Installing STM32CubeIDE in Linux Mint 21.1 and in Windows 10, and compiling and uploading the STM32F411 USB Audio DAC firmware.

Download STM32CubeIDE for Debian from here: https://www.st.com/en/development-tools/stm32cubeide.html - register or confirm with and email) – the file is named:
en.st-stm32cubeide_1.11.2_14494_20230119_0724.unsigned_amd64.deb_bundle.sh.zip

Extract the file in the Download folder, open a terminal and make it executable then run it:
sudo chmod +x ***.sh
sudo ./***.sh

Ignore the message about the sandbox etc., and reboot for the new udev rules to take effect.

Then run STM32CubeIDE and select a default workspace such as /home/user/STM32CubeIDE/workspace/, and then select File -> New -> STM32Project. Wait a few minutes until the message about a target selector appears then select your STM32 MCU - in this case type STM32F411CEU6 in the top lefthand box then select it in the bottom table and press Next.

Wait until the STM32F411 definition files (and any updates) have been downloaded and installed.

You can then follow the instructions https://community.st.com/s/question/0D53W00000HNrEsSAL/how-to-install-stm32cubeide-on-ubuntu further for doing a quick blinky test, or just cancel the project and start with the new USB Audio DAC project below. Remember to connect the MCU and the ST-Link-USB adapter to the PC.

Download the zip file from here https://github.com/har-in-air/STM32F411_USB_AUDIO_DAC and extract it in /home/user/STM32CubeIDE/workspace/. Then remove the -main part of the extracted folder and open CubeIDE.

Choose File -> New -> Makefile Project with Existing Code, browse to the STM32F411_USB_AUDIO_DAC folder and select it. Choose MCU Arm GCC – see below, and press Finish:
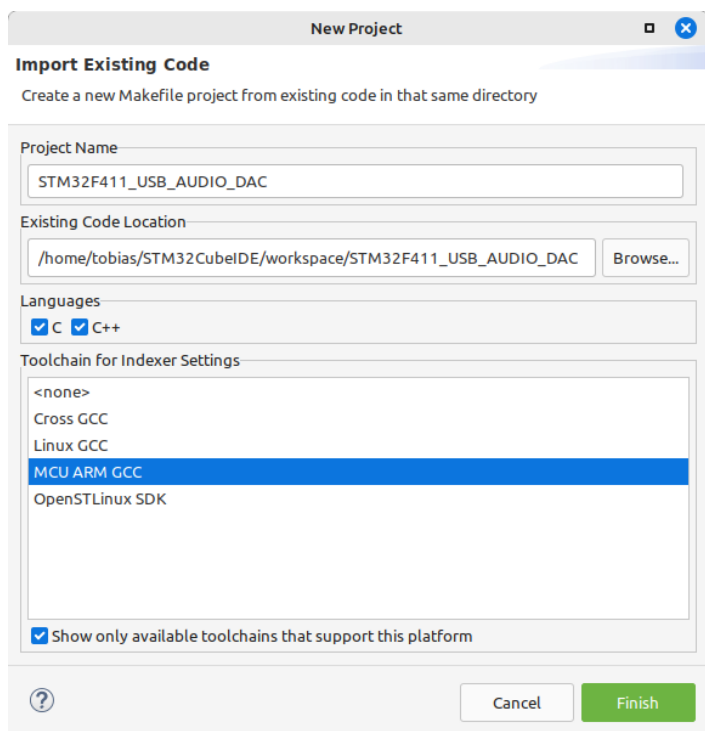
Open the Makefile and comment out the STM32F401 section and uncomment the STM32F411 section (3 lines each), and save the makefile. Then press Project -> Build Project - it should complete the build - see below:
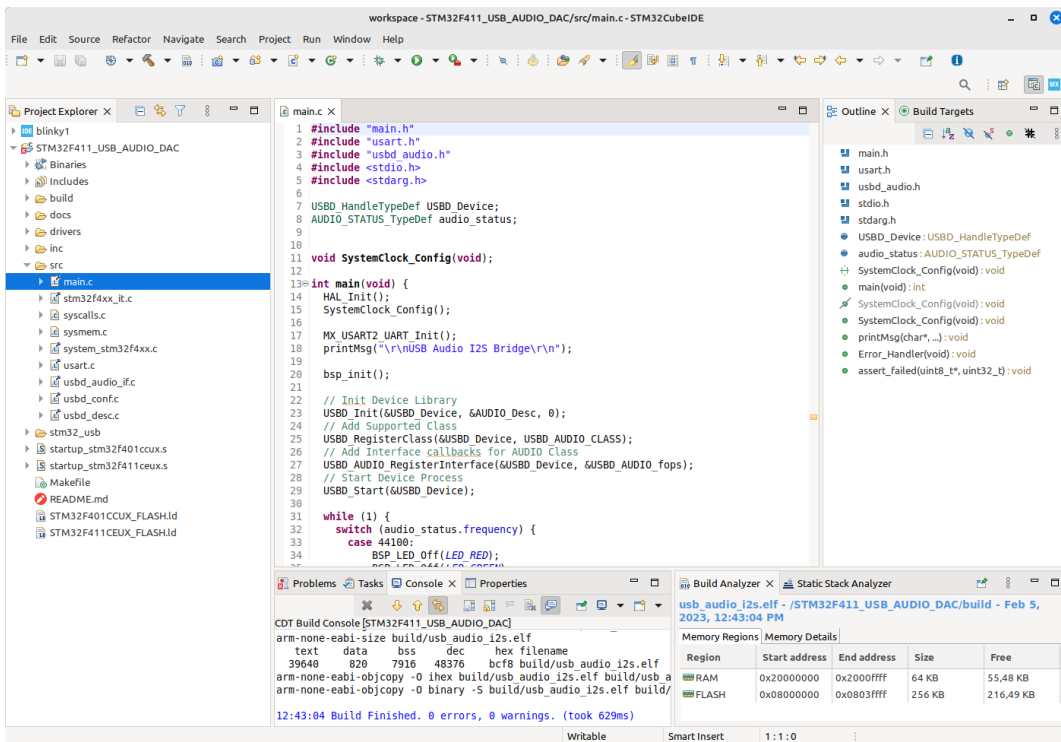
You can check in the build subfolder for the binaries files .bin and .hex – which you can use to program the MCU using STM32CubeProgrammer or continue to use the IDE to upload the code.

