



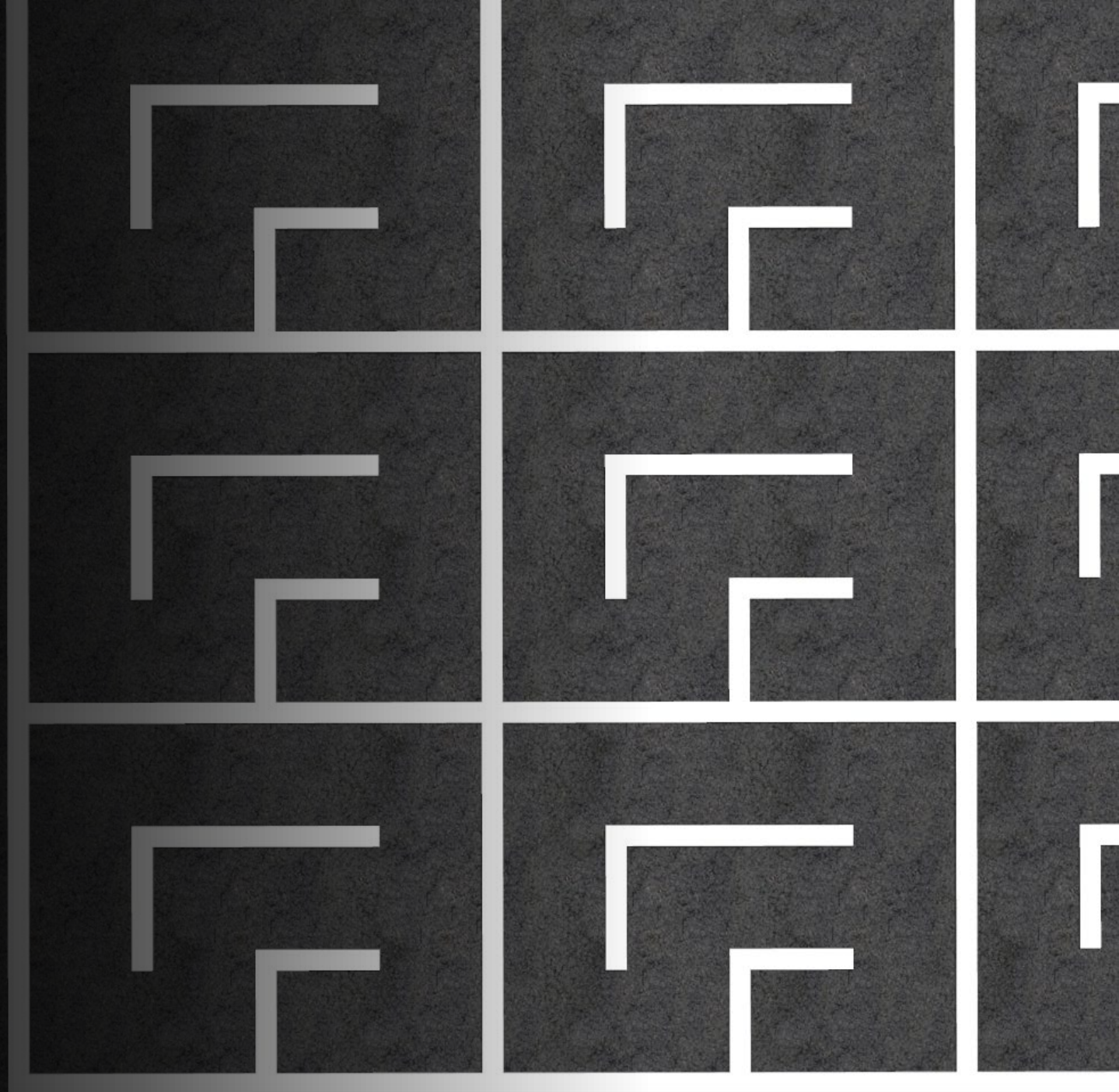
F1/10 Autonomous Racing Simulator

CS-4501 Simulator Access Instructions

Jingyun Ning

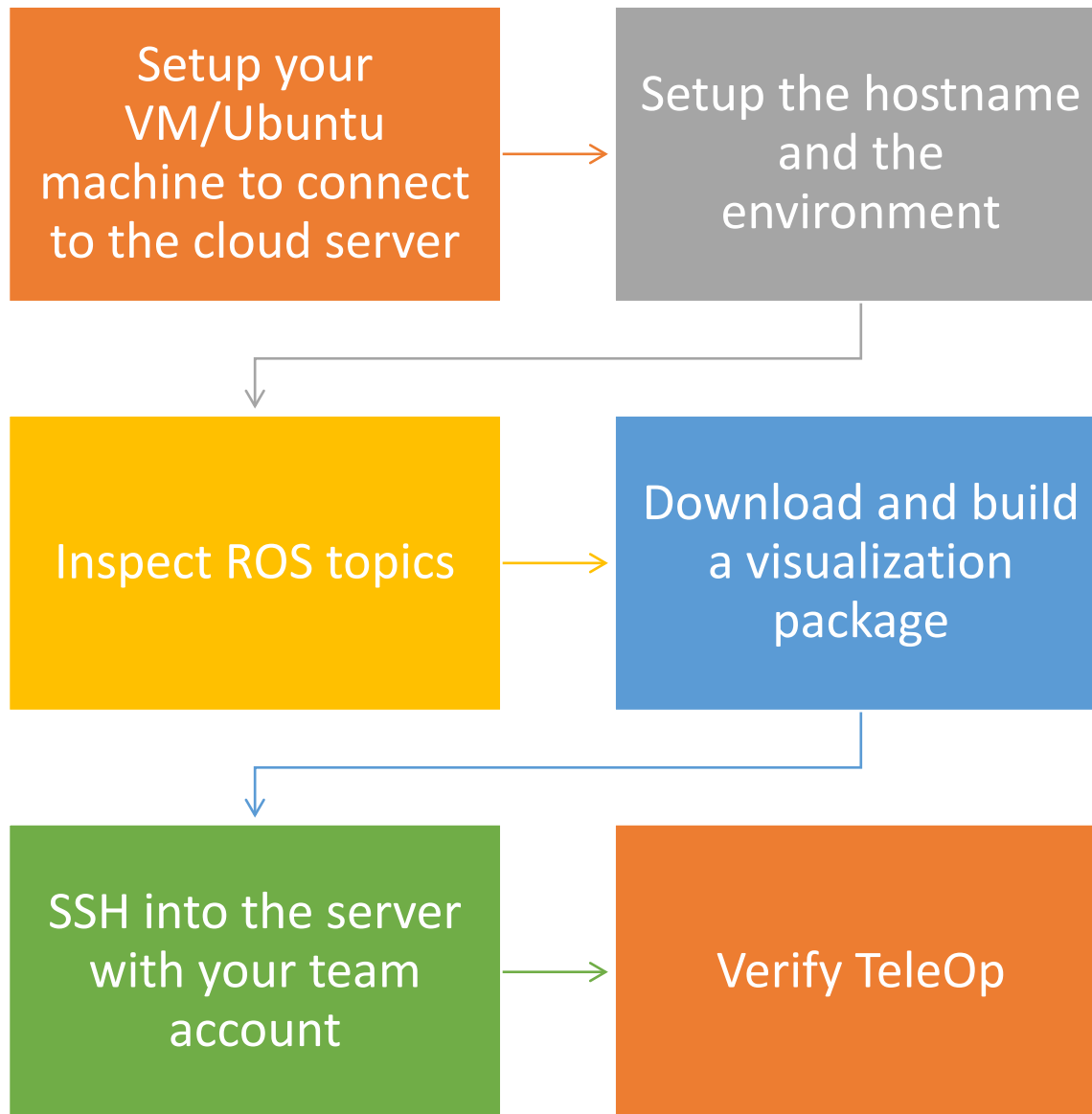
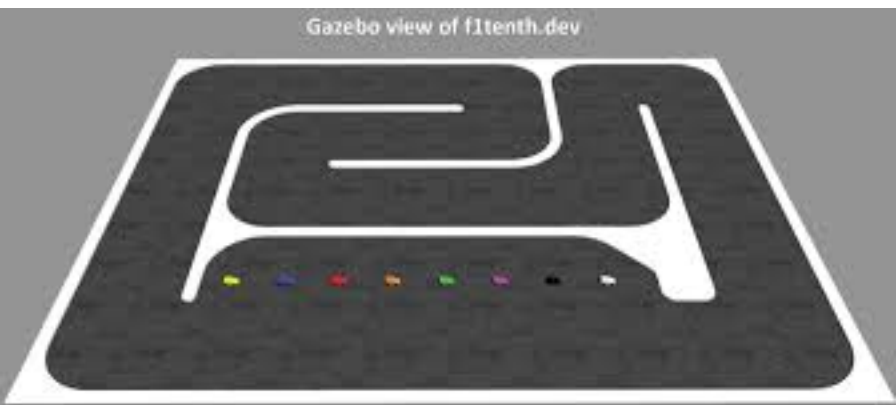
Varundev Sureshbabu

