File input & Convolution

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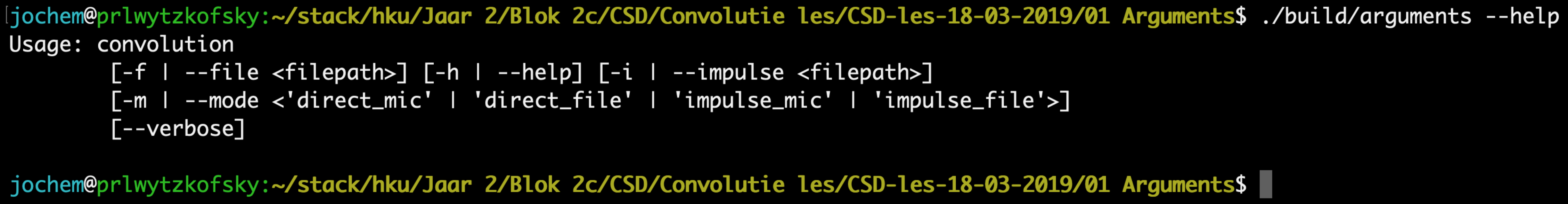
File input & Convolution

- Arguments
- File playback
- Convolution code
- Assignments

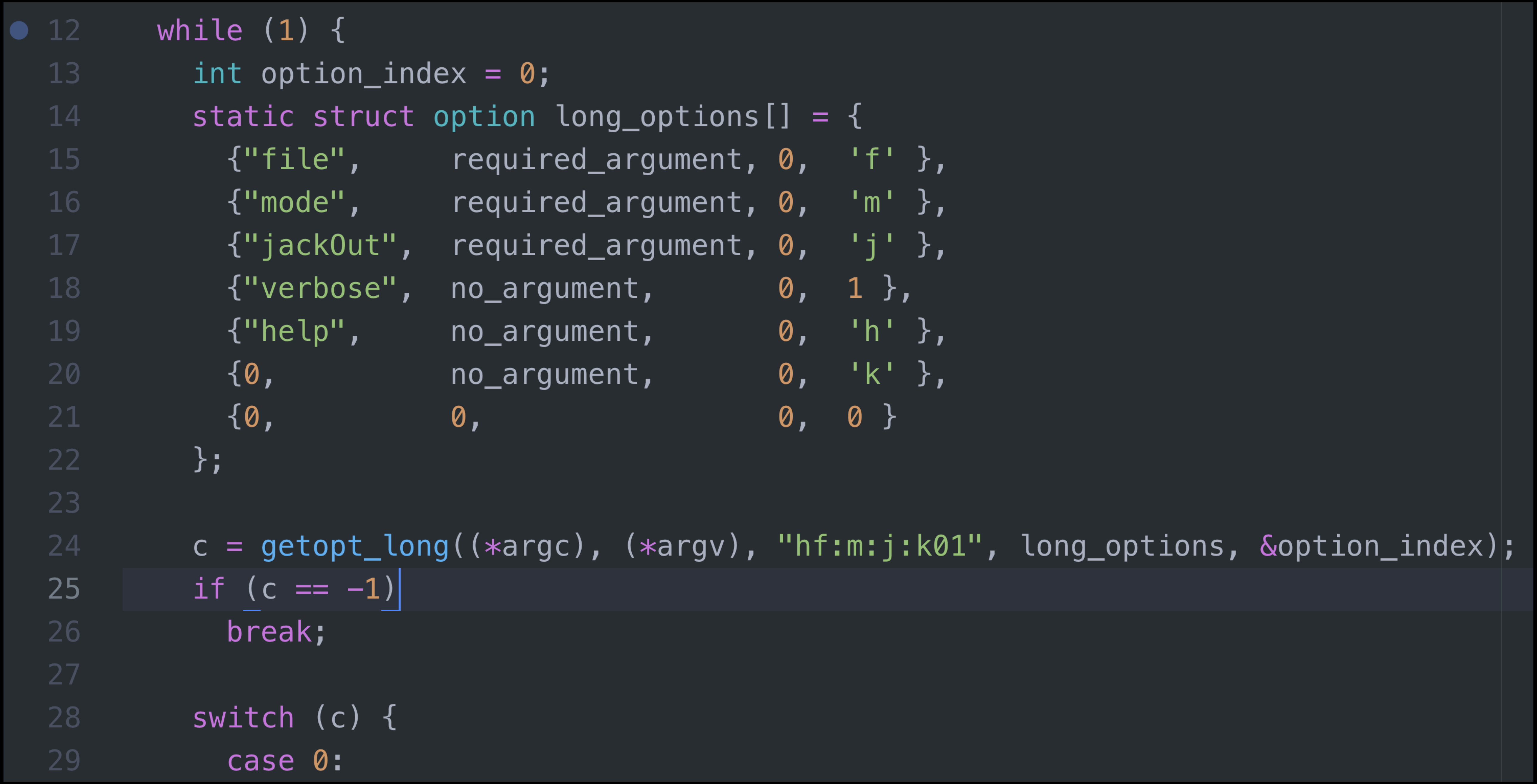
Arguments



```
jochem@prlwytzkofsky:~/stack/hku/Jaar 2/Blok 2c/CSD/Convolutie les/CSD-les-18-03-2019/01 Arguments$ ./build/arguments --help
Usage: convolution
        [-f | --file <filepath>] [-h | --help] [-i | --impulse <filepath>]
        [-m | --mode <'direct_mic' | 'direct_file' | 'impulse_mic' | 'impulse_file'>]
        [--verbose]

jochem@prlwytzkofsky:~/stack/hku/Jaar 2/Blok 2c/CSD/Convolutie les/CSD-les-18-03-2019/01 Arguments$
```