Press the Run button see below, then OK:
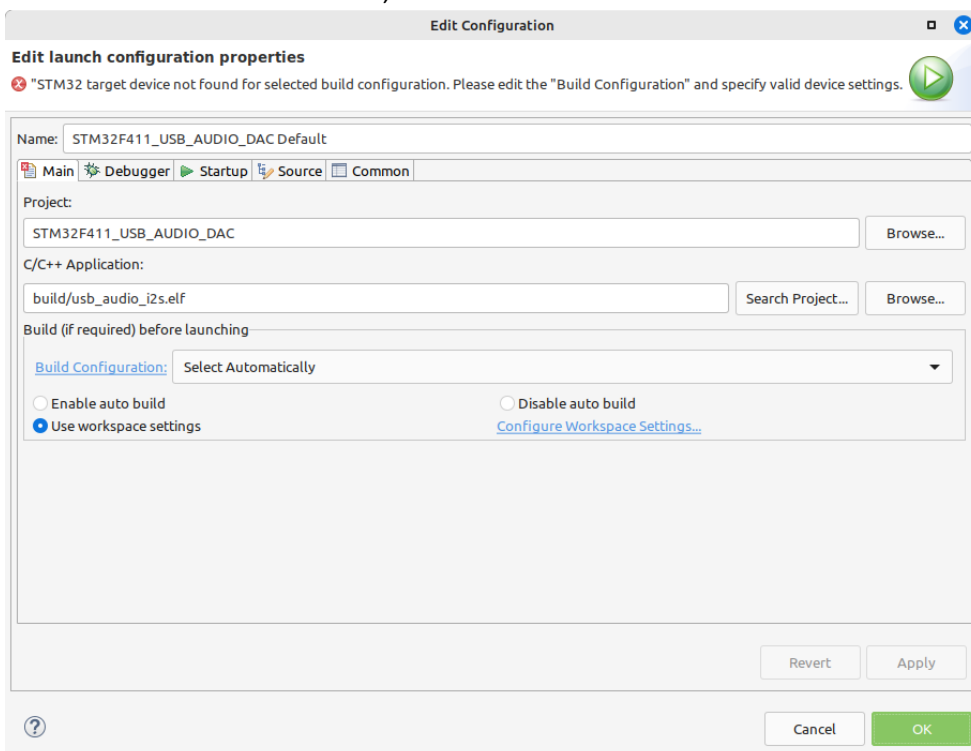
Then it will complete the upload:
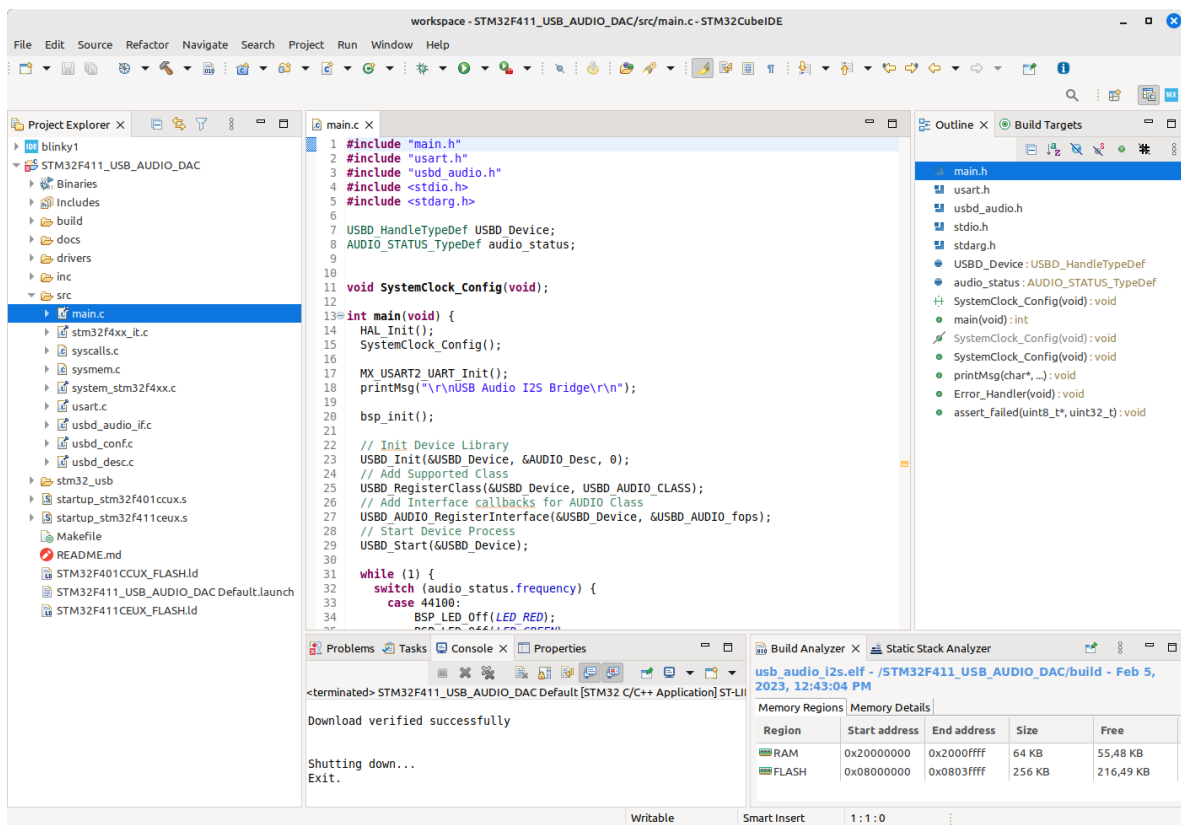
You can now close the IDE, unplug the ST-Link and plug the STM32F411 in with its own USB adapter – it should show up as a new USB Audio device using aplay -L