Prof. Madhur Behl





Overview of steps

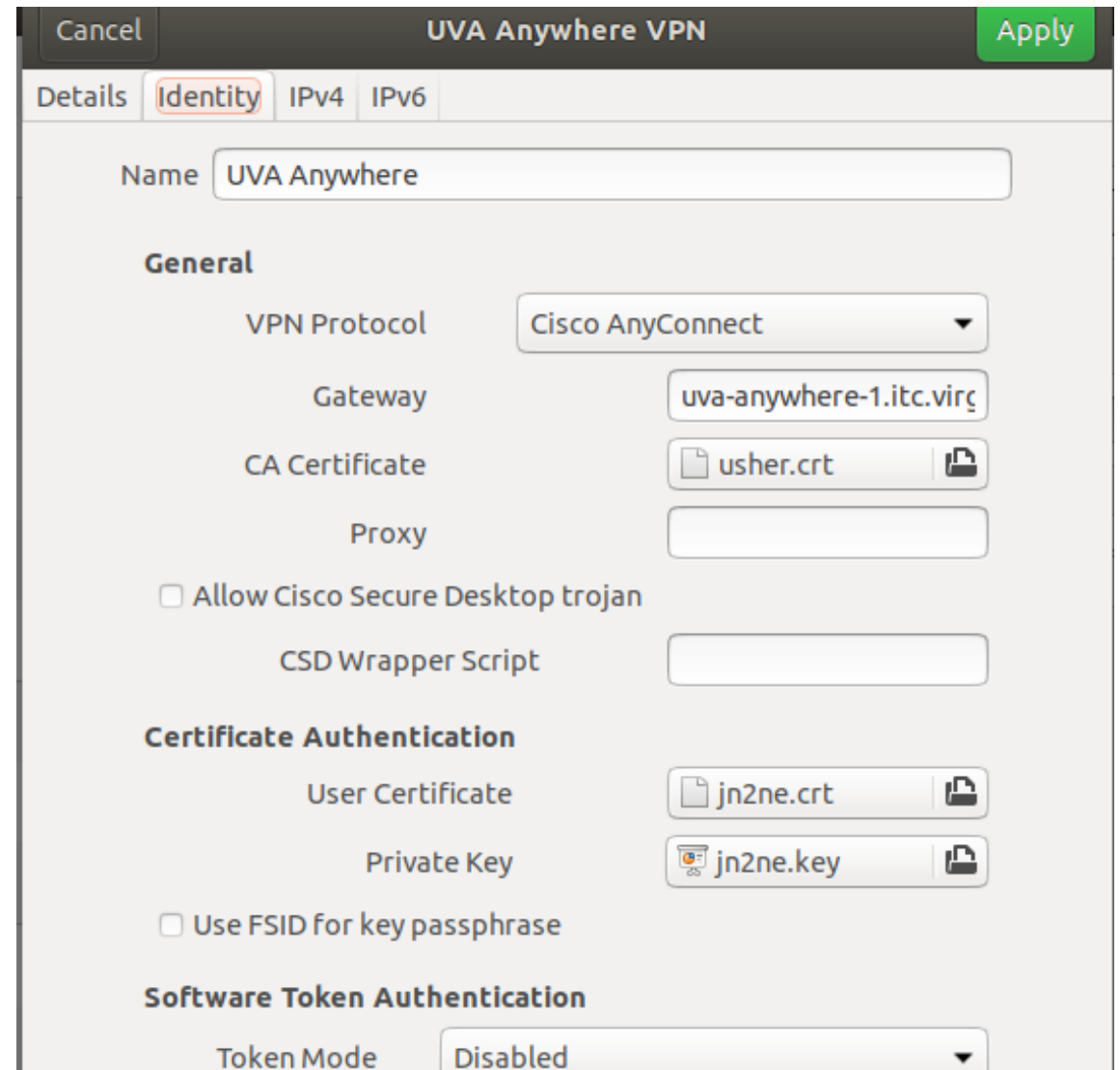


[Step 1] UVA VPN Setup

- Follow instructions on [this page](https://www.rc.virginia.edu/userinfo/linux/uva-anywhere-vpn-linux/) to setup VPN on Linux