Arguments



```
  while (1) {
    int option_index = 0;
    static struct option long_options[] = {
      {"file",      required_argument, 0,  'f' },
      {"mode",      required_argument, 0,  'm' },
      {"jackOut",   required_argument, 0,  'j' },
      {"verbose",   no_argument,       0,  1 },
      {"help",      no_argument,       0,  'h' },
      {0,           no_argument,       0,  'k' },
      {0,           0,                 0,  0 }
    };

    c = getopt_long((*argc), (*argv), "hf:m:j:k01", long_options, &option_index);
    if (c == -1)
      break;

    switch (c) {
      case 0:
```

Arguments

```cpp
    switch (c) {
      case 0:
        printf("option %s", long_options[option_index].name);
        if (optarg)
          printf(" with arg %s", optarg);
        printf("\n");
        break;
      case 'k':
        std::cout << "Letter K" << '\n';
        break;
      case 'f':
        filename = optarg;
        break;
      case 'o':
        jackOutputs = std::atoi (optarg);
        break;
```

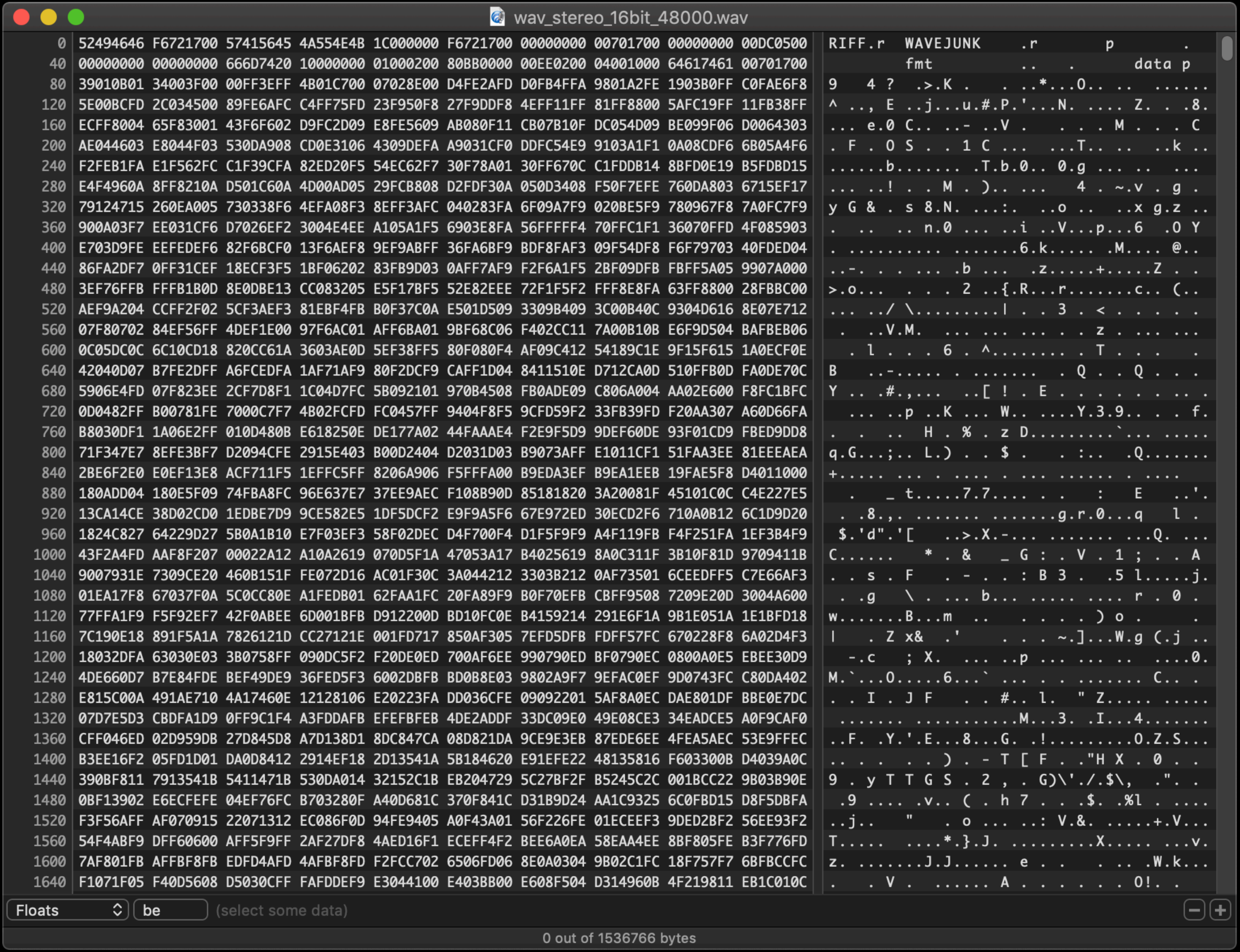
Audio file playback

- File Input
- Playback

Audio file

- Get file type
- Parse metadata
- Load PCM to vector

Wav file



wav_stereo_16bit_48000.wav

```
   0 52494646 F6721700 57415645 4A554E4B 1C000000 F6721700 00000000 00701700 00000000 00DC0500  RIFF.r  WAVEJUNK    .r       p       .
  40 00000000 00000000 666D7420 10000000 01000200 80BB0000 00EE0200 04001000 64617461 00701700              fmt        ..   .        data p
  80 39010B01 34003F00 00FF3EFF 4B01C700 07028E00 D4FE2AFD D0FB4FFA 9801A2FE 1903B0FF C0FAE6F8  9   4 ?  .>.K .   . ..*...O.. ..  ......
 120 5E00BCFD 2C034500 89FE6AFC C4FF75FD 23F950F8 27F9DDF8 4EFF11FF 81FF8800 5AFC19FF 11FB38FF  ^ .., E ..j...u.#.P.'...N. .... Z. . .8.