For windows 10 install the CubeIDE using the exe file and extract the Github files under the windows assigned workspace. Then follow the same instructions as for Linux above – refer to the set of screen dumps below – no changes were made to the default options offered.

Screenshot 1 — Makefile view (STM32CubeIDE)

```
1
2 #######################################
3 # target
4 #######################################
5 TARGET = usb_audio_i2s
6
7 # To build for STM32F411CEU6 versus STM32F401CCU6
8 # set ASM_SOURCES, CPU_DEF and LDSCRIPT below
9
10 # STM32F411CEU6 Black Pill (512kB flash, 256kB RAM, 100MHz)
11 CPU_DEF = STM32F411xE
12 ASM_SOURCES =  startup_stm32f411ceux.s
13 LDSCRIPT = STM32F411CEUX_FLASH.ld
14
15 # STM32F401CCU6 Black Pill (256kB flash, 64kB RAM, 84MHz)
16 #CPU_DEF = STM32F401xC
17 #ASM_SOURCES = startup_stm32f401ccux.s
18 #LDSCRIPT = STM32F401CCUX_FLASH.ld
19
20
21 #######################################
22 # building variables
23 #######################################
24 # debug build?
25 DEBUG = 0
26 # optimization
27 OPT = -O2
28
29 #######################################
30 # paths
31 #######################################
32 # Build path
33 BUILD_DIR = build
34
35 #######################################
36 # source
37 #######################################
```

Problems — 2 errors, 3 warnings, 0 others

Description	Resource	Path	Location	Type
Errors (2 items)				
Program "g++" not found in PATH	STM32F411_U...		Project Prope...	C/C++ Scann...
Program "gcc" not found in PATH	STM32F411_U...		Project Prope...	C/C++ Scann...
Warnings (3 items)				
#warning "FPU is not initialized, but the projec	main.c	/F411-P1/Src	line 22	C/C++ Probl...
Invalid project path: Include path not found (C	F411-P2		pathentry	Path Entry Pr...
Invalid project path: Include path not found (C	F411-P3		pathentry	Path Entry Pr...

Screenshot 2 — main.c view (STM32CubeIDE)

```
1 #include "main.h"
2 #include "usart.h"
3 #include "usbd_audio.h"
4 #include <stdio.h>
5 #include <stdarg.h>
6
7 USBD_HandleTypeDef USBD_Device;
8 AUDIO_STATUS_TypeDef audio_status;
9
10
11 void SystemClock_Config(void);
12
13 int main(void) {
14   HAL_Init();
15   SystemClock_Config();
16
17   MX_USART2_UART_Init();
18   printMsg("\r\nUSB Audio I2S Bridge\r\n");
19
20   bsp_init();
21
22   // Init Device Library
23   USBD_Init(&USBD_Device, &AUDIO_Desc, 0);
24   // Add Supported Class
25   USBD_RegisterClass(&USBD_Device, USBD_AUDIO_CLASS);
26   // Add Interface callbacks for AUDIO Class
27   USBD_AUDIO_RegisterInterface(&USBD_Device, &USBD_AUDIO_fops);
28   // Start Device Process
29   USBD_Start(&USBD_Device);
30
31   while (1) {
32     switch (audio_status.frequency) {
33       case 44100:
34         BSP_LED_Off(LED_RED);
35         BSP_LED_Off(LED_GREEN);
36         BSP_LED_On(LED_BLUE);
37         break;
```

Problems — 2 errors, 3 warnings, 0 others

Description	Resource	Path	Location	Type
Errors (2 items)				
Program "g++" not found in PATH	STM32F411_U...		Project Prope...	C/C++ Scann...
Program "gcc" not found in PATH	STM32F411_U...		Project Prope...	C/C++ Scann...
Warnings (3 items)				
#warning "FPU is not initialized, but the projec	main.c	/F411-P1/Src	line 22	C/C++ Probl...
Invalid project path: Include path not found (C	F411-P2		pathentry	Path Entry Pr...
Invalid project path: Include path not found (C	F411-P3		pathentry	Path Entry Pr...

Edit Configuration

Edit launch configuration properties

❌ [Main]: "STM32 target device not found for selected build configuration. Please edit the "Build Configuration" and specify valid device settings.

