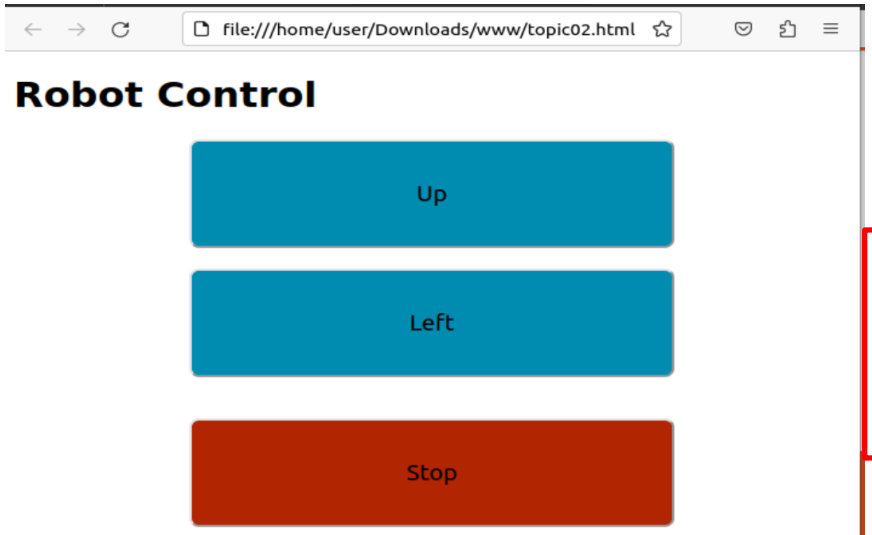
```
function cmd_vel_linear(idx_posminus){
  var cmdVel = new ROSLIB.Topic({
    ros : ros,
    name : '/cmd_vel',
    messageType : 'geometry_msgs/Twist'
  });
  var twist = new ROSLIB.Message({
    linear : {
      x : 0.8*idx_posminus,
      y : 0,
      z : 0,
    },
    angular : {
      x : 0,
      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);
 }
```