<https://www.rc.virginia.edu/userinfo/linux/uva-anywhere-vpn-linux/>

- If you are not able to connect to the More Secure VPN, try:
 - At step 5: instead of “*moresecure-vpn-1.itc.virginia.edu*”, set the gateway as “*uva-anywhere-1.itc.virginia.edu*”

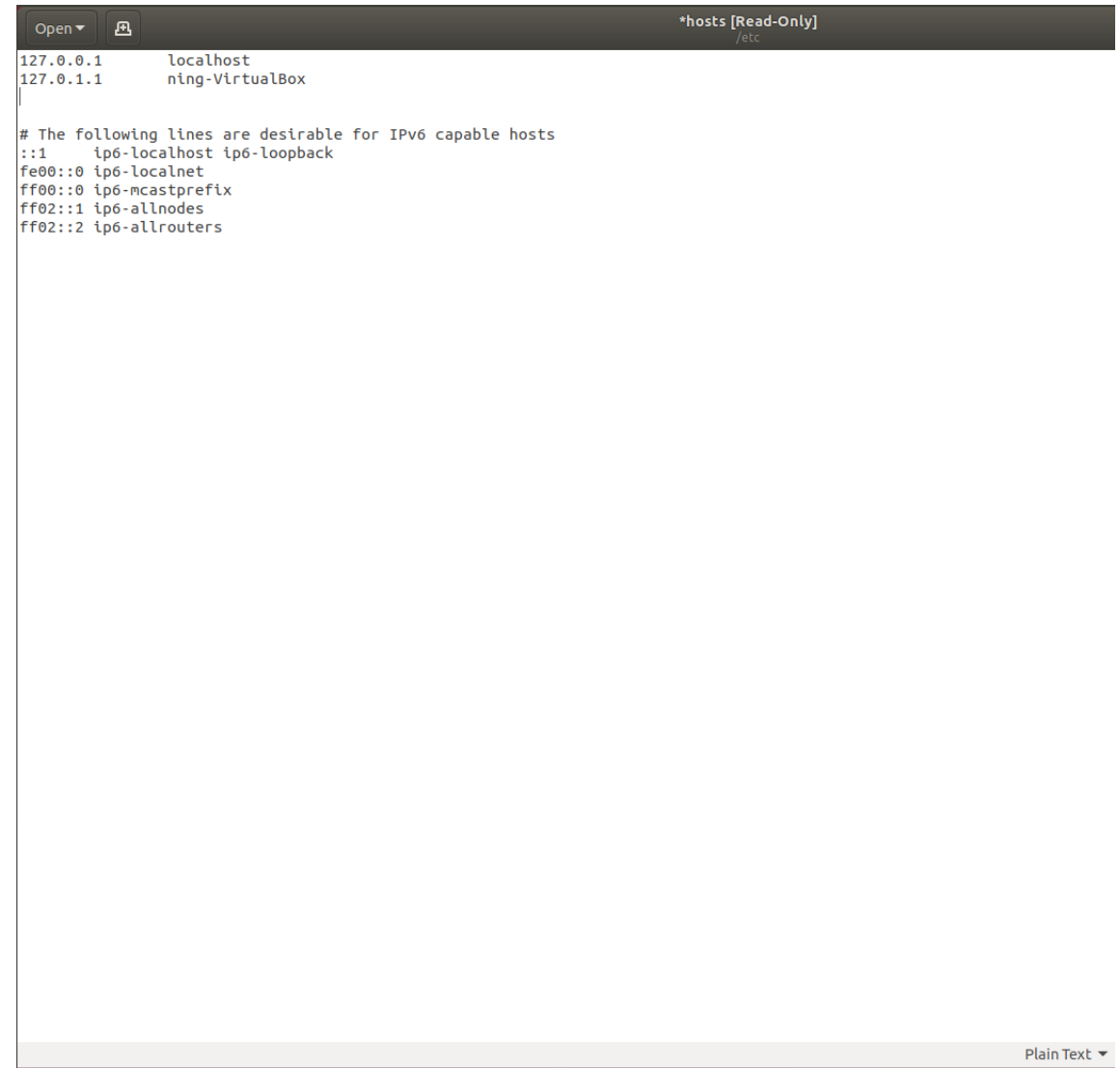


The screenshot shows the 'UVA Anywhere VPN' configuration window with the 'Identity' tab selected. The 'Name' field is set to 'UVA Anywhere'. Under the 'General' section, the 'VPN Protocol' is set to 'Cisco AnyConnect', the 'Gateway' is 'uva-anywhere-1.itc.virg', and the 'CA Certificate' is 'usher.crt'. The 'Proxy' field is empty. There is an unchecked checkbox for 'Allow Cisco Secure Desktop trojan' and an empty 'CSD Wrapper Script' field. Under 'Certificate Authentication', the 'User Certificate' is 'jn2ne.crt' and the 'Private Key' is 'jn2ne.key'. There is an unchecked checkbox for 'Use FSID for key passphrase'. Under 'Software Token Authentication', the 'Token Mode' is set to 'Disabled'.

