Open Speech Platform: Quick Start Guide

http://openspeechplatform.ucsd.edu

Release 2020a
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Abstract

This document describes download, build, install and test steps for the Open Speech Platform (OSP) Release 2020a software.

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Please visit OSP Forum - Getting Started to report bugs and suggest enhancements.

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Chapter 1

Release 2020a Installation

This section goes over what is required to install the Open Speech Platform software and what are the steps needed for the different installation methods.

The installation process of OSP may take around $30-90$ minutes, depending on your computer, download speeds over the internet, and any installation errors that you may encounter and resolve.

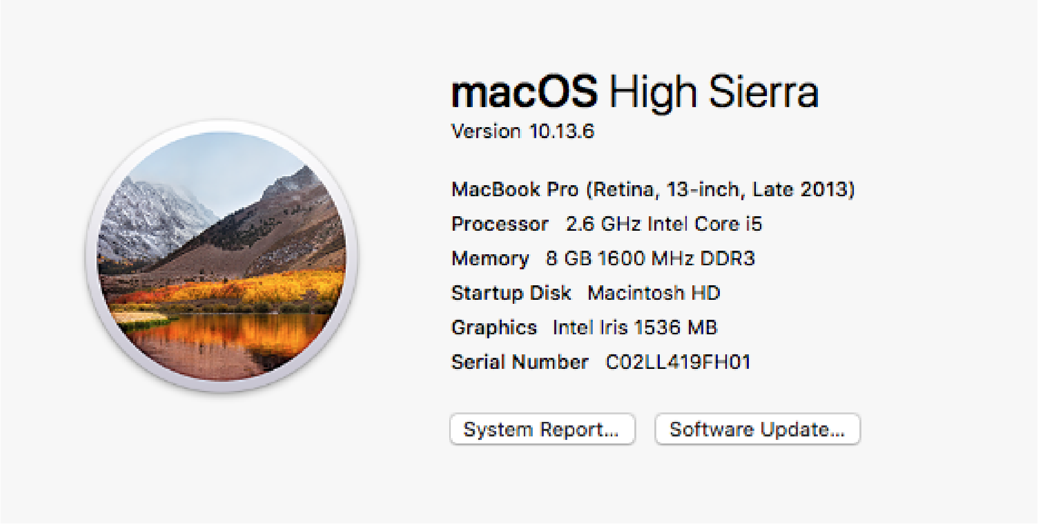
1.1 Requirements for OSP

1.1.1 Equipment Requirements

In order to use OSP, you must use either a Mac or a *debian-based* Linux machine (such as Ubuntu or Linaro) with the following processing, memory, and storage requirements. Figures 1.1 and 1.2 provide a reference for these requirements.

1. **Processor**:Equivalent to an Intel Core i5 processor.
2. **Memory/RAM**: At least 8GB or more.

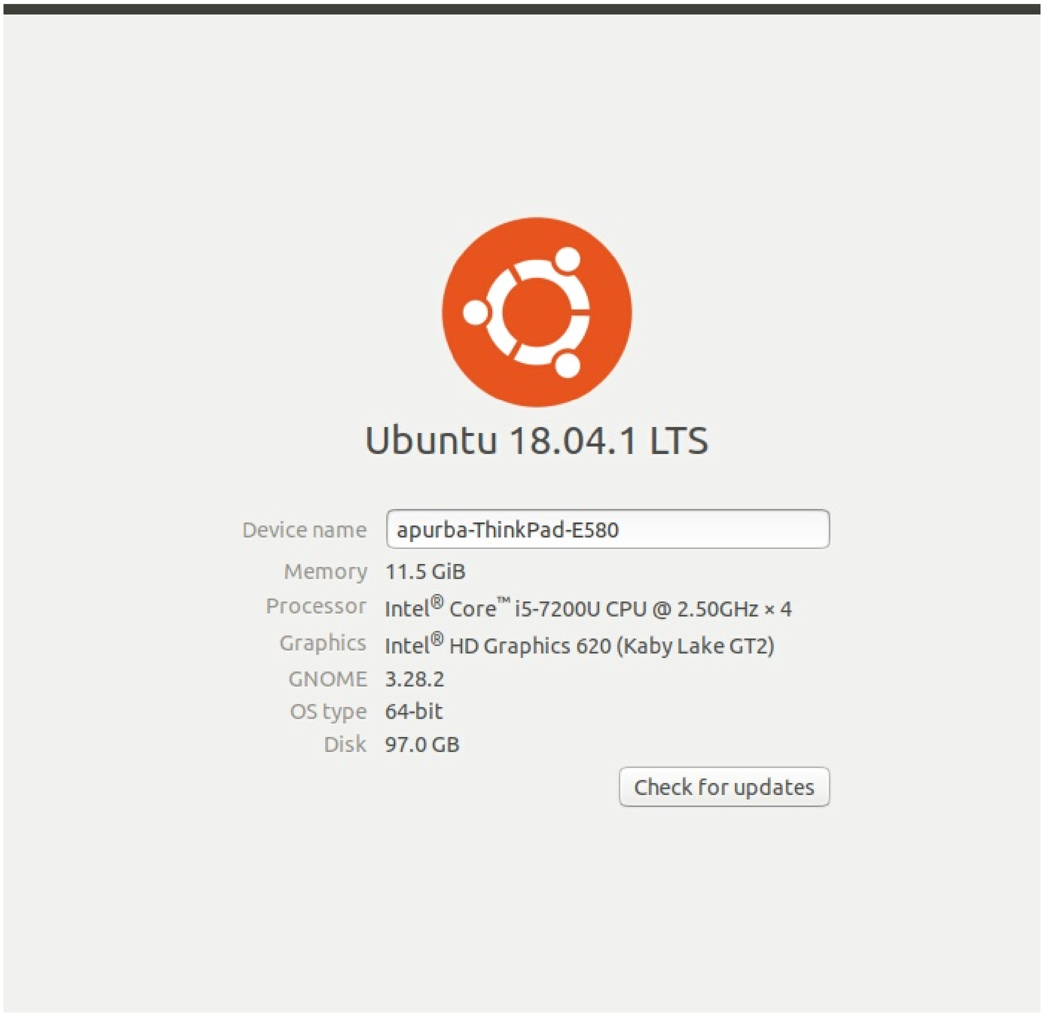
3. **Free Storage Space**: At least 2GB or more.



macOS High Sierra
Version 10.13.6

MacBook Pro (Retina, 13-inch, Late 2013)
Processor 2.6 GHz Intel Core i5
Memory 8 GB 1600 MHz DDR3
Startup Disk Macintosh HD
Graphics Intel Iris 1536 MB
Serial Number C02LL419FH01

Figure 1.1: System requirements for a Mac operating system computer.