 160 ECFF8004 65F83001 43F6F602 D9FC2D09 E8FE5609 AB080F11 CB07B10F DC054D09 BE099F06 D0064303  ... e.0 C.. ..- ..V .   . . . M . . . C
 200 AE044603 E8044F03 530DA908 CD0E3106 4309DEFA A9031CF0 DDFC54E9 9103A1F1 0A08CDF6 6B05A4F6  . F . O S . . 1 C ...  ...T.. ..  ..k ..
 240 F2FEB1FA E1F562FC C1F39CFA 82ED20F5 54EC62F7 30F78A01 30FF670C C1FDDB14 8BFD0E19 B5FDBD15  ......b....... .T.b.0.. 0.g ... ..  ...
 280 E4F4960A 8FF8210A D501C60A 4D00AD05 29FCB808 D2FDF30A 050D3408 F50F7EFE 760DA803 6715EF17  ... ..! . . M . ).. ...   4 . ~.v . g .
 320 79124715 260EA005 730338F6 4EFA08F3 8EFF3AFC 040283FA 6F09A7F9 020BE5F9 780967F8 7A0FC7F9  y G & . s 8.N. ...:.  ..o ..  ..x g.z ..
 360 900A03F7 EE031CF6 D7026EF2 3004E4EE A105A1F5 6903E8FA 56FFFFF4 70FFC1F1 36070FFD 4F085903  .  ..  .. n.0 ... ..i ..V...p...6  .O Y
 400 E703D9FE EEFEDEF6 82F6BCF0 13F6AEF8 9EF9ABFF 36FA6BF9 BDF8FAF3 09F54DF8 F6F79703 40FDED04  . ........... ........6.k..... .M.... @..
 440 86FA2DF7 0FF31CEF 18ECF3F5 1BF06202 83FB9D03 0AFF7AF9 F2F6A1F5 2BF09DFB FBFF5A05 9907A000  ..-. . . ... .b ...  .z.....+.....Z . .
 480 3EF76FFB FFFB1B0D 8E0DBE13 CC083205 E5F17BF5 52E82EEE 72F1F5F2 FFF8E8FA 63FF8800 28FBBC00  >.o...  . . . 2 ..{.R...r.........c.. (..
 520 AEF9A204 CCFF2F02 5CF3AEF3 81EBF4FB B0F37C0A E501D509 3309B409 3C00B40C 9304D616 8E07E712  ... ../ \..........| . . 3 . < . . . . . .
 560 07F80702 84EF56FF 4DEF1E00 97F6AC01 AFF6BA01 9BF68C06 F402CC11 7A00B10B E6F9D504 BAFBEB06   .  ..V.M.  ... ... ... . . z . ... ...
 600 0C05DC0C 6C10CD18 820CC61A 3603AE0D 5EF38FF5 80F080F4 AF09C412 54189C1E 9F15F615 1A0ECF0E    . l . . . 6 . ^......... . T . . . .
 640 42040D07 B7FE2DFF A6FCEDFA 1AF71AF9 80F2DCF9 CAFF1D04 8411510E D712CA0D 510FFB0D FA0DE70C  B   ..-..... . ........ . Q . . Q . . .