Field	Value
Name	UVA Anywhere
VPN Protocol	Cisco AnyConnect
Gateway	uva-anywhere-1.itc.virg
CA Certificate	usher.crt
Proxy	
Allow Cisco Secure Desktop trojan	<input type="checkbox"/>
CSD Wrapper Script	
User Certificate	jn2ne.crt
Private Key	jn2ne.key
Use FSID for key passphrase	<input type="checkbox"/>
Token Mode	Disabled

Setup the Hostnames

- Open the file at “/etc/hosts”
 - e.g. “\$ cd ~ && sudo gedit /etc/hosts”



The screenshot shows a text editor window titled “*hosts [Read-Only] /etc”. The editor contains the following text:

```
127.0.0.1    localhost
127.0.1.1    ning-VirtualBox

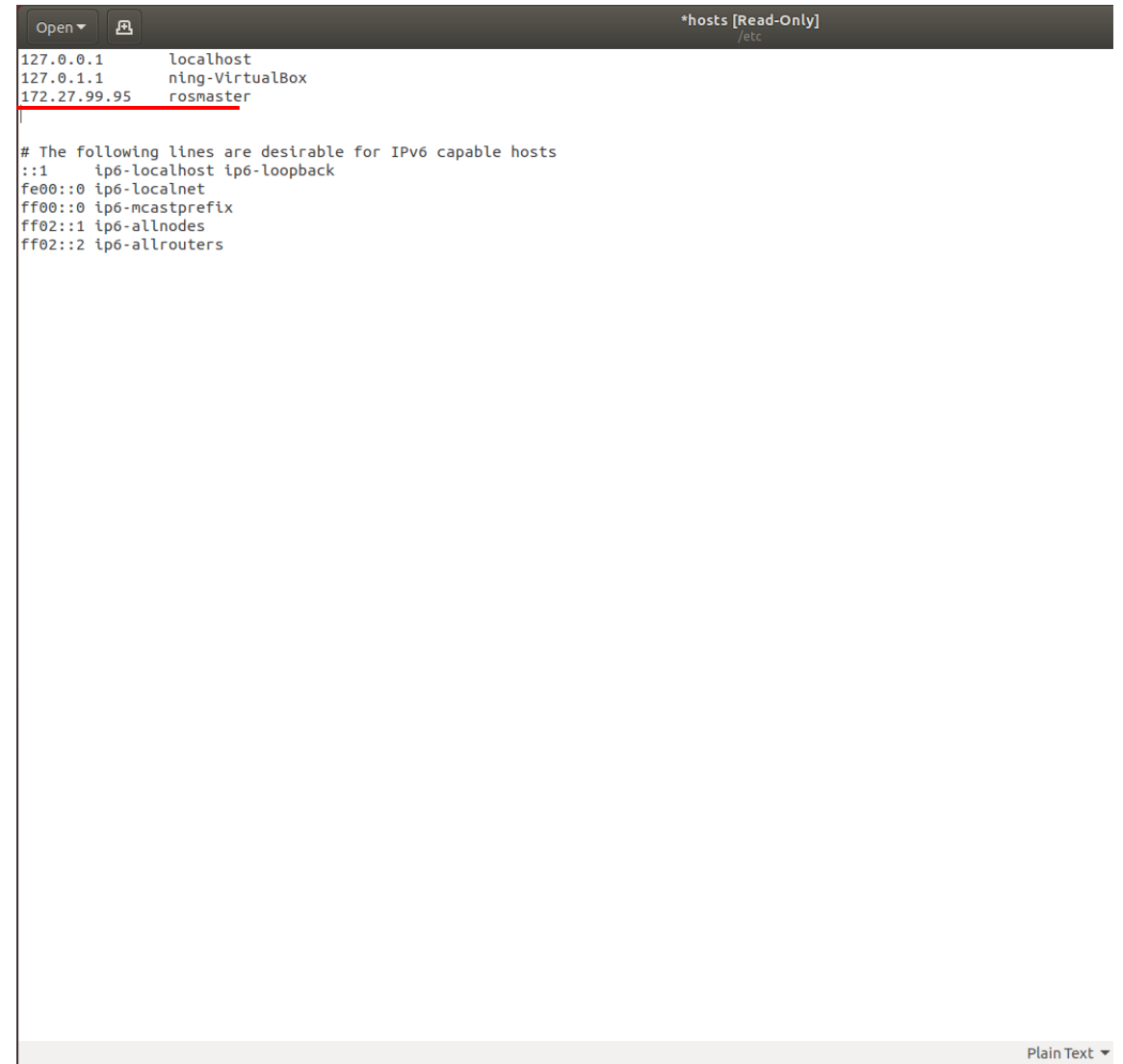
# The following lines are desirable for IPv6 capable hosts
::1         ip6-localhost ip6-loopback
fe00::0     ip6-localnet
ff00::0     ip6-mcastprefix
ff02::1     ip6-allnodes
ff02::2     ip6-allrouters
```

The editor interface includes a top bar with “Open” and a file icon, and a bottom right corner with a “Plain Text” dropdown menu.

Setup the Hostnames

- Add the current IP address and the hostname of the simulation server

172.27.99.95 rosmaster



```
Open [Read-Only] /etc
127.0.0.1 localhost
127.0.1.1 ning-VirtualBox
172.27.99.95 rosmaster

# The following lines are desirable for IPv6 capable hosts
::1 ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
```

Setup the Hostnames

- Enter “*\$ ping rosmaster*” to verify everything is set properly
 - If you do not see output info as the image shows on the right, check if VPN is connected.

```
ning@ning-VirtualBox: ~  
ning@ning-VirtualBox: ~ 108x31  
ning@ning-VirtualBox:~$ ping rosmaster  
PING rosmaster (172.27.99.95) 56(84) bytes of data.  
64 bytes from rosmaster (172.27.99.95): icmp_seq=1 ttl=60 time=24.5 ms  
64 bytes from rosmaster (172.27.99.95): icmp_seq=2 ttl=60 time=27.5 ms  
64 bytes from rosmaster (172.27.99.95): icmp_seq=3 ttl=60 time=38.6 ms  
64 bytes from rosmaster (172.27.99.95): icmp_seq=4 ttl=60 time=39.3 ms  
64 bytes from rosmaster (172.27.99.95): icmp_seq=5 ttl=60 time=45.4 ms  
64 bytes from rosmaster (172.27.99.95): icmp_seq=6 ttl=60 time=31.5 ms  
  
$ ping rosmaster
```

Setup the Environment

- Add following lines to your .bashrc file:
 - e.g. ~/“\$ gedit .bashrc”