Ubuntu 18.04.1 LTS

Device name	apurba-ThinkPad-E580
Memory	11.5 GiB
Processor	Intel® Core™ i5-7200U CPU @ 2.50GHz × 4
Graphics	Intel® HD Graphics 620 (Kaby Lake GT2)
GNOME	3.28.2
OS type	64-bit
Disk	97.0 GB

Figure 1.2: System requirements for a Linux computer on Ubunt.

To check if your computer meets these specifications...

- **On Mac**, click on the Apple menu icon at the top of your screen. In the dropdown menu, choose ”About This Mac”. The specifications should look similar to Figure 1.1. Apple has more information for finding computer specifications.
- **On Linux**, you may need to use a terminal that accepts command lines to figure out the specifications. Figure 1.2 is a reference of what

the specifications look like on Ubuntu 18.04.1, though this may appear differently for different Linux systems. You check out this Stack Exchange post for answers related to Ubuntu: askUbuntu - How do I check system specifications?.

After the installation, to verify that the system can deliver audio output, **you need some way to input and output audio**. Ideally, a working device such as a headset or pair of headphones would be used, but your computer's built-in microphone and speakers are good enough (as long as you remember to turn up the volume).

1.1.2 Installation Requirements

Finally, these are the additional applications and tools needed to successfully install OSP.

- **Command Terminal**: You will need to know how to operate the command terminal with working knowledge of basic terminal commands and features. This is to navigate through different folders and operate OSP after installation. Fortunately, this guide will cover all of the commands needed, as long as you follow the steps in order.
- **GitHub and git**: Our files are stored online via our GitHub Page. You will need to install git within the terminal, if this hasn't been done already. You will also need to know the `git clone` command to retrieve the files through the terminal.

1.2 Download Files from OSP

1. **Open the terminal application.**
   (a) On Mac, you can go to "Applications" within your Finder and type in the search bar "terminal". It should appear as a thumbnail that looks like a black box.

(b) On Linux, there are many methods to open the terminal. An article on How-To Geek's website covers this: Four Ways to get Instant Access to a Terminal in Linux.

2. **Install git.** If you already have git installed in your computer, skip this step and proceed to step 3. If not, please follow the following steps:

   (a) Type in `sudo apt-get install git` to install git in your computer.

   (b) For Mac systems, you can install git from the following link: https://sourceforge.net/projects/git-osx-installer/files/.

3. **Download the 2020a Release from GitHub**
   On your browser, navigate to https://github.com/nihospr01/OpenSpeechPlatform-UCSD to download the latest release. You can either "clone the software on your computer" or "download ZIP file to your computer."

   (a) **Use the `git clone` method.**
   If you wish to clone, type `cd` in to your terminal, to make sure you are in the local directory. Then press clone in github, and copy the line of code generated into your terminal. Refer to Figure **??** for the expected output. Once it has cloned, type `cd nameofdirectory` (for example `cd OpenSpeechPlatform-UCSD`). Then, type `git pull` to get the latest version. This is the preferred approach. Refer to Figure **??** for the expected output.

   (b) **.zip file method** The downloaded .zip file should have "osp" attached to its name.

      i. Mac computers support opening .zip files. Once you download the .zip file, go to the "Downloads" within Finder and open the .zip file.

      ii. Debian-based Linux computers may need a third-party application (such as 7-Zip) to open the .zip file. Extract the folder within the .zip file and move it to an appropriate place within the file manager application.

4. After doing the git clone command or downloading and extracting the .zip file, **enter the command** `cd osp-release/staging/Software/Build-Scripts`**, to navigate to**

a folder named ”Build-Scripts” before proceeding to the next steps of the installation. You will install OSP’s software packages needed within this folder. Depending on your use, you will have multiple options and flexibility with regards to installation.

1.3 Choosing the Installation Method

You have several options to go about the installation process.

- Installing Everything - OSP and PHP version of EWS
- Installing Everything - OSP and Node.js version of EWS
- Installing/Updating just the OSP/RTMHA
- Installing/Updating just the PHP version of EWS
- Installing/Updating just the Node.js version of EWS

1.3.1 Installing Everything - OSP and PHP version of EWS

1. Run the command `./install_all_php`. This command will do the following:
   (a) Identify the operating system (OS) on your computer – currently OS X, Debian and Redhat/Fedora based Linux (it will work with apt-get and yum package managers)
   (b) Install all the pre-requisite software packages.
   (c) Build and install RT-MHA as well as the PHP version of EWS
   (d) Finally, it installs osp in `/usr/local/bin/osp` and a script to invoke ews in `/usr/local/bin/ews`.
2. To check whether the system has successfully installed in your system:

(a) In the current terminal, run `osp`, this should start running the OSP

(b) In a separate terminal type `ews`. This should start running the PHP version of ews.

(c) Open a Browser window and type the URL `0.0.0.0:8080`. This will open the webpage to the PHP version of EWS.

1.3.2 Installing Everything - OSP and Node.js version of EWS

1. Run the command `./install_all_njs`. This command will do the following:

   (a) Identify the operating system (OS) on your computer – currently OS X, Debian and Redhat/Fedora based Linux(It will work with apt-get and yum package managers).