 680 5906E4FD 07F823EE 2CF7D8F1 1C04D7FC 5B092101 970B4508 FB0ADE09 C806A004 AA02E600 F8FC1BFC  Y .. .#.,...  ..[ ! . E . . . . . . . ... .
 720 0D0482FF B00781FE 7000C7F7 4B02FCFD FC0457FF 9404F8F5 9CFD59F2 33FB39FD F20AA307 A60D66FA     ... ..p ..K ... W.. ....Y.3.9.. . . f.
 760 B8030DF1 1A06E2FF 010D480B E618250E DE177A02 44FAAAE4 F2E9F5D9 9DEF60DE 93F01CD9 FBED9DD8  .  .  ..  H . % . z D.........`... .....
 800 71F347E7 8EFE3BF7 D2094CFE 2915E403 B00D2404 D2031D03 B9073AFF E1011CF1 51FAA3EE 81EEEAEA  q.G...;.. L.) . . $ .   . :..  .Q.......
 840 2BE6F2E0 E0EF13E8 ACF711F5 1EFFC5FF 8206A906 F5FFFA00 B9EDA3EF B9EA1EEB 19FAE5F8 D4011000  +..... ... . .... . ... ...... . ....
 880 180ADD04 180E5F09 74FBA8FC 96E637E7 37EE9AEC F108B90D 85181820 3A20081F 45101C0C C4E227E5    .   _ t.....7.7.... . .    :   E   ..'.
 920 13CA14CE 38D02CD0 1EDBE7D9 9CE582E5 1DF5DCF2 E9F9A5F6 67E972ED 30ECD2F6 710A0B12 6C1D9D20   . .8.,. ....... .......g.r.0...q   l .
 960 1824C827 64229D27 5B0A1B10 E7F03EF3 58F02DEC D4F700F4 D1F5F9F9 A4F119FB F4F251FA 1EF3B4F9   $.'d".'[   ..>.X.-... ....... ...Q. ...
1000 43F2A4FD AAF8F207 00022A12 A10A2619 070D5F1A 47053A17 B4025619 8A0C311F 3B10F81D 9709411B  C......    * . &   _ G : . V . 1 ; . . A
1040 9007931E 7309CE20 460B151F FE072D16 AC01F30C 3A044212 3303B212 0AF73501 6CEEDFF5 C7E66AF3  . . s . F   . - . . : B 3 .  .5 l.....j.
1080 01EA17F8 67037F0A 5C0CC80E A1FEDB01 62FAA1FC 20FA89F9 B0F70EFB CBFF9508 7209E20D 3004A600   . .g   \ . ... b... ..... .... r . 0 .
1120 77FFA1F9 F5F92EF7 42F0ABEE 6D001BFB D912200D BD10FC0E B4159214 291E6F1A 9B1E051A 1E1BFD18  w.......B...m  ..   . . . . ) o .     .