Name: usb_audio_i2s

Main | **Debugger** | **Startup** | **Source** | **Common**

GDB Connection Settings

◉ Autostart local GDB server   Host name or IP address   localhost

○ Connect to remote GDB server   Port number   61234

Debug probe   ST-LINK (ST-LINK GDB server) ▾

GDB Server Command Line Options

[Show Command Line]

Interface

◉ SWD   ○ JTAG

☐ ST-LINK S/N [＿＿＿＿＿＿＿＿＿＿＿＿▾] [Scan]

Frequency (kHz): [Auto ▾]

Access port: [0 ▾]

Reset behaviour

Type: [Connect under reset ▾]

Device settings

Debug in low power modes: [Enable ▾]

[Revert] [Apply]

?   [OK] [Cancel]

Edit Configuration

Edit launch configuration properties

❌ [Main]: "STM32 target device not found for selected build configuration. Please edit the "Build Configuration" and specify valid device settings.

Name: usb_audio_i2s

Main | **Debugger** | **Startup** | **Source** | **Common**

Initialization Commands

[   ]

Load Image and Symbols

File	Build	Download	Load symbols	
▶ build/usb_audio_i2s.elf [STM32F411_USB_AUDIO_DAC]	See Main tab	✓ true	✓ true	

[Add...]
[Edit...]
[Remove]
[Move up]
[Move down]

Runtime Options

Start Address

◉ Default start address

○ Set program counter (hex): [＿＿＿＿＿＿＿]

○ Specify vector table (hex): [＿＿＿＿＿＿＿]

☑ Set breakpoint at: [＿＿＿＿＿＿＿]

[Revert] [Apply]

?   [OK] [Cancel]

Edit Configuration

Edit launch configuration properties

❌ [Main]: "STM32 target device not found for selected build configuration. Please edit the "Build Configuration" and specify valid device settings.

Name: usb_audio_i2s

📄 Main | 🐞 Debugger | ▶ Startup | 🔍 Source | 🔲 Common

Source Lookup Path:

- 📂 Default
  - 📄 Absolute File Path
  - 📄 Program Relative File Path
  - 📂 STM32F411_USB_AUDIO_DAC
    - 📂 .settings - \STM32F411_USB_AUDIO_DAC
    - 📂 build - \STM32F411_USB_AUDIO_DAC
    - 📂 docs - \STM32F411_USB_AUDIO_DAC
    - 📂 drivers - \STM32F411_USB_AUDIO_DAC
    - 📂 inc - \STM32F411_USB_AUDIO_DAC
    - 📂 src - \STM32F411_USB_AUDIO_DAC
    - 📂 stm32_usb - \STM32F411_USB_AUDIO_DAC

Add...
Edit...
Remove
Up
Down
Restore Default

☐ Search for duplicate source files on the path

Revert | Apply

? | OK | Cancel

Edit Configuration

Edit launch configuration properties

❌ [Main]: "STM32 target device not found for selected build configuration. Please edit the "Build Configuration" and specify valid device settings.

Name: usb_audio_i2s

📄 Main | 🐞 Debugger | ▶ Startup | 🔍 Source | 🔲 Common

Save as
- ○ Local file
- ◉ Shared file: \STM32F411_USB_AUDIO_DAC   Browse...

Display in favorites menu
- ☐ 🐞 Debug
- ☐ ▶ Run

Encoding
- ◉ Default - inherited (UTF-8)
- ○ Other   ISO-8859-1

Standard Input and Output
- ☑ Allocate console (necessary for input)
- ☐ Input File:
  - Workspace... | File System... | Variables...
- ☐ Output File:
  - Workspace... | File System... | Variables...
- ☐ Append

☑ Launch in background
☑ Terminate child-processes if terminating the launched process