   (b) Install all the pre-requisite software packages.

   (c) Build and install RT-MHA as well as the Node.js version of EWS.

2. To check whether the system has successfully installed in your system:

   (a) In the current terminal, run `osp`, this should start running the OSP

   (b) In a separate terminal type `ews-backend`. This should start running the backend of the Node.js version of EWS, this backend will also have the frontend built-in.

   (c) Open a Browser window and type the URL `0.0.0.0:5080`. This will open the webpage to the NodeJS version of EWS.

1.3.3 Installing just the OSP/RTMHA

1. **Usually only Needed on first install.** Run the command `./pre_req_all`. This command will identify your OS install all the necessary pre-requisite packages in your system

2. Run the command `./libosp`. This will install the librtmha and RTMHA in your system.

3. To check whether the OSP has successfully installed in your system, In the current terminal, run `osp`, this should start running the OSP.

1.3.4 Installing just the PHP version of EWS

1. **Usually only Needed on first install.** Run the command `./pre_req_all`. This command will identify your OS install all the necessary pre-requisite packages in your system

2. Run the command `./ews_php_public`. This will install the PHP version of EWS on your system.

3. To check the frontend run `ews` on the terminal, You can open a Browser window and type the URL `0.0.0.0:8080`. This will open the webpage to the PHP version of EWS.

1.3.5 Installing just the Node.js version of EWS

1. **Usually only Needed on first install.** Run the command `./pre_req_all`. This command will identify your OS install all the necessary pre-requisite packages in your system

2. Run the command `./ews_njs`. This will install the Node.js version of EWS on your system..

3. To check the EWS installation run `ews-backend` on the terminal, You can open a Browser window and type the URL `localhost:5000`. This will open the webpage to the Node.js version of EWS.

Chapter 2

Package Testing and Validation

This chapter describes how to check that the installed software package(s) for OSP are working properly.

2.1 Connecting Your Audio Device

2.1.1 On Mac Computers

1. Connect your audio device to your computer. You can do so in the following ways.

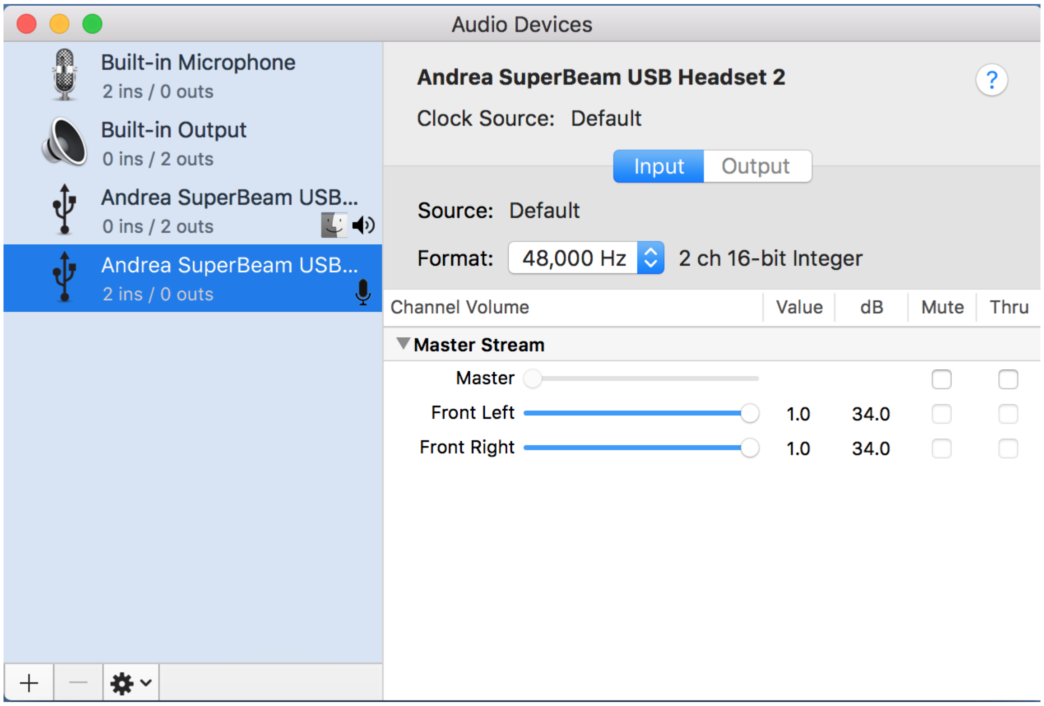
   (a) Connecting the device to the audio or USB port.

   (b) Connecting the device via Bluetooth.

2. **Open Audio MIDI Setup**: This can be found in `Finder | Applications | Utilities`. Figure 2.1 shows the settings for audio *input* and Figure 2.2 shows the settings for audio *output*.

   - For general audio headsets and headphones, set the format to 48,000 Hz. Levels should be 1.0.

- For any high end audio interface box (such as Zoom TAC-8), set the format to 48,000 Hz. (Additional step to guide the person to set the option to 24 bit.)