ROS environment variables

source /opt/ros/melodic/setup.bash

source ~/catkin_ws/devel/setup.bash

ROS network variables

export ROS_MASTER_URI=http://rosmaster:11311

Confirm setup to user

echo "This terminal is connected to the UVA F1/10 simulator"

```
Open ▾ .bashrc
# enable color support of ls and also add handy aliases
if [ -x /usr/bin/dircolors ]; then
    test -r ~/.dircolors && eval "$(dircolors -b ~/.dircolors)" || eval "$(dircolors -b)"
    alias ls='ls --color=auto'
    #alias dir='dir --color=auto'
    #alias vdir='vdir --color=auto'

    alias grep='grep --color=auto'
    alias fgrep='fgrep --color=auto'
    alias egrep='egrep --color=auto'
fi

# colored GCC warnings and errors
#export GCC_COLORS='error=01;31:warning=01;35:note=01;36:caret=01;32:locus=01:quote=01'

# some more ls aliases
alias ll='ls -alF'
alias la='ls -A'
alias l='ls -CF'

# Add an "alert" alias for long running commands. Use like so:
# sleep 10; alert
alias alert='notify-send --urgency=low -i "${[ $? = 0 ]} && echo terminal || echo error" "${history|tail -n1|sed -e '\s*alert$//\'\'\'"}'

# Alias definitions.
# You may want to put all your additions into a separate file like
# ~/.bash_aliases, instead of adding them here directly.
# See /usr/share/doc/bash-doc/examples in the bash-doc package.

if [ -f ~/.bash_aliases ]; then
    . ~/.bash_aliases
fi

# enable programmable completion features (you don't need to enable
# this, if it's already enabled in /etc/bash.bashrc and /etc/profile
# sources /etc/bash.bashrc).
if ! shopt -oq posix; then
    if [ -f /usr/share/bash-completion/bash_completion ]; then
        . /usr/share/bash-completion/bash_completion
    elif [ -f /etc/bash_completion ]; then
        . /etc/bash_completion
    fi
fi

# ROS environment variables
source /opt/ros/melodic/setup.bash
source ~/catkin_ws/devel/setup.bash
# ROS network variables
export ROS_MASTER_URI=http://rosmaster:11311
# export ROS_HOSTNAME=ning
echo "This terminal is connected to the UVA F1/10 simulator"

sh ▾
```


Source the Environment

- Open a new terminal.
 - Enter “*\$ rostopic list*”
- make sure VPN is connected

```
ning@ning-VirtualBox: ~  
ning@ning-VirtualBox: ~  
ning@ning-VirtualBox: ~ 181x50  
This terminal is connected to the UVA F1/10 simulator  
ning@ning-VirtualBox:~$ rostopic list  
/TA_inst_demo_car/base/footprint  
/TA_inst_demo_car/base/odom  
/TA_inst_demo_car/camera/image  
/TA_inst_demo_car/camera/image/compressed  
/TA_inst_demo_car/camera/image/compressed/parameter_descriptions  
/TA_inst_demo_car/camera/image/compressed/parameter_updates  
/TA_inst_demo_car/camera/image/compressedDepth  
/TA_inst_demo_car/camera/image/compressedDepth/parameter_descriptions  
/TA_inst_demo_car/camera/image/compressedDepth/parameter_updates  
/TA_inst_demo_car/camera/image/theora  
/TA_inst_demo_car/camera/image/theora/parameter_descriptions  
/TA_inst_demo_car/camera/image/theora/parameter_updates  
/TA_inst_demo_car/camera/parameter_descriptions  
/TA_inst_demo_car/camera/parameter_updates  
/TA_inst_demo_car/camera/rgb/camera_info  
/TA_inst_demo_car/ground_truth  
/TA_inst_demo_car/joint_states  
/TA_inst_demo_car/left_front_wheel_velocity_controller/command  
/TA_inst_demo_car/left_front_wheel_velocity_controller/pid/parameter_descriptions  
/TA_inst_demo_car/left_front_wheel_velocity_controller/pid/parameter_updates  
/TA_inst_demo_car/left_front_wheel_velocity_controller/state  
/TA_inst_demo_car/left_rear_wheel_velocity_controller/command  
/TA_inst_demo_car/left_rear_wheel_velocity_controller/pid/parameter_descriptions  
/TA_inst_demo_car/left_rear_wheel_velocity_controller/pid/parameter_updates  
/TA_inst_demo_car/left_rear_wheel_velocity_controller/state  
/TA_inst_demo_car/left_steering_hinge_position_controller/command  
/TA_inst_demo_car/left_steering_hinge_position_controller/pid/parameter_descriptions  
/TA_inst_demo_car/left_steering_hinge_position_controller/pid/parameter_updates  
/TA_inst_demo_car/left_steering_hinge_position_controller/state  
/TA_inst_demo_car/multiplexer/command  
/TA_inst_demo_car/right_front_wheel_velocity_controller/command  
/TA_inst_demo_car/right_front_wheel_velocity_controller/pid/parameter_descriptions  
/TA_inst_demo_car/right_front_wheel_velocity_controller/pid/parameter_updates  
/TA_inst_demo_car/right_front_wheel_velocity_controller/state  
/TA_inst_demo_car/right_rear_wheel_velocity_controller/command  
/TA_inst_demo_car/right_rear_wheel_velocity_controller/pid/parameter_descriptions  
/TA_inst_demo_car/right_rear_wheel_velocity_controller/pid/parameter_updates  
/TA_inst_demo_car/right_rear_wheel_velocity_controller/state  
/TA_inst_demo_car/right_steering_hinge_position_controller/command  
/TA_inst_demo_car/right_steering_hinge_position_controller/pid/parameter_descriptions  
/TA_inst_demo_car/right_steering_hinge_position_controller/pid/parameter_updates  
/TA_inst_demo_car/right_steering_hinge_position_controller/state  
/TA_inst_demo_car/scan  
/clock  
/gazebo/link_states  
/gazebo/model_states  
/gazebo/parameter_descriptions  
/gazebo/parameter_updates  
/gazebo/set link state
```