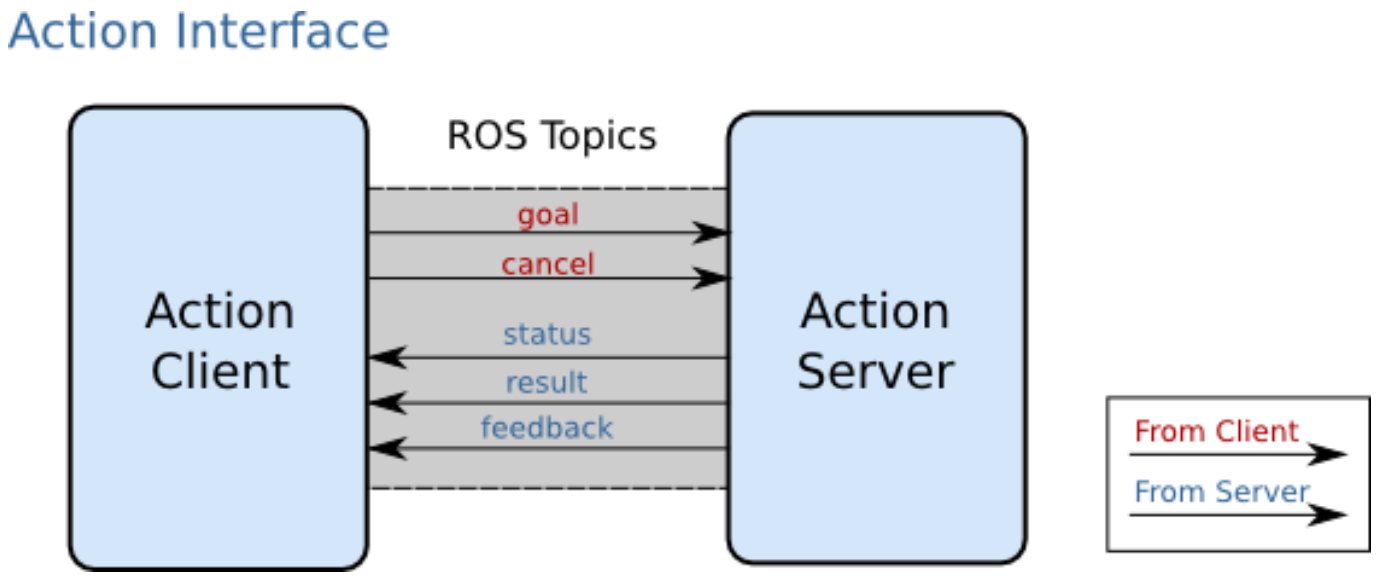



```
<body>
<h1>Robot Control</h1>
<center>
 <input type="submit"
    value="Up"
    onclick="cmd_up()"
    style="font-size : 20px; width: 400px; height: 100px;
background-color: #008CB1; border-radius: 8px;" />
 </br>
 </br>
 <input type="submit"
    value="Left"
    onclick="cmd_left()"
    style="font-size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

action

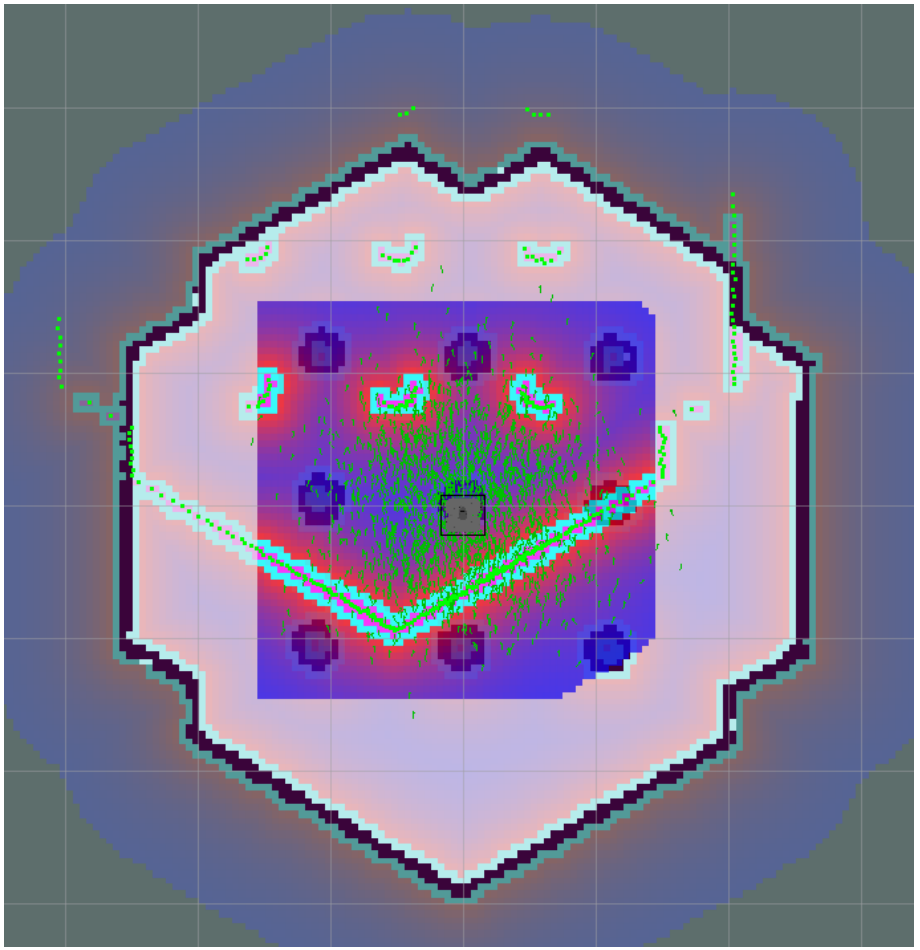
ROS ROSLIBJS

ros roslibjs – action 01



- 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

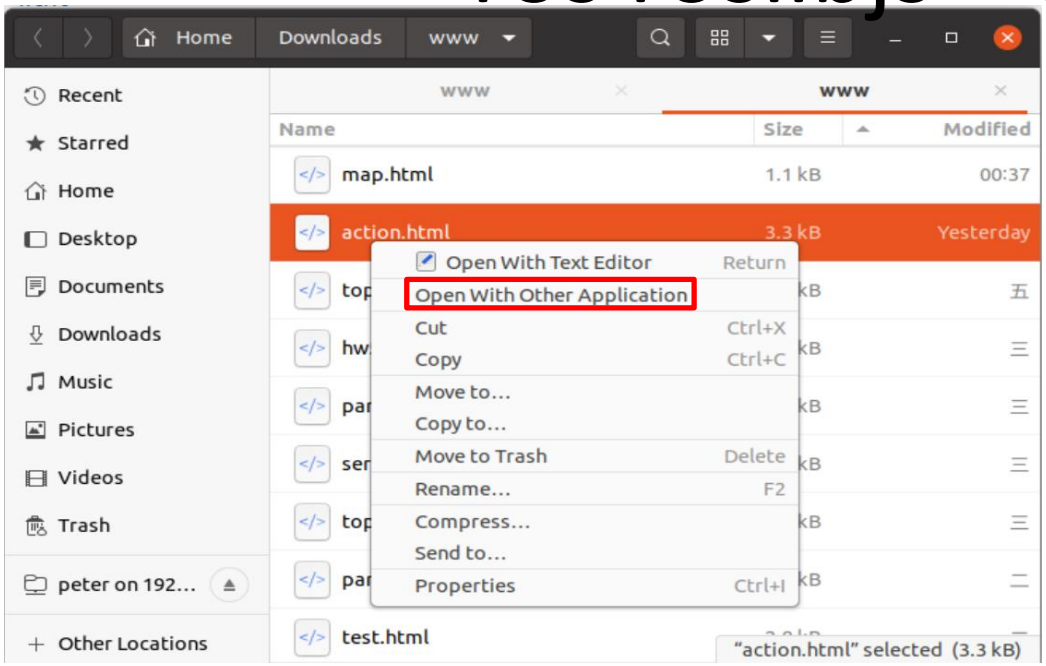
rostopic list

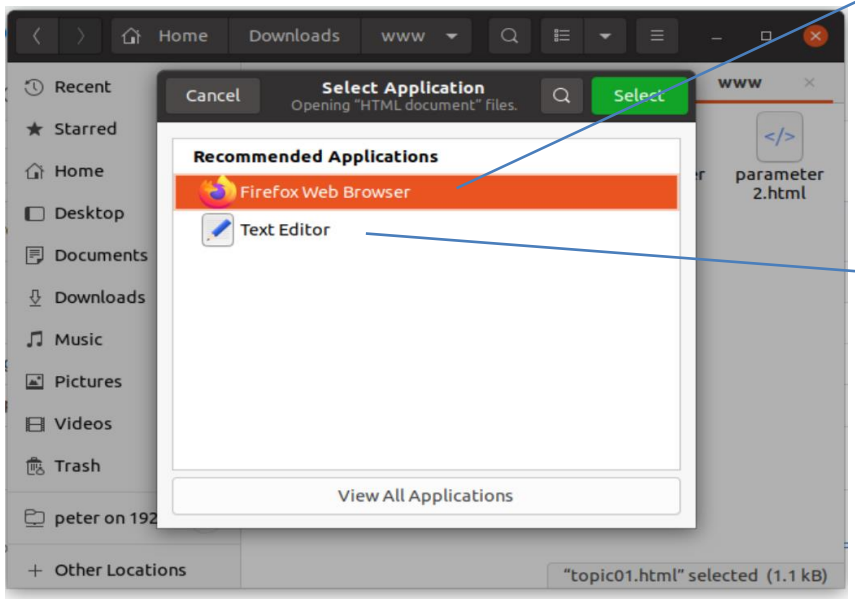
rostopic pub /move_base/goal 

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

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>
```