Built-in Microphone
2 ins / 0 outs

Built-in Output
0 ins / 2 outs

Andrea SuperBeam USB...
0 ins / 2 outs

Andrea SuperBeam USB...
2 ins / 0 outs

Andrea SuperBeam USB Headset 2

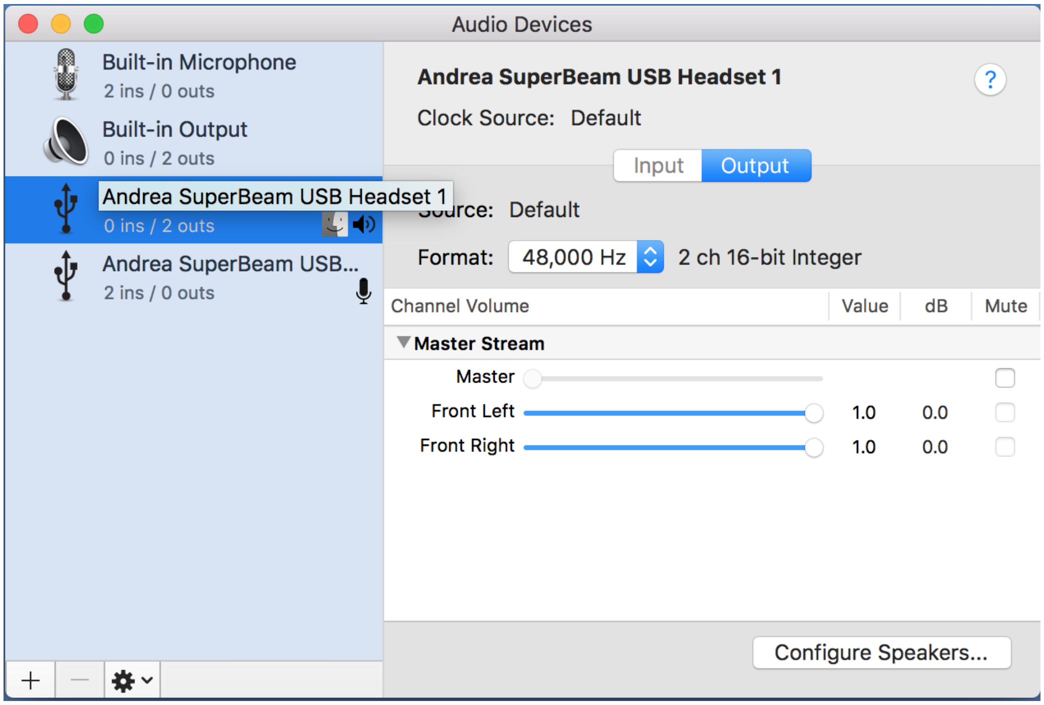
Clock Source: Default

Source: Default

Format: 48,000 Hz 2 ch 16-bit Integer

Channel Volume	Value	dB	Mute	Thru
Master Stream				
Master			□	□
Front Left	1.0	34.0	□	□
Front Right	1.0	34.0	□	□

Figure 2.1: Audio settings interface on a Mac computer for audio input. For most devices you should set the format to 48,000 Hz and the levels to 1.0.



Built-in Microphone
2 ins / 0 outs

Built-in Output
0 ins / 2 outs

Andrea SuperBeam USB Headset 1
0 ins / 2 outs

Andrea SuperBeam USB...
2 ins / 0 outs

Andrea SuperBeam USB Headset 1

Clock Source: Default

Source: Default

Format: 48,000 Hz 2 ch 16-bit Integer

Channel Volume	Value	dB	Mute
Master Stream			
Master			□
Front Left	1.0	0.0	□
Front Right	1.0	0.0	□

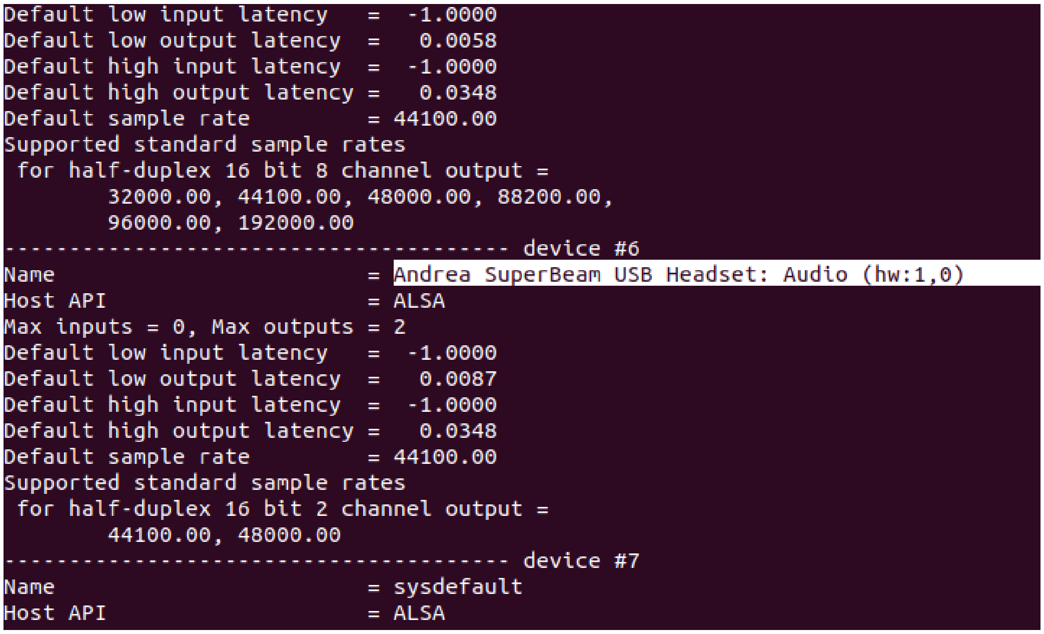
Figure 2.2: Audio settings interface on a Mac computer for audio output. For most devices you should set the format to 48,000 Hz and the levels to 1.0.

2.1.2 On Linux Computers

1. On Linux machines, the default audio is not set. Within the terminal, enter the command `pa_devs` to give the list of the available devices and the device numbers they correspond to.

2. Scroll up in the terminal to view a list of different devices and single-digit numbers associated with each device. Run the command `osp --input_device x --output_device y`, where `x` is the number associated with the device that inputs sound and `y` is the number associated with the device that ouputs sound.

   Figure 2.3, for example, shows the command issued as `osp --input_device 6 --output_device 6`, where 6 is the value associated to the connected audio device.