1160 7C190E18 891F5A1A 7826121D CC27121E 001FD717 850AF305 7EFD5DFB FDFF57FC 670228F8 6A02D4F3  |   . Z x&  .'     . . . ~.]...W.g (.j ..
1200 18032DFA 63030E03 3B0758FF 090DC5F2 F20DE0ED 700AF6EE 990790ED BF0790EC 0800A0E5 EBEE30D9    -.c   ; X.  ... ..p ... ... ..  ....0.
1240 4DE660D7 B7E84FDE BEF49DE9 36FED5F3 6002DBFB BD0B8E03 9802A9F7 9EFAC0EF 9D0743FC C80DA402  M.`...O.....6...` ... . . ........ C.. .
1280 E815C00A 491AE710 4A17460E 12128106 E20223FA DD036CFE 09092201 5AF8A0EC DAE801DF BBE0E7DC  . . I . J F   . . #.. l.  " Z..... .....
1320 07D7E5D3 CBDFA1D9 0FF9C1F4 A3FDDAFB EFEFBFEB 4DE2ADDF 33DC09E0 49E08CE3 34EADCE5 A0F9CAF0   ....... ...........M...3. .I...4.......
1360 CFF046ED 02D959DB 27D845D8 A7D138D1 8DC847CA 08D821DA 9CE9E3EB 87EDE6EE 4FEA5AEC 53E9FFEC  ..F. .Y.'.E...8...G. .!.........O.Z.S...
1400 B3EE16F2 05FD1D01 DA0D8412 2914EF18 2D13541A 5B184620 E91EFE22 48135816 F603300B D4039A0C  .. . .  . . ) . - T [ F . ."H X . 0 . .
1440 390BF811 7913541B 5411471B 530DA014 32152C1B EB204729 5C27BF2F B5245C2C 001BCC22 9B03B90E  9 . y T T G S . 2 , . G)\'./.$\,  .". .
1480 0BF13902 E6ECFEFE 04EF76FC B703280F A40D681C 370F841C D31B9D24 AA1C9325 6C0FBD15 D8F5DBFA   .9 .... .v.. ( . h 7 . . .$. .%l . ....
1520 F3F56AFF AF070915 22071312 EC086F0D 94FE9405 A0F43A01 56F226FE 01ECEEF3 9DED2BF2 56EE93F2  ..j..   "   . o ... ..: V.&. .....+.V...
1560 54F4ABF9 DFF60600 AFF5F9FF 2AF27DF8 4AED16F1 ECEFF4F2 BEE6A0EA 58EAA4EE 8BF805FE B3F776FD  T.....  ....*.}.J. .........X...... ...v.
1600 7AF801FB AFFBF8FB EDFD4AFD 4AFBF8FD F2FCC702 6506FD06 8E0A0304 9B02C1FC 18F757F7 6BFBCCFC  z. ........J.J...... e . .    . .. .W.k...
1640 F1071F05 F40D5608 D5030CFF FAFDDEF9 E3044100 E403BB00 E608F504 D314960B 4F219811 EB1C010C  .   . V .  ....... A . . . . . . . O!. .
```