Revert | Apply

? | OK | Cancel

STM32CubeIDE Window

workspace - STM32F411_USB_AUDIO_DAC/src/main.c - STM32CubeIDE

File Edit Source Refactor Navigate Search Project Run Window Help

Project Explorer

- F411-P1
- F411-P2
- F411-P3
- STM32F411_USB_AUDIO_DAC
  - Binaries
  - Includes
  - build
  - docs
  - drivers
  - inc
  - src
    - main.c
    - stm32f4xx_it.c
    - syscalls.c
    - sysmem.c
    - system_stm32f4xx.c
    - usart.c
    - usbd_audio_if.c
    - usbd_conf.c
    - usbd_desc.c
  - stm32_usb
  - startup_stm32f401ccux.s
  - startup_stm32f411ceux.s
  - Makefile
  - README.md
  - STM32F401CCUX_FLASH.ld
  - STM32F411CEUX_FLASH.ld
  - usb_audio_i2s.launch

```c
1  #include "main.h"
2  #include "usart.h"
3  #include "usbd_audio.h"
4  #include <stdio.h>
5  #include <stdarg.h>
6
7  USBD_HandleTypeDef USBD_Device;
8  AUDIO_STATUS_TypeDef audio_status;
9
10
11 void SystemClock_Config(void);
12
13 int main(void) {
14   HAL_Init();
15   SystemClock_Config();
16
17   MX_USART2_UART_Init();
18   printMsg("\r\nUSB Audio I2S Bridge\r\n");
19
20   bsp_init();
21
22   // Init Device Library
23   USBD_Init(&USBD_Device, &AUDIO_Desc, 0);
24   // Add Supported Class
25   USBD_RegisterClass(&USBD_Device, USBD_AUDIO_CLASS);
26   // Add Interface callbacks for AUDIO Class
27   USBD_AUDIO_RegisterInterface(&USBD_Device, &USBD_AUDIO_fops);
28   // Start Device Process
29   USBD_Start(&USBD_Device);
30
31   while (1) {
32     switch (audio_status.frequency) {
33       case 44100:
34         BSP_LED_Off(LED_RED);
35         BSP_LED_Off(LED_GREEN);
36         BSP_LED_On(LED_BLUE);
37         break;
```

Outline
- main.h
- usart.h
- usbd_audio.h
- stdio.h
- stdarg.h
- USBD_Device : USBD_HandleTypeDef
- audio_status : AUDIO_STATUS_TypeDef
- SystemClock_Config(void) : void
- main(void) : int
- SystemClock_Config(void) : void
- SystemClock_Config(void) : void
- printMsg(char*, ...) : void
- Error_Handler(void) : void
- assert_failed(uint8_t*, uint32_t) : void

Console
<terminated> usb_audio_i2s [STM32 C/C++ Application] ST-LINK (ST-LINK GDB server) (Terminated 06 Feb 2023, 09:15:10) [pid: 26]

Verifying ...

Download verified successfully

Shutting down...
Exit.

Build Analyzer
usb_audio_i2s.elf - /STM32F411_USB_AUDIO_DAC/build - 06 Feb 2023, 09:13:30

Memory Regions | Memory Details

Region	Start address	End address	Size	Free	Used
RAM	0x20000000	0x2001ffff	128 KB	96,98 KB	31,02 KB
FLASH	0x08000000	0x0807ffff	512 KB	472,39 KB	39,61 KB

Windows Sound Settings

Sound

Output

Choose your output device

Speakers (PCM5102A DAC)

Certain apps may be set up to use different sound devices than the one selected here. Customize app volumes and devices in advanced sound options.

Device properties

Master volume

34

Troubleshoot

Manage sound devices

Input

Choose your input device

Microphone (Creative SB X-F...)

Certain apps may be set up to... selected here. Customize app... options.

Device properties

Test your microphone

Troubleshoot

Manage sound devices

Advanced sound options

Related Settings

Bluetooth and other devices

Sound Control Panel

Microphone privacy settings

Ease of Access audio settings

Help from the web

Troubleshooting Audio problem with Windows update KB5015878

Turning on spatial sound

Setting up a microphone

Fixing sound problems

Get help

Speakers Properties

General | Levels | Enhancements | Advanced | Spatial sound

Default Format

Select the sample rate and bit depth to be used when running in shared mode.

24 bit, 48000 Hz (Studio Quality)

- 24 bit, 44100 Hz (Studio Quality)
- 24 bit, 48000 Hz (Studio Quality)
- 24 bit, 96000 Hz (Studio Quality)

Test

☑ Allow applications to take exclusive control of this device
☑ Give exclusive mode applications priority

Restore Defaults

OK   Cancel   Apply

Settings Navigation
- Home
- System
- Display
- Sound
- Notifications & actions
- Focus assist
- Power & sleep
- Storage
- Tablet
- Multitasking
- Projecting to this PC
- Shared experiences
- Clipboard
- Remote Desktop
- About