**Enabling Bluetooth Audio and Audio Subsystem on Jetson Devices**

**Bluetooth Audio: Hardware Support Overview**

* Bluetooth audio is **disabled by default** to maintain product conformance.
* **Module and SoC Support:**
  + Jetson AGX Orin (T234): Support status TBD
  + Jetson Xavier NX series (T194): Supported
  + Jetson AGX Xavier series (T194): Supported
  + Jetson Nano/Nano 2GB: Requires USB Bluetooth adapter

**Steps to Enable Bluetooth Audio**

**1. Modify Bluetooth Service Configuration**

* Edit the systemd service file using command:

sudo nano /lib/systemd/system/bluetooth.service.d/nv-bluetooth-service.conf

* Change this line

ExecStart=/usr/lib/bluetooth/bluetoothd -d --noplugin=audio,a2dp,avrcp

To this:

ExecStart=/usr/lib/bluetooth/bluetoothd -d

*(Delete the --noplugin option and all its values)*

**2. Install PulseAudio Bluetooth Module**

* Update package list and install module using command:

sudo apt-get update

sudo apt-get install pulseaudio-module-bluetooth

**3. Reboot the Device**

* Reboot to apply changes using command:

sudo reboot

**4. Pair and Connect Bluetooth Headset**

* Use bluetoothctl or GUI tools after reboot to pair and connect.

**Audio Setup and Development**

**Key Components**

* **ASoC Driver:** Manages audio routing between hardware blocks (I2S, DMIC, DSPK, etc.).
* **Audio Hub (AHUB):** Hardware block for audio processing with modules:
  + I2S: 6 bidirectional audio interfaces
  + DMIC: 4 digital microphone controllers
  + DSPK: 2 digital speaker interfaces
  + Mixer/AMX/ADX: Audio multiplexing/demultiplexing

**Steps for Configuration Workflow**

**1] Device Tree Setup**

* Example I2S node configuration using command:

tegra\_i2s1: i2s@2901000 {

compatible = "nvidia,tegra210-i2s";

reg = <0x0 0x2901000 0x0 0x100>;

clocks = <&bpmp\_clks TEGRA194\_CLK\_I2S1>;

status = "okay";

};

2] **Dynamic Audio Routing**

* Use amixer to configure audio paths using command:

amixer -c APE cset name='I2S1 Mux' 'ADMAIF1'

**3] Runtime Parameters**

* Set sample rate and format for playback using command:

aplay -D hw:0,0 -r 48000 -f S16\_LE audio.wav

**Troubleshooting Tips**

**1] Verify ALSA Configuration** using command:

aplay -l *# List playback devices*

arecord -l *# List capture devices*

**2] Check Kernel Messages** using command:

dmesg | grep -i audio

**3] Test Audio Hardware** using command:

speaker-test -c 2 -t wav *# Test stereo output*

**High-Definition Audio (HDA) Support**

* **HD Audio Header:** Exposes Intel HDA-compatible interface for codecs.
* **Typical Use Case:** Connect external audio codecs via hda-analog or hda-digital nodes.

**Summary**

* Bluetooth audio is disabled by default; enable by editing the service file and installing the PulseAudio Bluetooth module.
* The Jetson audio subsystem uses the ASoC driver and AHUB hardware for flexible, high-performance audio routing.
* Use ALSA utilities (amixer, aplay, arecord) for configuration, playback, and troubleshooting.
* For custom audio pipelines, refer to /etc/asound.conf and NVIDIA Audio Hub documentation.