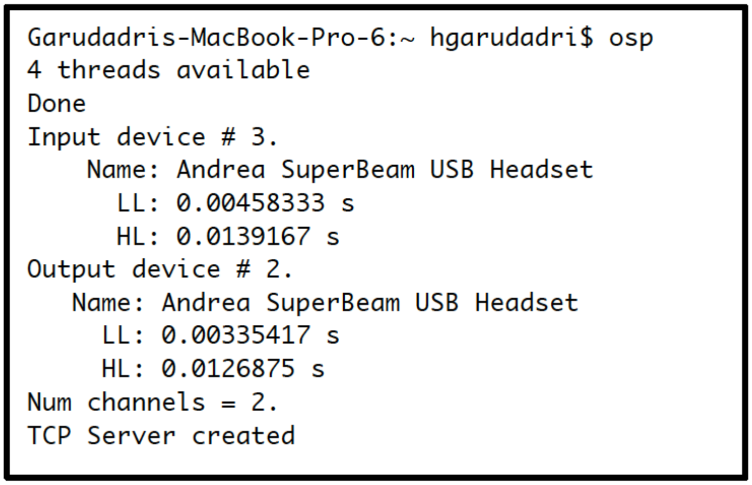
```
Default low input latency   =  -1.0000
Default low output latency  =   0.0058
Default high input latency  =  -1.0000
Default high output latency =   0.0348
Default sample rate         = 44100.00
Supported standard sample rates
 for half-duplex 16 bit 8 channel output =
        32000.00, 44100.00, 48000.00, 88200.00,
        96000.00, 192000.00
--------------------------------------- device #6
Name                        = Andrea SuperBeam USB Headset: Audio (hw:1,0)
Host API                    = ALSA
Max inputs = 0, Max outputs = 2
Default low input latency   =  -1.0000
Default low output latency  =   0.0087
Default high input latency  =  -1.0000
Default high output latency =   0.0348
Default sample rate         = 44100.00
Supported standard sample rates
 for half-duplex 16 bit 2 channel output =
        44100.00, 48000.00
--------------------------------------- device #7
Name                        = sysdefault
Host API                    = ALSA
```

Figure 2.3: List of devices displayed by running the **pa_devs** command

2.2 Test RT-MHA

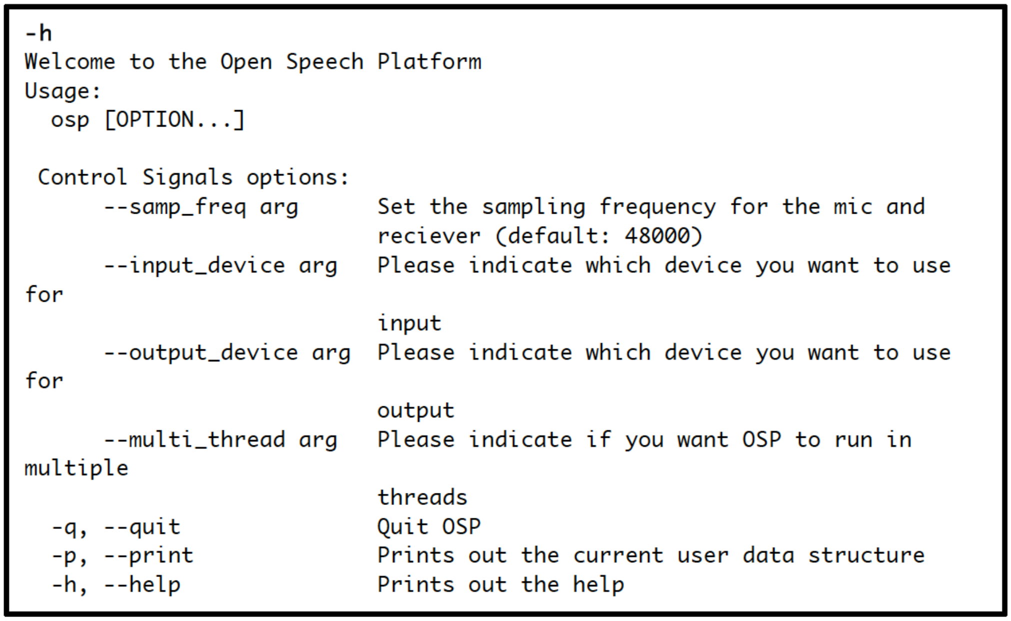
You can interact with RT-MHA from command line interface (CLI) to display and change the HA state. **Please make sure that the audio device is connected and that you can hear sound from the device. Otherwise, go back to section 2.1 to connect the device.**

1. Do not wear the audio device for now.
2. Open or navigate to your terminal and enter the command `osp`. The terminal should show results similar to Figure 2.4.
3. To familiarize you with the initial commands that OSP has, please enter the following series of commands and steps in the terminal.
   (a) `-p` This command will print the *complete state* of RT-MHA. In the terminal messages above, notice that the gain on the left and right channels is -20 dB, to account for overall gain of RT-MHA.
   (b) `--gain -15` This command, with a value of -15, will set the system volume to -15 dB. By default, the gain is set to -20 dB. By entering this command, you are making RT-MHA louder by 5 dB. The -15 value can be changed to a different value.
   (c) `-h` This command should help you experiment with OSP by generating a list of commands that you can use within OSP, shown in Figure 2.5.
4. Wear the audio device and make sure the audio output connection is stable. Enter the command `--gain -15` again and listen for external audio stimuli. This is how you know that RT-MHA is working.
5. The last command to enter is `-q`, which will quit OSP.



```
Garudadris-MacBook-Pro-6:~ hgarudadri$ osp
4 threads available
Done
Input device # 3.
    Name: Andrea SuperBeam USB Headset
      LL: 0.00458333 s
      HL: 0.0139167 s
Output device # 2.
   Name: Andrea SuperBeam USB Headset
     LL: 0.00335417 s
     HL: 0.0126875 s
Num channels = 2.
TCP Server created
```