Floats be (select some data)

0 out of 1536766 bytes

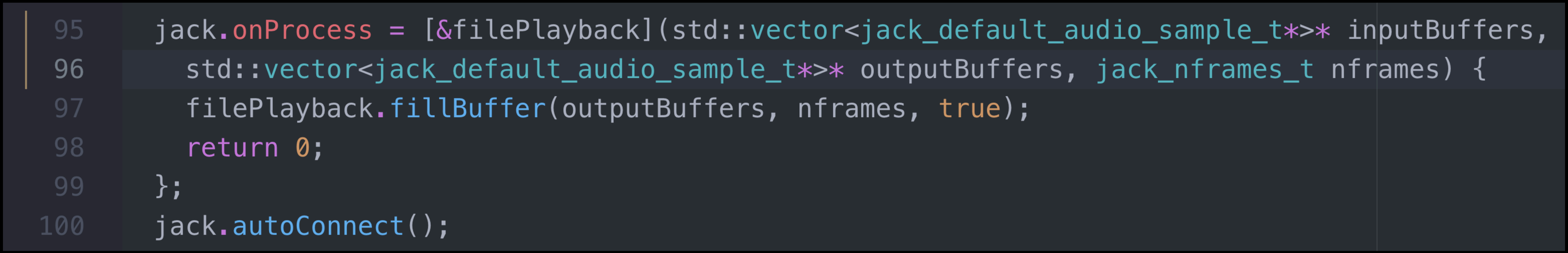
http://soundfile.sapp.org/doc/WaveFormat/