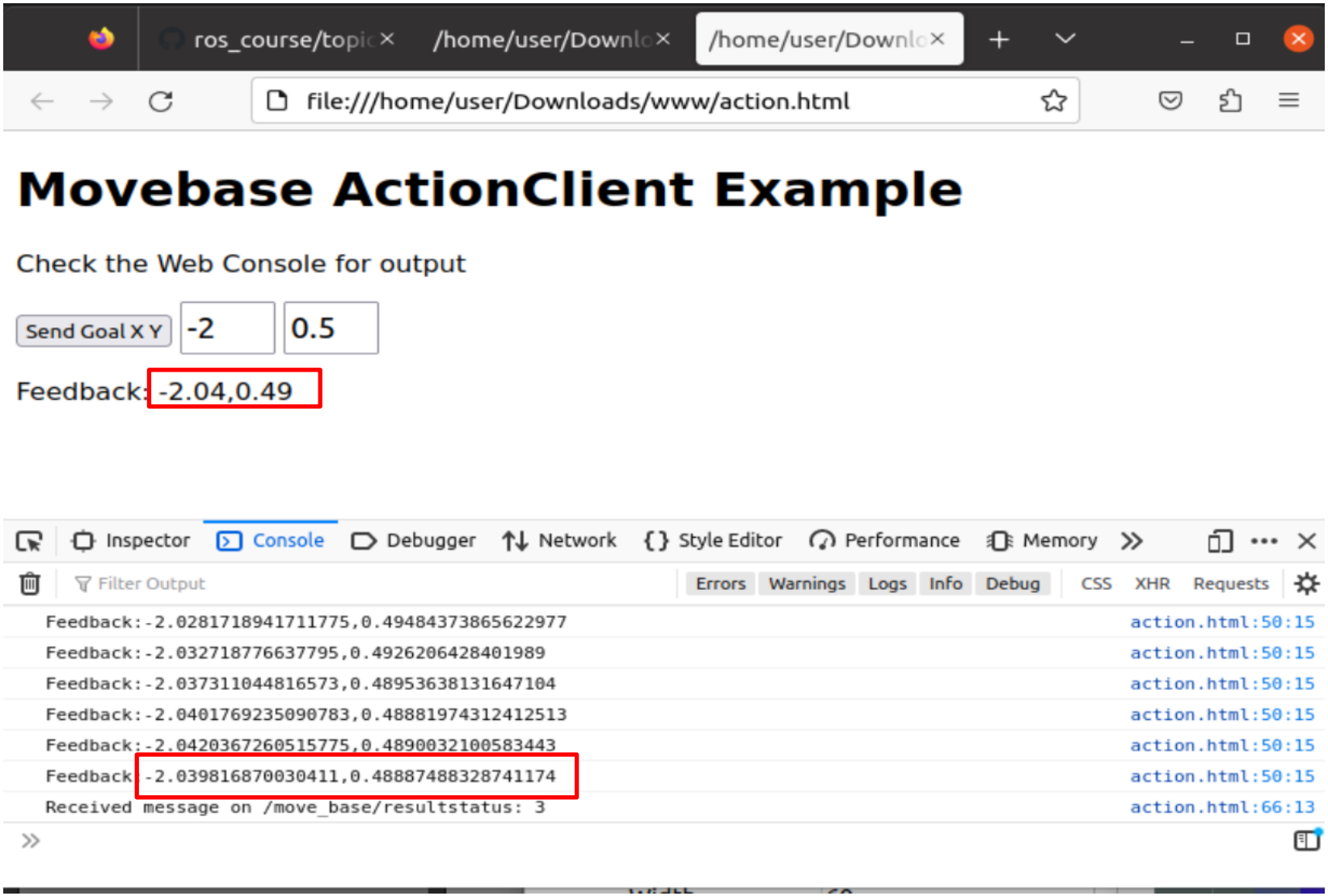
topic訂閱 result

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



map

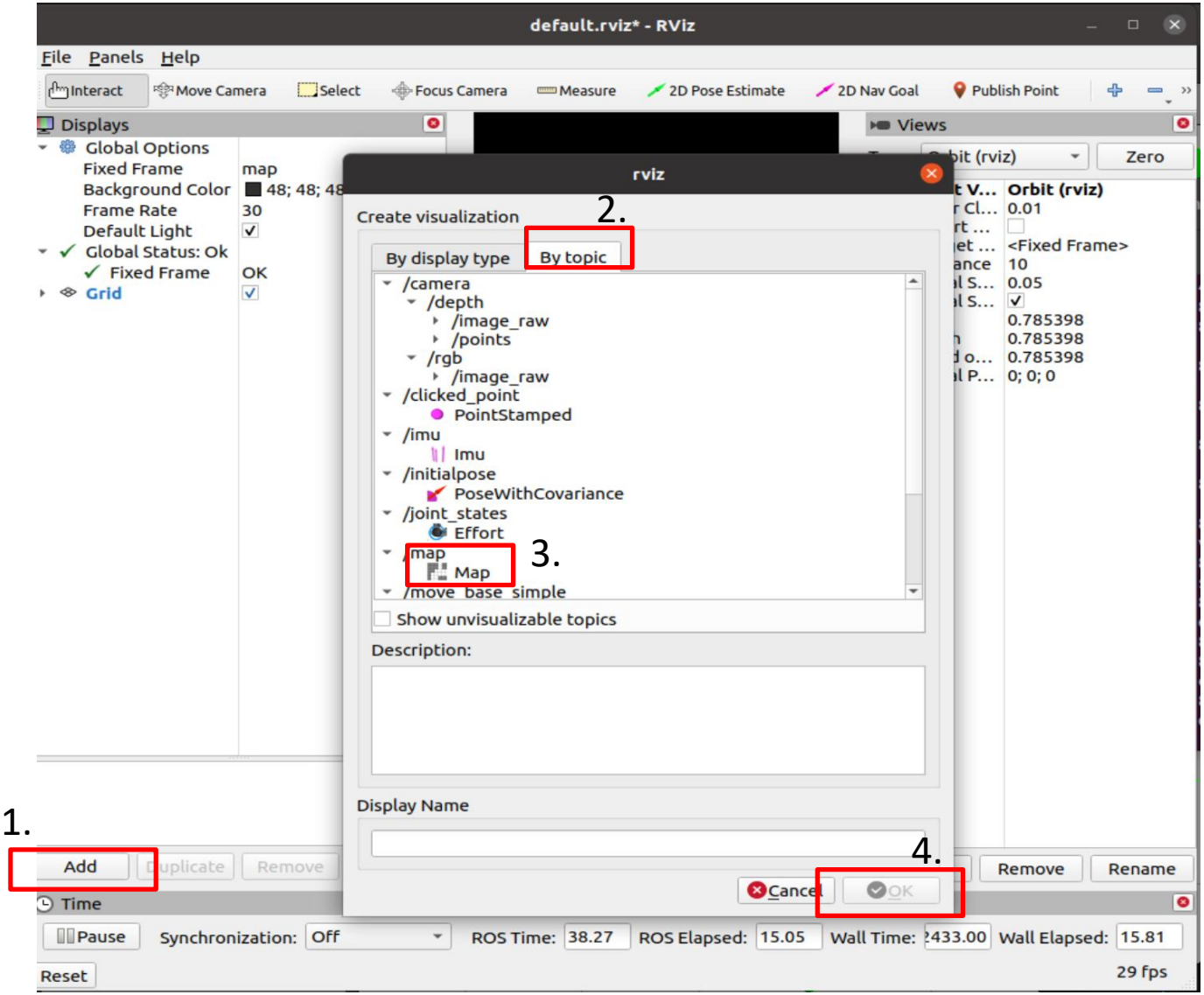
ROS ROSLIBJS

ros roslibjs – map 01

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

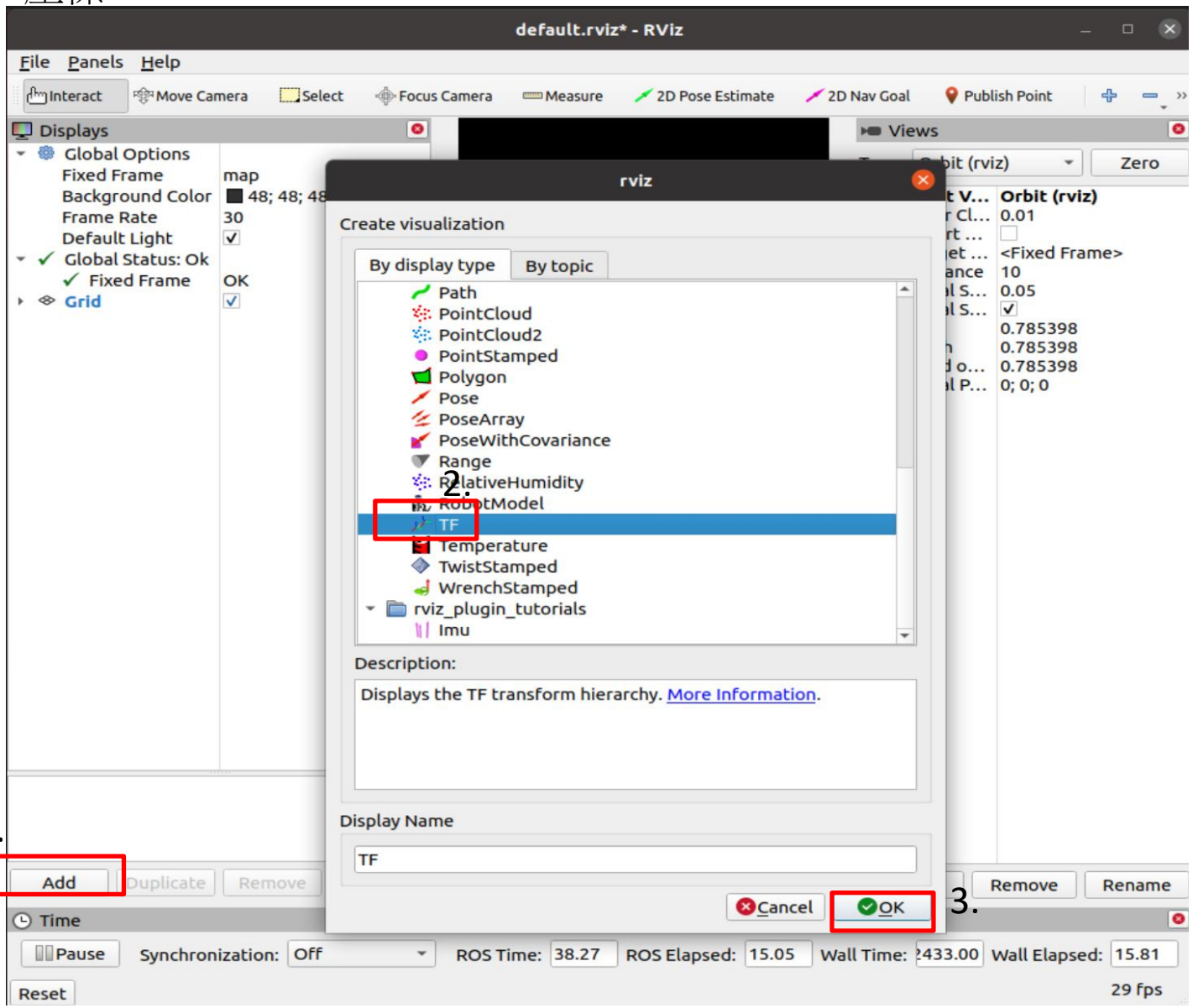
ros roslibjs – map 02

rviz 增加顯示 map

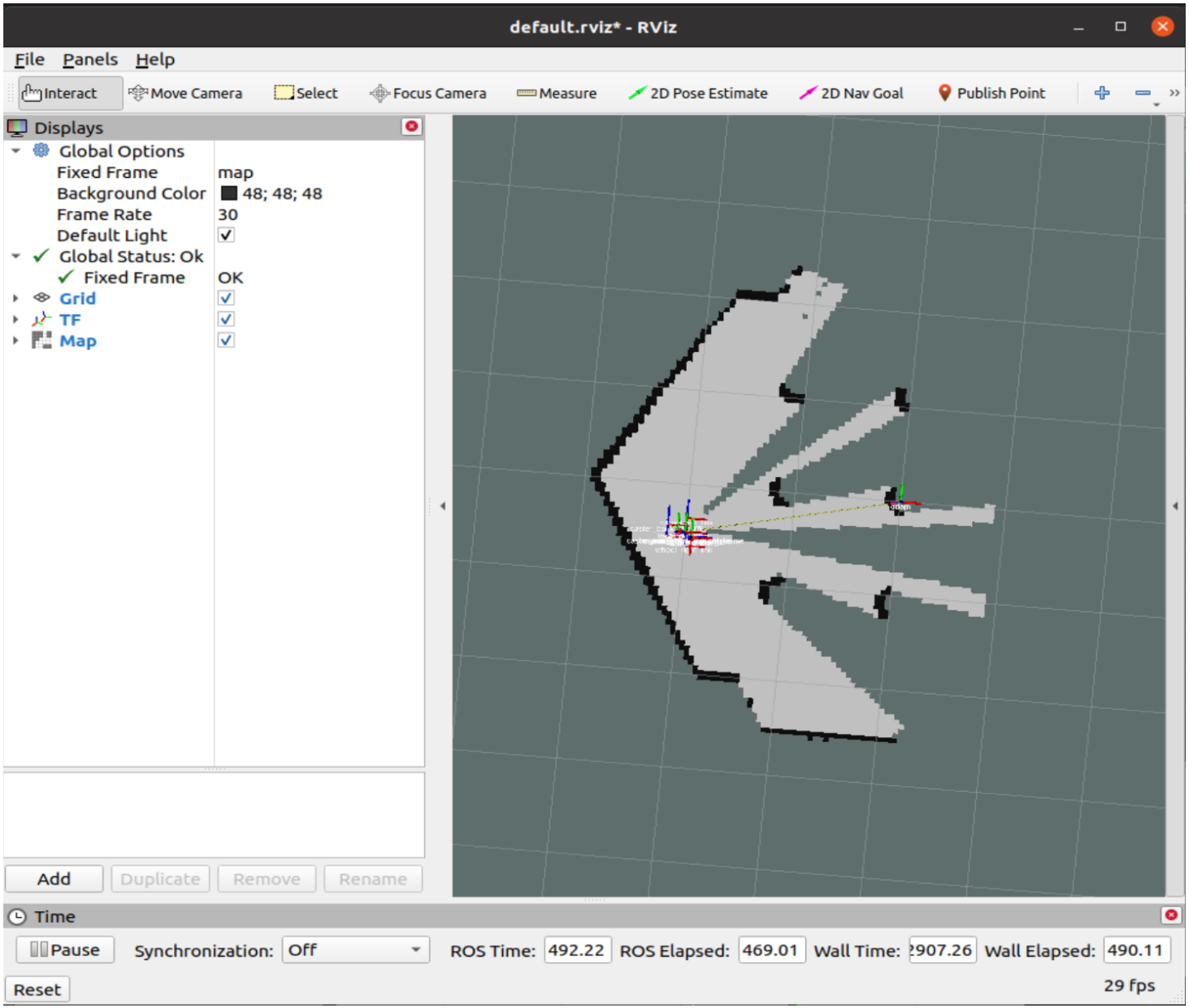


ros roslibjs – map 03

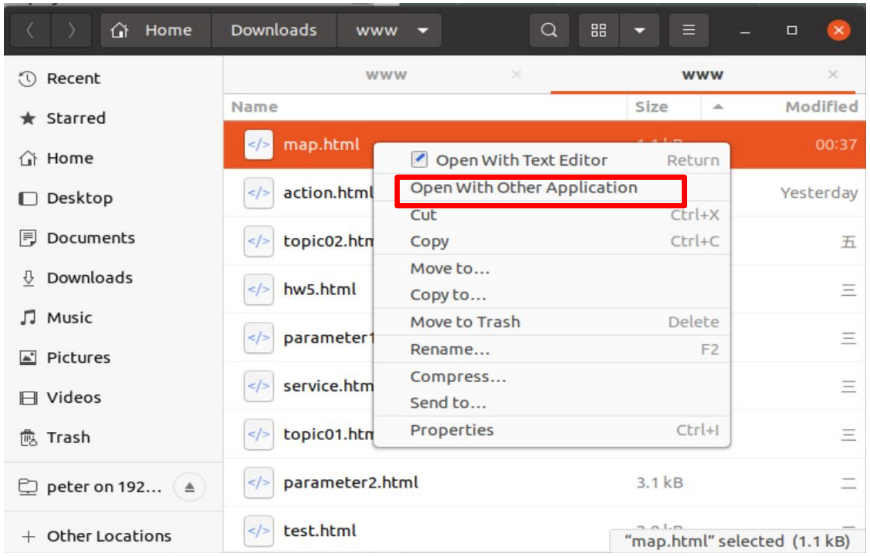
rviz 增加顯示 tf 座標

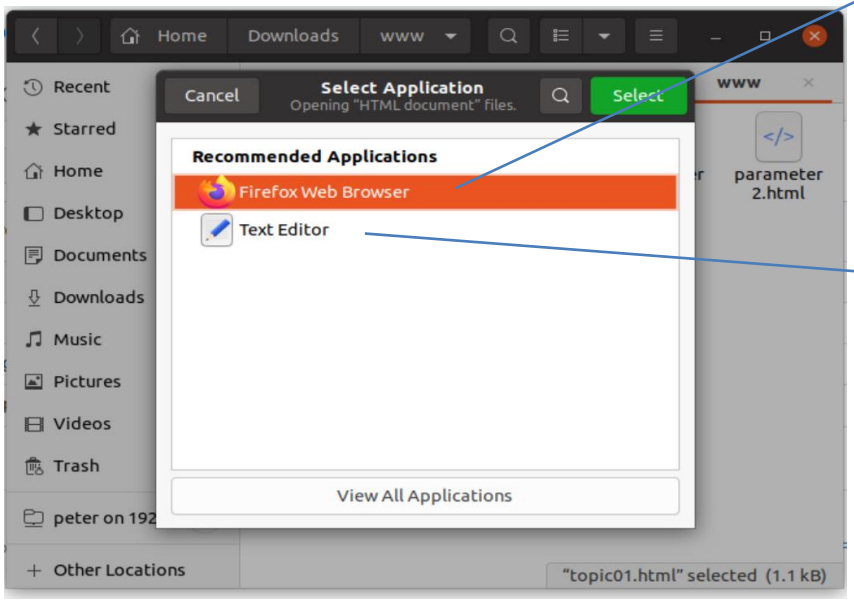


ros roslibjs – map 04



ros roslibjs – map 05





用瀏覽器執行網頁

編輯網頁內容

ros roslibjs – map 06

```
<!DOCTYPE html>
<html>
<head>
<meta charset="utf-8" />
<script type="text/javascript" src="basic/easeljs.js"></script>
<script type="text/javascript" src="basic/eventemitter2.js"></script>
<script type="text/javascript" src="basic/roslib.js"></script>
<script type="text/javascript" src="basic/ros2d.js"></script>
<script>
  function init() {
      var ros = new ROSLIB.Ros({
      url : 'ws://localhost:9090'
    });
    // Create the main viewer.
    var viewer = new ROS2D.Viewer({
      divID : 'map',
      width : 640,
      height : 480
    });

    // Setup the map client.
    var gridClient = new ROS2D.OccupancyGridClient({
      ros : ros,
      rootObject : viewer.scene,
      //continuous: true
    });

    // Scale the canvas to fit to the map
    gridClient.on('change', function() {
      viewer.scaleToDimensions(gridClient.currentGrid.width, gridClient.currentGrid.height);
      viewer.shift(gridClient.currentGrid.pose.position.x, gridClient.currentGrid.pose.position.y);
    });
  }
</script>
</head>

<body onload="init()">
  <h1>Simple Map Example</h1>
  <p>Turtle Robot</p>
  <div id="map"></div>
</body>
</html>
```