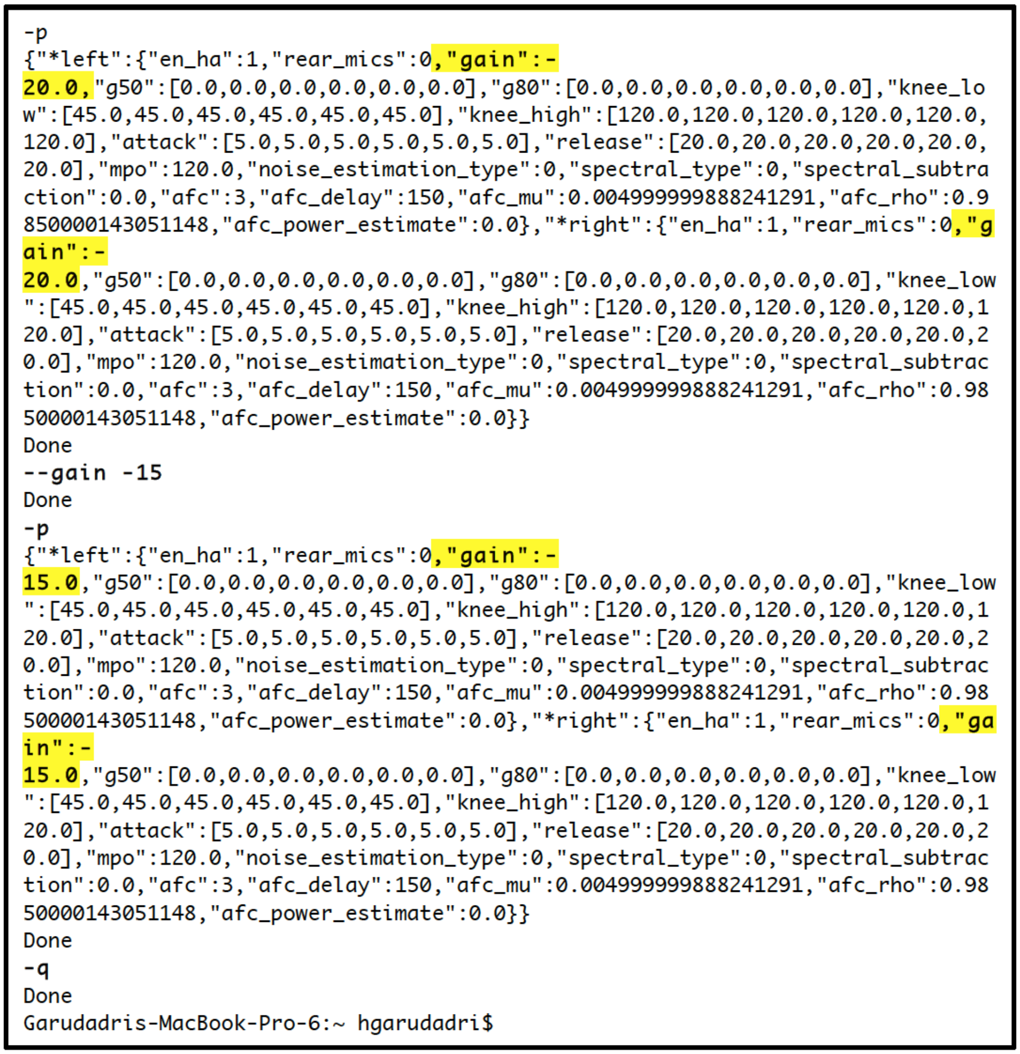
Figure 2.4: Output of the terminal when you issue `osp` command.



```
-h
Welcome to the Open Speech Platform
Usage:
  osp [OPTION...]

 Control Signals options:
      --samp_freq arg      Set the sampling frequency for the mic and
                           reciever (default: 48000)
      --input_device arg   Please indicate which device you want to use
for
                           input
      --output_device arg  Please indicate which device you want to use
for
                           output
      --multi_thread arg   Please indicate if you want OSP to run in
multiple
                           threads
  -q, --quit               Quit OSP
  -p, --print              Prints out the current user data structure
  -h, --help               Prints out the help
```

Figure 2.5: High level commands for **osp** using the command line interface (CLI).



```
-p
{"*left":{"en_ha":1,"rear_mics":0,"gain":-
20.0,"g50":[0.0,0.0,0.0,0.0,0.0,0.0],"g80":[0.0,0.0,0.0,0.0,0.0,0.0],"knee_lo
w":[45.0,45.0,45.0,45.0,45.0,45.0],"knee_high":[120.0,120.0,120.0,120.0,120.0,
120.0],"attack":[5.0,5.0,5.0,5.0,5.0,5.0],"release":[20.0,20.0,20.0,20.0,20.0,
20.0],"mpo":120.0,"noise_estimation_type":0,"spectral_type":0,"spectral_subtra
ction":0.0,"afc":3,"afc_delay":150,"afc_mu":0.004999999888241291,"afc_rho":0.9
850000143051148,"afc_power_estimate":0.0},"*right":{"en_ha":1,"rear_mics":0,"g
ain":-
20.0,"g50":[0.0,0.0,0.0,0.0,0.0,0.0],"g80":[0.0,0.0,0.0,0.0,0.0,0.0],"knee_low
":[45.0,45.0,45.0,45.0,45.0,45.0],"knee_high":[120.0,120.0,120.0,120.0,120.0,1
20.0],"attack":[5.0,5.0,5.0,5.0,5.0,5.0],"release":[20.0,20.0,20.0,20.0,20.0,2
0.0],"mpo":120.0,"noise_estimation_type":0,"spectral_type":0,"spectral_subtrac
tion":0.0,"afc":3,"afc_delay":150,"afc_mu":0.004999999888241291,"afc_rho":0.98
50000143051148,"afc_power_estimate":0.0}}
Done
--gain -15
Done
-p
{"*left":{"en_ha":1,"rear_mics":0,"gain":-
15.0,"g50":[0.0,0.0,0.0,0.0,0.0,0.0],"g80":[0.0,0.0,0.0,0.0,0.0,0.0],"knee_low
":[45.0,45.0,45.0,45.0,45.0,45.0],"knee_high":[120.0,120.0,120.0,120.0,120.0,1
20.0],"attack":[5.0,5.0,5.0,5.0,5.0,5.0],"release":[20.0,20.0,20.0,20.0,20.0,2
0.0],"mpo":120.0,"noise_estimation_type":0,"spectral_type":0,"spectral_subtrac
tion":0.0,"afc":3,"afc_delay":150,"afc_mu":0.004999999888241291,"afc_rho":0.98
50000143051148,"afc_power_estimate":0.0},"*right":{"en_ha":1,"rear_mics":0,"ga
in":-
15.0,"g50":[0.0,0.0,0.0,0.0,0.0,0.0],"g80":[0.0,0.0,0.0,0.0,0.0,0.0],"knee_low
":[45.0,45.0,45.0,45.0,45.0,45.0],"knee_high":[120.0,120.0,120.0,120.0,120.0,1
20.0],"attack":[5.0,5.0,5.0,5.0,5.0,5.0],"release":[20.0,20.0,20.0,20.0,20.0,2
0.0],"mpo":120.0,"noise_estimation_type":0,"spectral_type":0,"spectral_subtrac
tion":0.0,"afc":3,"afc_delay":150,"afc_mu":0.004999999888241291,"afc_rho":0.98
50000143051148,"afc_power_estimate":0.0}}
Done
-q
Done
Garudadris-MacBook-Pro-6:~ hgarudadri$
```