\$ rostopic list

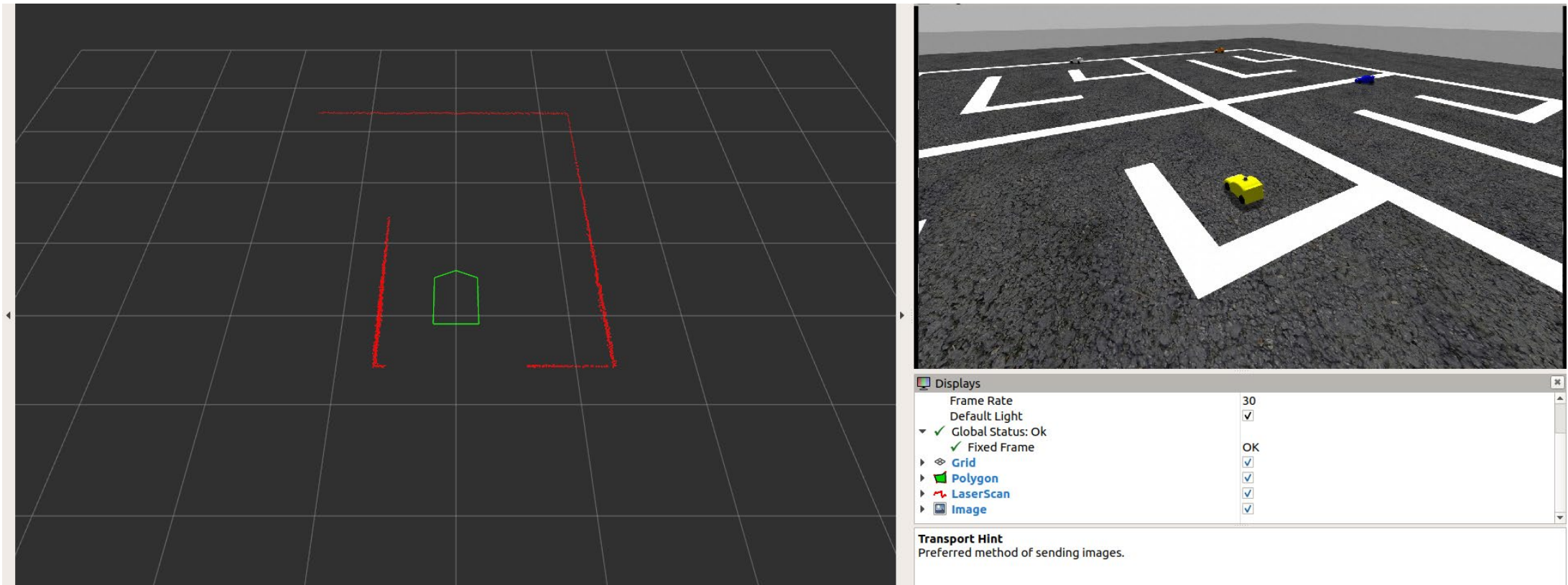
Remote Visualization

- Download the F1/10 visualization package
 - `$ cd ~/catkin_ws/src/f1tenth-course-labs && git pull.`
 - If not working, try rebuild your workspace:
`$ mkdir -p catkin_ws/src/ && cd catkin_ws/src && catkin_init_workspace`
`$ git clone https://github.com/linklab-uva/f1tenth-course-labs`
`$ cd .. && catkin_make && source devel/setup.bash`

```
ning@ning-VirtualBox: ~/catkin_ws/src/f1tenth-course-labs
ning@ning-VirtualBox: ~/catkin_ws/src/f1tenth-course-labs
ning@ning-VirtualBox:~$ cd catkin_ws/src/f1tenth-course-labs/
ning@ning-VirtualBox:~/catkin_ws/src/f1tenth-course-labs$ git pull
Already up to date.
ning@ning-VirtualBox:~/catkin_ws/src/f1tenth-course-labs$
```

\$ git pull

Remote Visualization



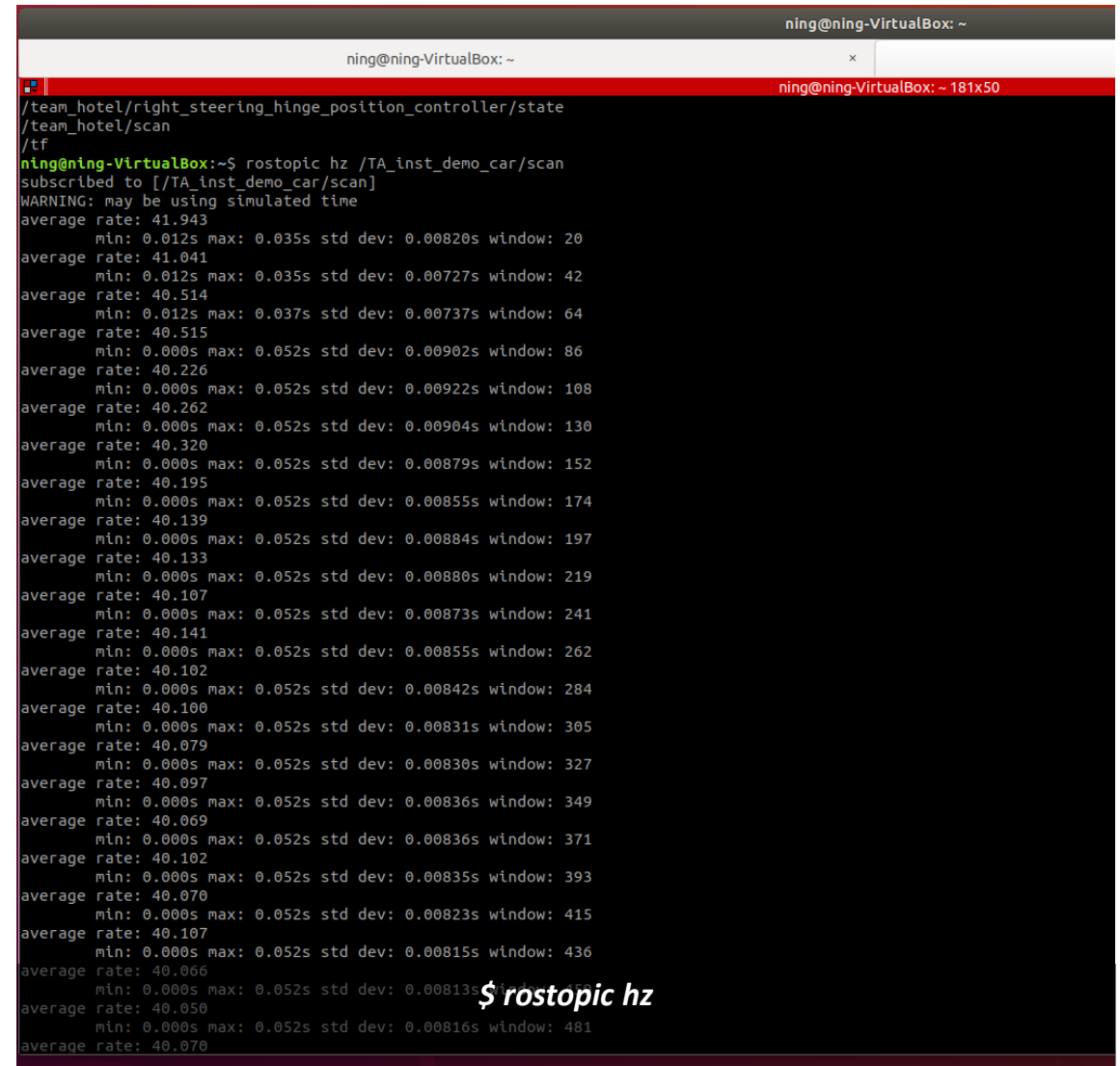
- Connect to team car
 - Open a new terminal:

```
$ roslaunch f1tenth-sim-viz racecar.viz \  
> computing_id:=<your_computing_ID> \  
> team_name:=team_<phonetic_alphabet>
```