持續隨著地圖更新，於網頁上重畫

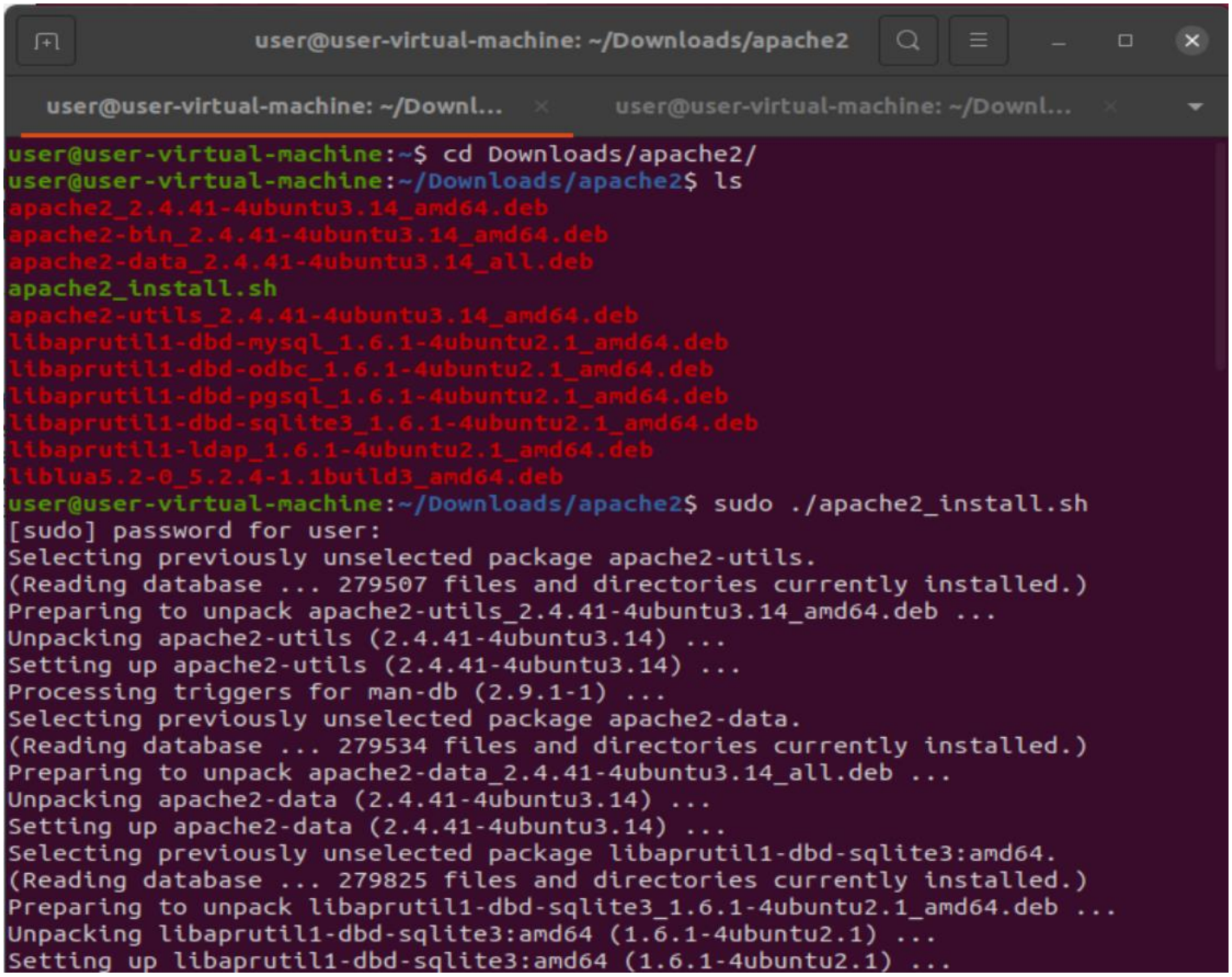
Apache 網頁伺服器

ROS ROSLIBJS

apache -離線安裝

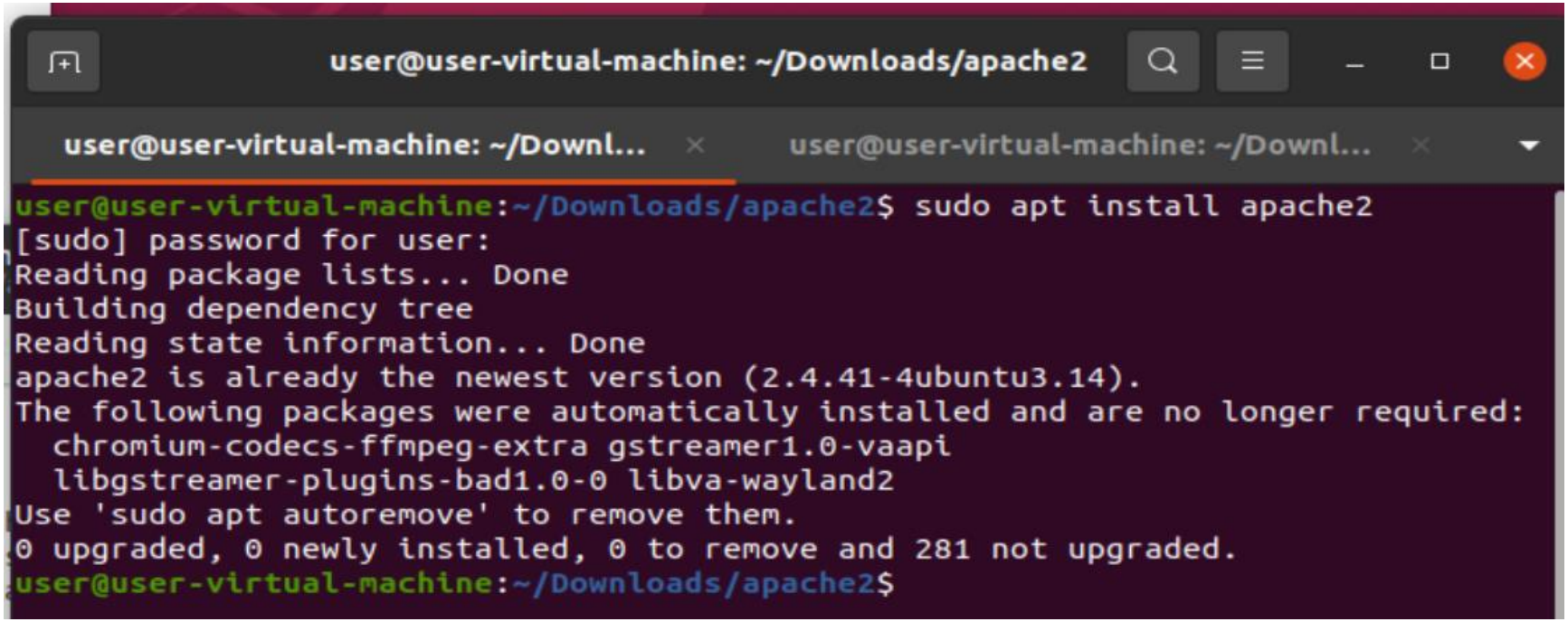
下載並解壓縮
apache2.zip

cd ~/Downloads/
cd apache2/
./apache2_install.sh



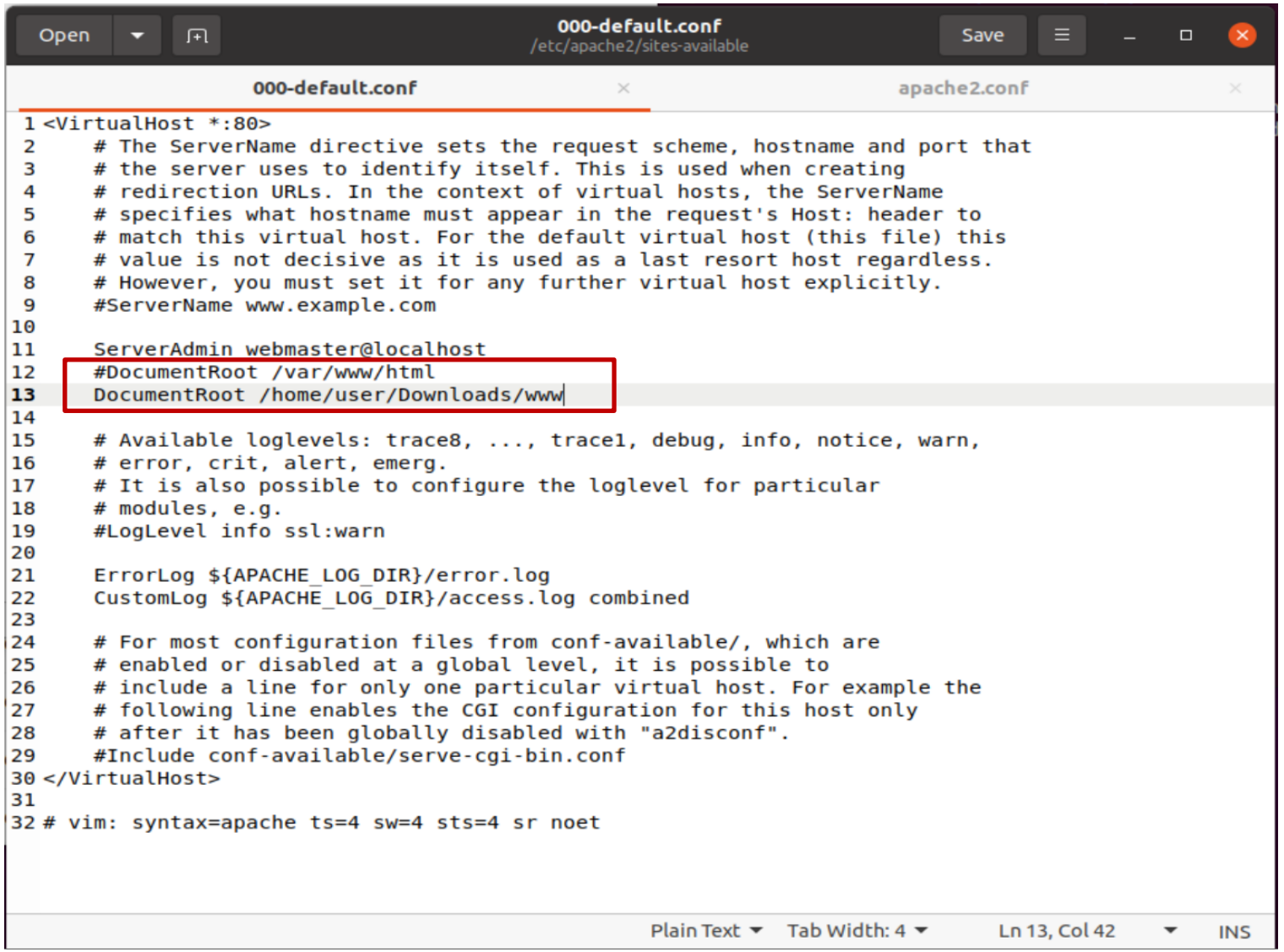
apache -網路安裝

在有網路的環境下 用以下指令安裝
sudo apt install apache2