Figure 2.6:   in the terminal.

2.3 Test EWS - PHP version

1. For testing EWS, open two terminals side by side.
2. In the first terminal, type `osp`. In the second terminal, type `ews`.
3. Open a browser, such as Chrome. Enter `http://localhost:8000` in

the search bar. You will see the landing page as shown in Figure 2.8.

4. There are several blue-green buttons with labels. Navigate and click the one labeled "Researcher Page". What you should see is the Researcher Page interface, similar to Figure 2.8

5. You should be within the "Amplification" page. Pay attention to the settings area labeled "Control via", which have buttons to toggle either "G50/G80" or "CR/65". Choose "CR/G65".

6. You can now change gains in individual bands by entering numerical values for individual cells in the G65 row. In the G65/All cell, enter 5 for the value. You should see new values for RT-MHA highlighted.

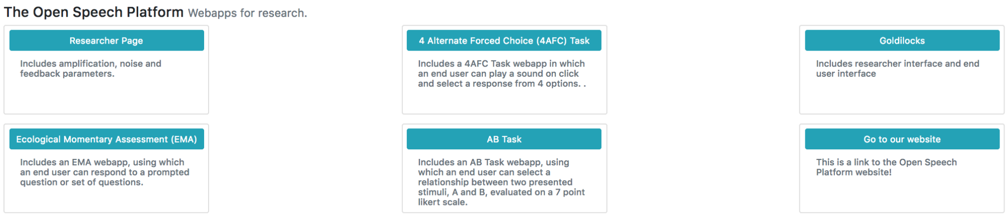
7. Wear your connected audio device. Press the "Transmit" button below and listen. Your audio experience should be similar to when you entered the `--gain -15` command in the terminal.

8. Navigate to the terminal where you entered the `osp` command. Enter `-p`. You will notice values for the different settings for both the left and right audio channels: overall gain is -20, compression ratio (CR) is 1, and G65 is 5.

9. Navigate back to the Researcher Page on your browser. You should still be in the Amplification section. Navigate to the 3 cells corresponding to the G65 row and columns 250, 500, and 1000. Enter -15 for each cell. By setting this value for the 3 cells, you are setting a -15 dB attenuation for the 250, 500, and 1000 Hz frequencies.

10. Press the "Transmit" button below and listen. As a result of changing these values, you will notice that the low frequency noise is significantly reduced. Depending the headsets you are using, your experience might be different.

11. When you are finished, be sure to close both terminals to make sure you don't receive errors from the terminal from accidentally running OSP or EWS twice.



The Open Speech Platform Webapps for research.

Researcher Page

Includes amplification, noise and feedback parameters.

4 Alternate Forced Choice (4AFC) Task

Includes a 4AFC Task webapp in which an end user can play a sound on click and select a response from 4 options. .

Goldilocks

Includes researcher interface and end user interface

Ecological Momentary Assessment (EMA)

Includes an EMA webapp, using which an end user can respond to a prompted question or set of questions.

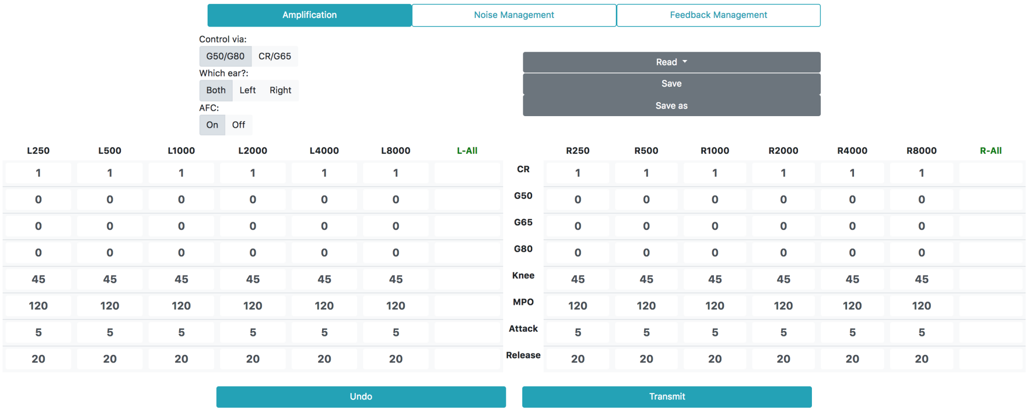
AB Task

Includes an AB Task webapp, using which an end user can select a relationship between two presented stimuli, A and B, evaluated on a 7 point likert scale.

Go to our website

This is a link to the Open Speech Platform website!

Figure 2.7: OSP Landing Page. Some of the apps are not yet connected to RT-MHA, but included here for early feedback on the user interface. These in progress web-apps are 4AFC and AB Task apps.