Remember to connect to VPN before connecting to your team car.

Connecting to the Team Workspace

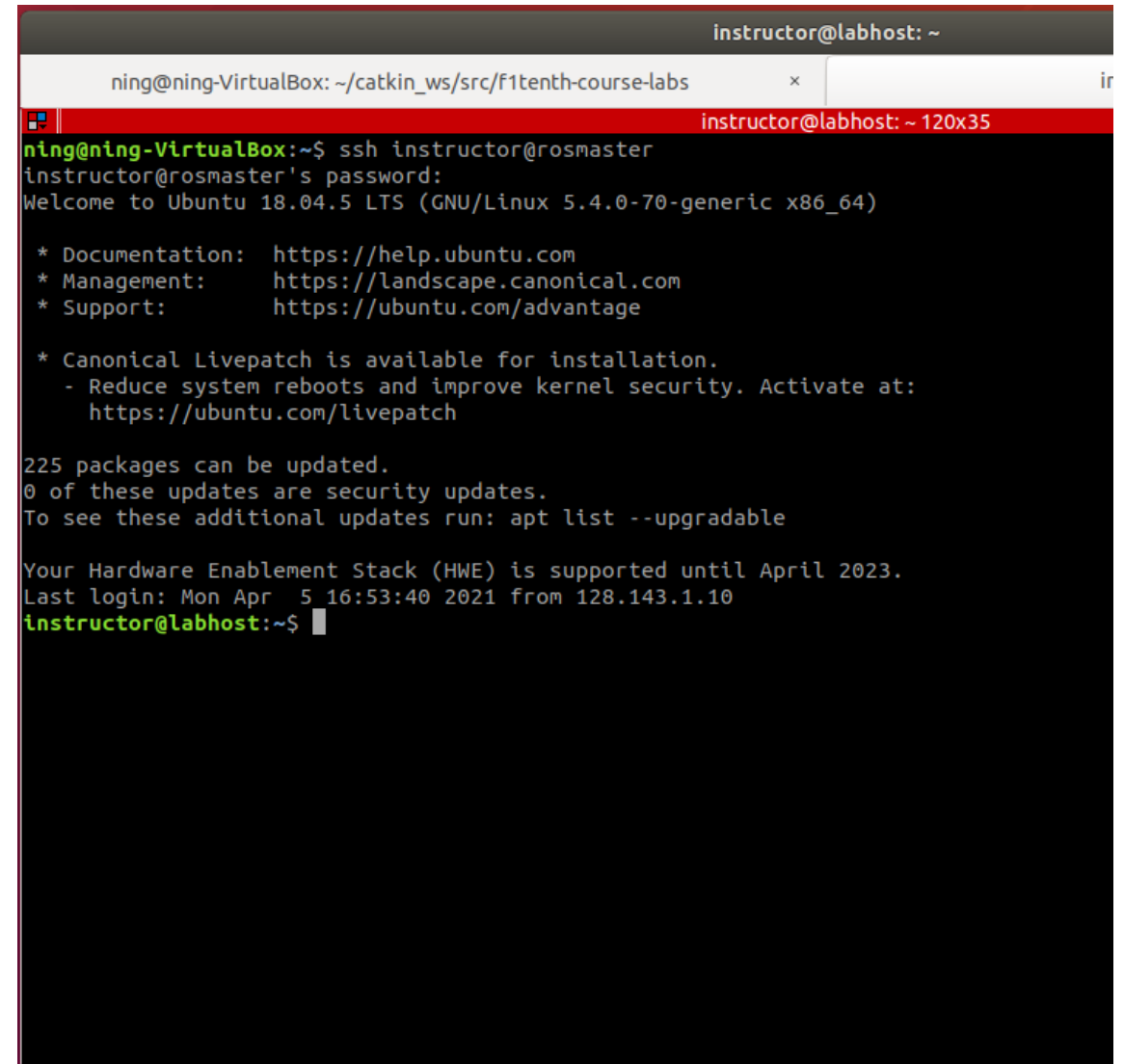
- Check the configurations have been setup correctly.
 - In your terminal, enter “`$ rostopic hz /team_<phonetic_alphabet>/scan`” in a terminal



```
ning@ning-VirtualBox: ~  
ning@ning-VirtualBox: ~  
ning@ning-VirtualBox: ~ 181x50  
/team_hotel/right_steering_hinge_position_controller/state  
/team_hotel/scan  
/tf  
ning@ning-VirtualBox:~$ rostopic hz /TA_inst_demo_car/scan  
subscribed to [/TA_inst_demo_car/scan]  
WARNING: may be using simulated time  
average rate: 41.943  
  min: 0.012s max: 0.035s std dev: 0.00820s window: 20  
average rate: 41.041  
  min: 0.012s max: 0.035s std dev: 0.00727s window: 42  
average rate: 40.514  
  min: 0.012s max: 0.037s std dev: 0.00737s window: 64  
average rate: 40.515  
  min: 0.000s max: 0.052s std dev: 0.00902s window: 86  
average rate: 40.226  
  min: 0.000s max: 0.052s std dev: 0.00922s window: 108  
average rate: 40.262  
  min: 0.000s max: 0.052s std dev: 0.00904s window: 130  
average rate: 40.320  
  min: 0.000s max: 0.052s std dev: 0.00879s window: 152  
average rate: 40.195  
  min: 0.000s max: 0.052s std dev: 0.00855s window: 174  
average rate: 40.139  
  min: 0.000s max: 0.052s std dev: 0.00884s window: 197  
average rate: 40.133  
  min: 0.000s max: 0.052s std dev: 0.00880s window: 219  
average rate: 40.107  
  min: 0.000s max: 0.052s std dev: 0.00873s window: 241  
average rate: 40.141  
  min: 0.000s max: 0.052s std dev: 0.00855s window: 262  
average rate: 40.102  
  min: 0.000s max: 0.052s std dev: 0.00842s window: 284  
average rate: 40.100  
  min: 0.000s max: 0.052s std dev: 0.00831s window: 305  
average rate: 40.079  
  min: 0.000s max: 0.052s std dev: 0.00830s window: 327  
average rate: 40.097  
  min: 0.000s max: 0.052s std dev: 0.00836s window: 349  
average rate: 40.069  
  min: 0.000s max: 0.052s std dev: 0.00836s window: 371  
average rate: 40.102  
  min: 0.000s max: 0.052s std dev: 0.00835s window: 393  
average rate: 40.070  
  min: 0.000s max: 0.052s std dev: 0.00823s window: 415  
average rate: 40.107  
  min: 0.000s max: 0.052s std dev: 0.00815s window: 436  
average rate: 40.066  
  min: 0.000s max: 0.052s std dev: 0.00813s window: 458  
average rate: 40.050  
  min: 0.000s max: 0.052s std dev: 0.00816s window: 481  
average rate: 40.070  
$ rostopic hz
```