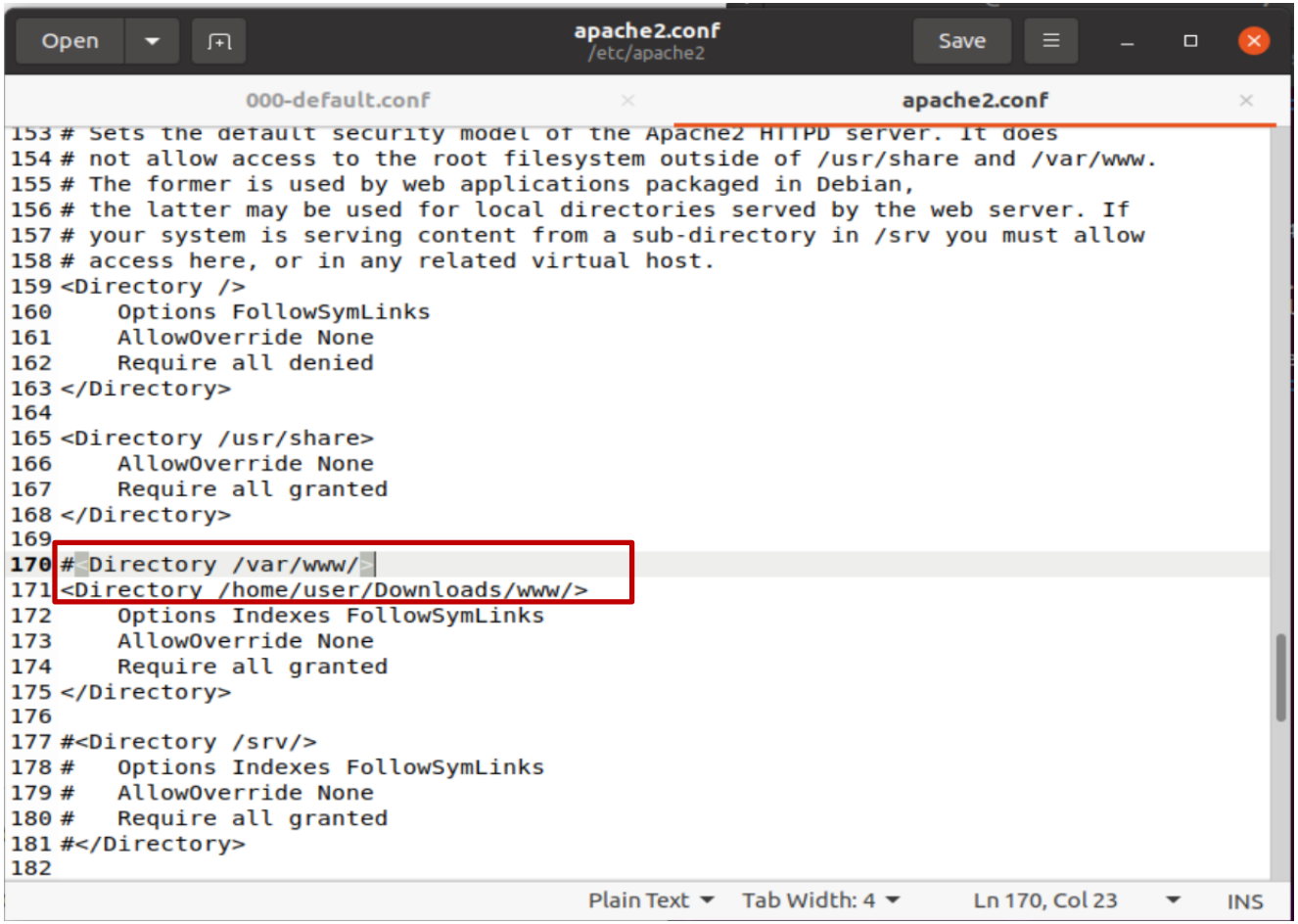
apache –設定

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



apache –設定

sudo gedit /etc/apache2/apache2.conf &

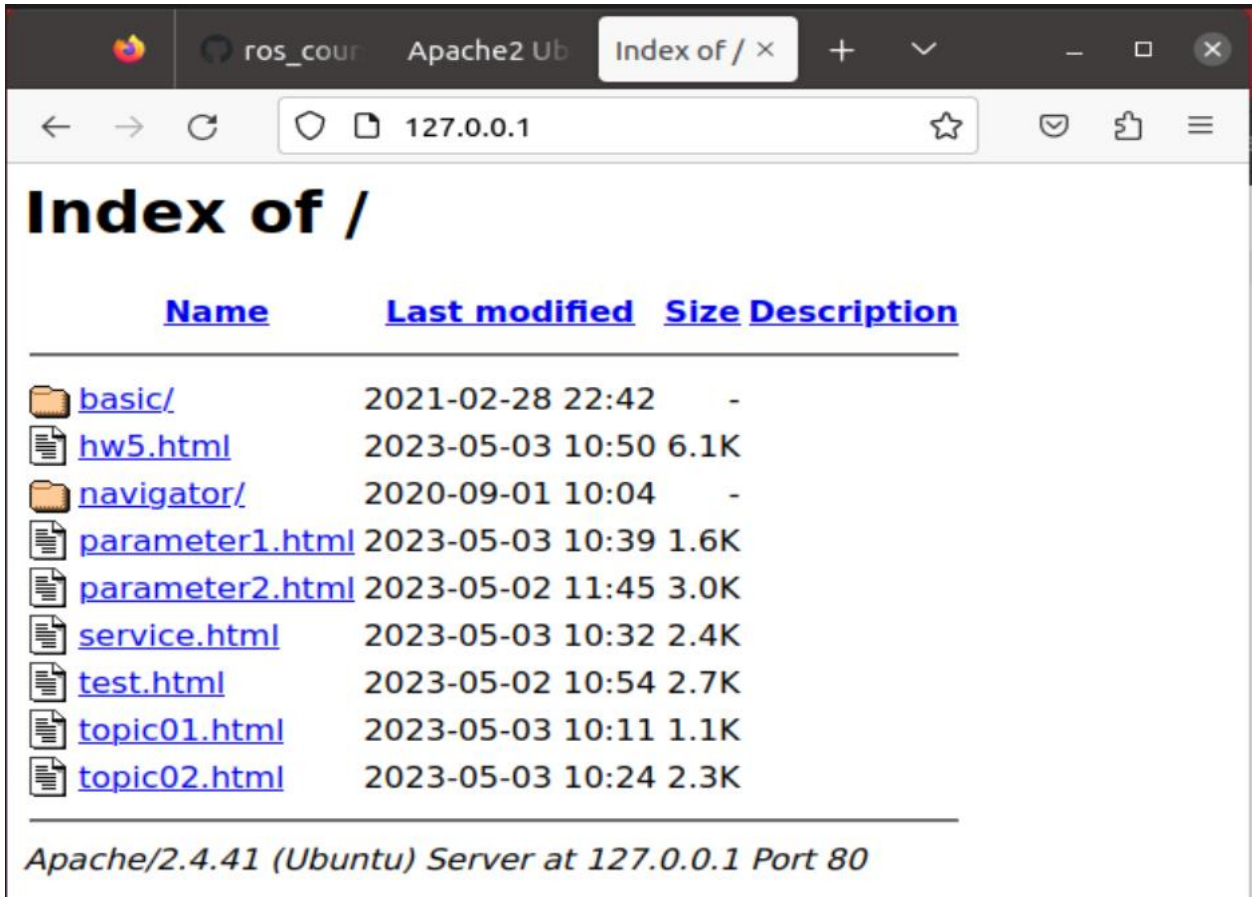



```
user@user-virtual-machine:~/Downloads/www$ sudo service apache2 restart
user@user-virtual-machine:~/Downloads/www$
```

sudo service apache2 restart　重啟apache，讀取新設定

ros roslibjs – apache

127.0.0.1




```
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
- 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)
    - rosnode 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