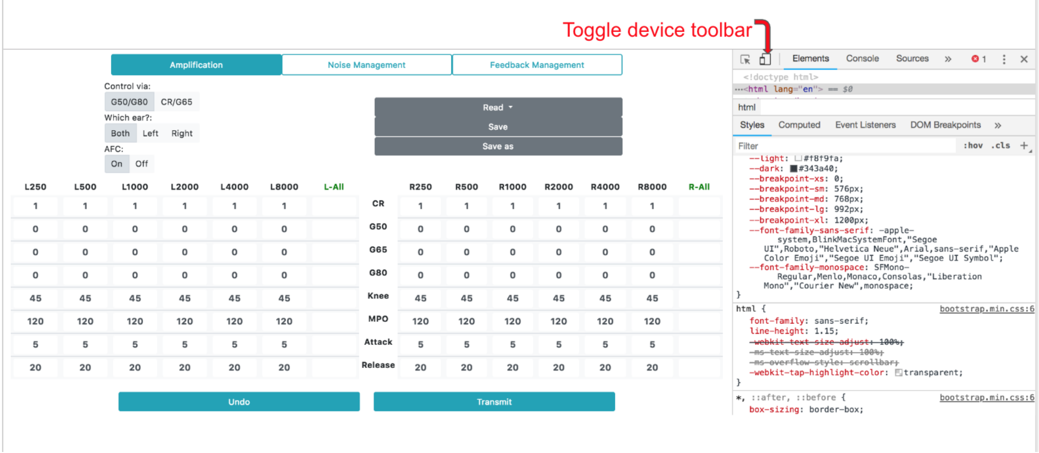
Control via: G50/G80 CR/G65

Which ear?: Both Left Right

AFC: On Off

L250	L500	L1000	L2000	L4000	L8000	L-All		R250	R500	R1000	R2000	R4000	R8000	R-All
1	1	1	1	1	1		CR	1	1	1	1	1	1	
0	0	0	0	0	0		G50	0	0	0	0	0	0	
0	0	0	0	0	0		G65	0	0	0	0	0	0	
0	0	0	0	0	0		G80	0	0	0	0	0	0	
45	45	45	45	45	45		Knee	45	45	45	45	45	45	
120	120	120	120	120	120		MPO	120	120	120	120	120	120	
5	5	5	5	5	5		Attack	5	5	5	5	5	5	
20	20	20	20	20	20		Release	20	20	20	20	20	20	

Figure 2.8: OSP Researcher Page. You can change Amplification, Noise Management and Feedback Management values from the first, second and third tabs, respectively.



Control via: [✓ G50/G80] CR/G65

Which ear?: [✓ Both] Left Right

AFC: [✓ On] Off

L250	L500	L1000	L2000	L4000	L8000	L-All		R250	R500	R1000	R2000	R4000	R8000	R-All
1	1	1	1	1	1		CR	1	1	1	1	1	1	
0	0	0	0	0	0		G50	0	0	0	0	0	0	
0	0	0	0	0	0		G65	0	0	0	0	0	0	
0	0	0	0	0	0		G80	0	0	0	0	0	0	
45	45	45	45	45	45		Knee	45	45	45	45	45	45	
120	120	120	120	120	120		MPO	120	120	120	120	120	120	
5	5	5	5	5	5		Attack	5	5	5	5	5	5	
20	20	20	20	20	20		Release	20	20	20	20	20	20	

```
<!doctype html>
…<html lang="en"> == $0
```

```
  --light: #f8f9fa;
  --dark: #343a40;
  --breakpoint-xs: 0;
  --breakpoint-sm: 576px;
  --breakpoint-md: 768px;
  --breakpoint-lg: 992px;
  --breakpoint-xl: 1200px;
  --font-family-sans-serif: -apple-
      system,BlinkMacSystemFont,"Segoe
    UI",Roboto,"Helvetica Neue",Arial,sans-serif,"Apple
    Color Emoji","Segoe UI Emoji","Segoe UI Symbol";
  --font-family-monospace: SFMono-
      Regular,Menlo,Monaco,Consolas,"Liberation
    Mono","Courier New",monospace;
}
html {                                      bootstrap.min.css:6
  font-family: sans-serif;
  line-height: 1.15;
  ~~-webkit-text-size-adjust: 100%;~~
  ~~-ms-text-size-adjust: 100%;~~
  ~~-ms-overflow-style: scrollbar;~~
  -webkit-tap-highlight-color: transparent;
}
*, ::after, ::before {                      bootstrap.min.css:6
  box-sizing: border-box;
```

Figure 2.9: OSP Web Apps in Console Mode. If you are using a browser such as Chrome, you can right click in the browser window and choose Inspect. In this mode, you can view exchange of information between RT-MHA and the app. You can also change the app to be formatted for laptop and mobile devices using the Toggle Device Toolbar.

Chapter 3

Development - EWS Node.js version

This section is useful if you want to perform development on the Node.js version of the EWS. **Please make sure that you have all the necessary packages installed in your computer before moving forward with this section. Otherwise, go back to 1.3.2 or 1.3.5 to either install OSP and EWS - Node.js version or just EWS - Node.js version.**

Now you have the following options:

1. **Executing the Compiled Node.js Backend**-Run the command `./ews_njs`. This will install the Node.js version of EWS on your system(which also contains the frontend) and will automatically execute the Node.js backend.
2. **Executing just the Node.js backend**-Run the command `./ews_njs_backend`.This will execute the Node.js backend from the /usr/local/bin directory where it has been installed
3. **Executing just the Node.js frontend**-Run the command `./ews_njs_frontend`.This will execute the Node.js frontend from the local /osp-release-staging/Software directory.

4. **Executing the Node.js backend in development mode**-Run the command `./ews_njs_dev`. This will execute the Node.js backend in live development mode(using watch), any changes you make to the backend will be instantly reflected live in the webpages and recompiled to the backend(**Note: This code will not compile the frontend into the backend, for that you will need to run the script in step 1**)