Connecting to the Team Workspace

- SSH to access the workspace
 - `$ ssh team_<phonetic_alphabet>@rosmaster`
 - For the first time, type “**yes**” then enter your team password
- *One step process to connect to workspace
 - `$ sshpass -p '<your_team_password>' ssh team_<phonetic_alphabet>@rosmaster`
 - Install **sshpass** using **apt-get**



```
instructor@labhost: ~  
ning@ning-VirtualBox: ~/catkin_ws/src/F1tenth-course-labs x ir  
instructor@labhost: ~ 120x35  
ning@ning-VirtualBox:~$ ssh instructor@rosmaster  
instructor@rosmaster's password:  
Welcome to Ubuntu 18.04.5 LTS (GNU/Linux 5.4.0-70-generic x86_64)  
  
* Documentation:  https://help.ubuntu.com  
* Management:    https://landscape.canonical.com  
* Support:        https://ubuntu.com/advantage  
  
* Canonical Livepatch is available for installation.  
  - Reduce system reboots and improve kernel security. Activate at:  
    https://ubuntu.com/livepatch  
  
225 packages can be updated.  
0 of these updates are security updates.  
To see these additional updates run: apt list --upgradable  
  
Your Hardware Enablement Stack (HWE) is supported until April 2023.  
Last login: Mon Apr  5 16:53:40 2021 from 128.143.1.10  
instructor@labhost:~$
```

Verify Teleop

- After connecting to your team workspace
- Enter “\$ roslaunch f1tenth-sim-utils teleop.control”
 - Instructions:
 - w – forward
 - s – reverse
 - a – turn left
 - d – turn right
 - q – stop

```
/home/instructor/catkin_ws/src/f1tenth-sim-utils/launch/teleop.control
/home/instructor/catkin_ws/src/f1tenth-sim-utils/l... x /home/ning/catkin_ws/src/f1tenth-course-labs/f1t...
/home/instructor/catkin_ws/src/f1tenth-sim-utils/launch/teleop.control http

* Documentation: https://help.ubuntu.com
* Management: https://landscape.canonical.com
* Support: https://ubuntu.com/advantage

* Canonical Livepatch is available for installation.
- Reduce system reboots and improve kernel security. Activate at:
https://ubuntu.com/livepatch

225 packages can be updated.
0 of these updates are security updates.
To see these additional updates run: apt list --upgradable

New release '20.04.2 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Your Hardware Enablement Stack (HWE) is supported until April 2023.
Last login: Sun Apr 11 11:38:19 2021 from 128.143.1.10
instructor@labhost:~$ roslaunch f1tenth-sim-utils teleop.control
... logging to /home/instructor/.ros/log/58423c32-9254-11eb-b2fc-b068e619f887/roslaunch
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

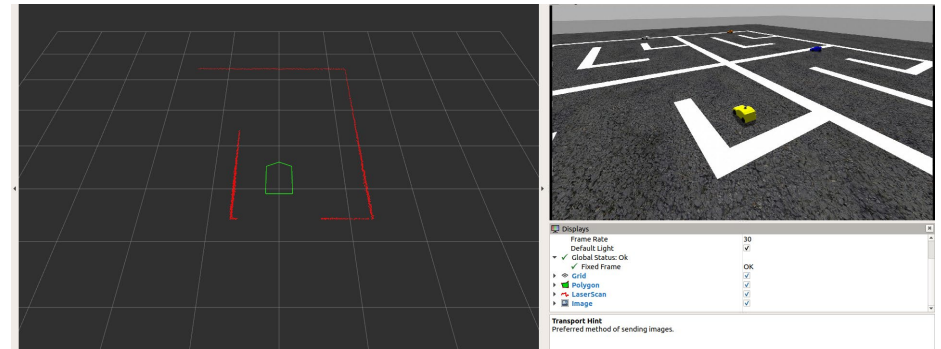
started roslaunch server http://rosmaster:42361/

SUMMARY
=====

PARAMETERS
* /rostdistro: melodic
* /rosversion: 1.14.10

NODES
/TA_inst_demo_car $ roslaunch f1tenth-sim-utils teleop.control
keyboard_teleop (f1tenth-sim-utils/keyboard_teleop.py)
```

Reset car position



- Open a new terminal and connect to team workspace
- Enter “\$ rosparam set /*team_<phonetic_alphabet>/reset_to_pit_stop* 1”

```
instructor@labhost: ~  
/home/instructor/catkin_ws/src/fitenth-sim-utils/fit... x /home/ning/catkin_ws/src/fitenth-course-labs/fit... x instructor@labhost: ~  
instructor@labhost: ~$ rosparam set /TA_inst_demo_car/reset_to_pit_stop 1  
instructor@labhost: ~$
```