MP3 file

- libmpg123
- Convert mp3 to PCM data

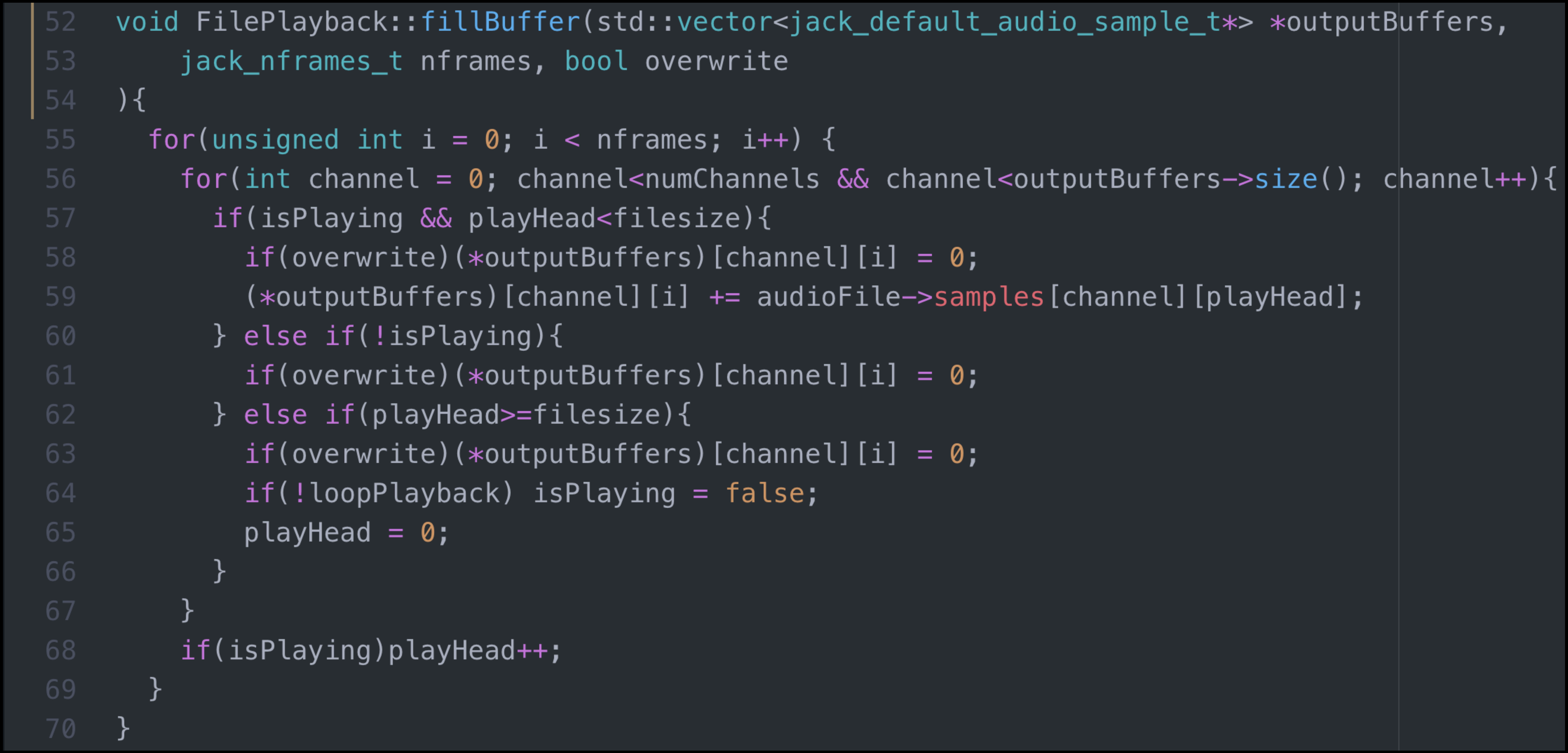
https://www.mpg123.de

Playback



```
jack.onProcess = [&filePlayback](std::vector<jack_default_audio_sample_t*>* inputBuffers,
  std::vector<jack_default_audio_sample_t*>* outputBuffers, jack_nframes_t nframes) {
  filePlayback.fillBuffer(outputBuffers, nframes, true);
  return 0;
};
jack.autoConnect();
```

Playback

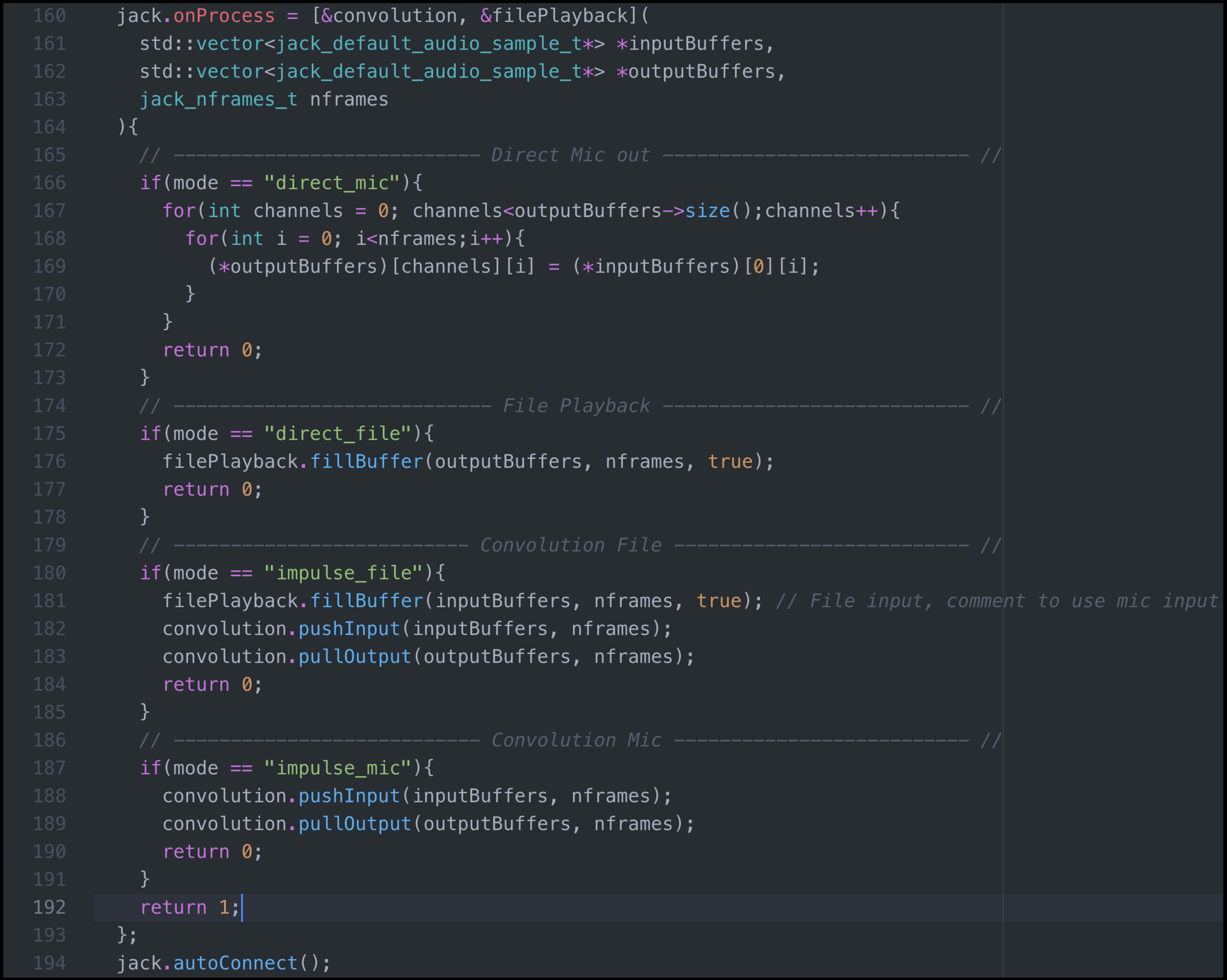


```cpp
void FilePlayback::fillBuffer(std::vector<jack_default_audio_sample_t*> *outputBuffers,
    jack_nframes_t nframes, bool overwrite
){
  for(unsigned int i = 0; i < nframes; i++) {
    for(int channel = 0; channel<numChannels && channel<outputBuffers->size(); channel++){
      if(isPlaying && playHead<filesize){
        if(overwrite)(*outputBuffers)[channel][i] = 0;
        (*outputBuffers)[channel][i] += audioFile->samples[channel][playHead];
      } else if(!isPlaying){
        if(overwrite)(*outputBuffers)[channel][i] = 0;
      } else if(playHead>=filesize){
        if(overwrite)(*outputBuffers)[channel][i] = 0;
        if(!loopPlayback) isPlaying = false;
        playHead = 0;
      }
    }
    if(isPlaying)playHead++;
  }
}
```

Convolution

- Direct convolution
- 4 modes
    - Direct/Convolved + Mic/File
- RMS

Convolution



```
  jack.onProcess = [&convolution, &filePlayback](
    std::vector<jack_default_audio_sample_t*> *inputBuffers,
    std::vector<jack_default_audio_sample_t*> *outputBuffers,
    jack_nframes_t nframes
  ){
    // --------------------------- Direct Mic out --------------------------- //
    if(mode == "direct_mic"){
      for(int channels = 0; channels<outputBuffers->size();channels++){
        for(int i = 0; i<nframes;i++){
          (*outputBuffers)[channels][i] = (*inputBuffers)[0][i];
        }
      }
      return 0;
    }
    // ---------------------------- File Playback --------------------------- //
    if(mode == "direct_file"){
      filePlayback.fillBuffer(outputBuffers, nframes, true);
      return 0;
    }
    // -------------------------- Convolution File -------------------------- //
    if(mode == "impulse_file"){
      filePlayback.fillBuffer(inputBuffers, nframes, true); // File input, comment to use mic input
      convolution.pushInput(inputBuffers, nframes);
      convolution.pullOutput(outputBuffers, nframes);
      return 0;
    }
    // --------------------------- Convolution Mic -------------------------- //
    if(mode == "impulse_mic"){
      convolution.pushInput(inputBuffers, nframes);
      convolution.pullOutput(outputBuffers, nframes);
      return 0;
    }
    return 1;
  };
  jack.autoConnect();
```

Assignments

https://github.com/JochemVanIterson/CSD-les-18-03-2019

1. Arguments
2. File playback
3. (Direct) convolution