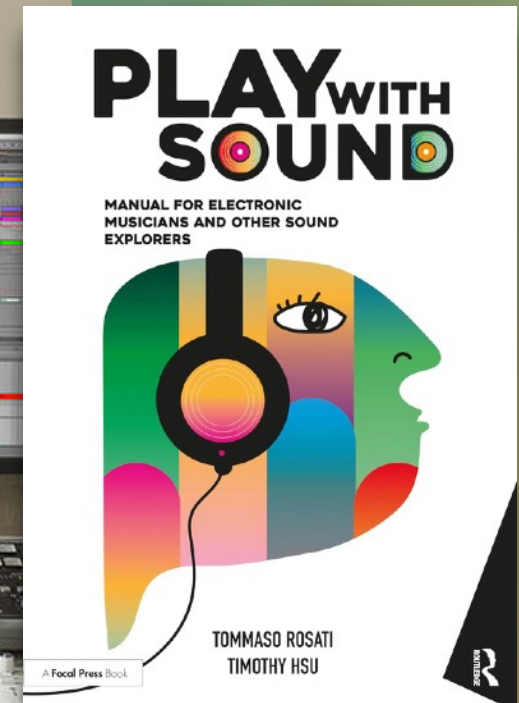


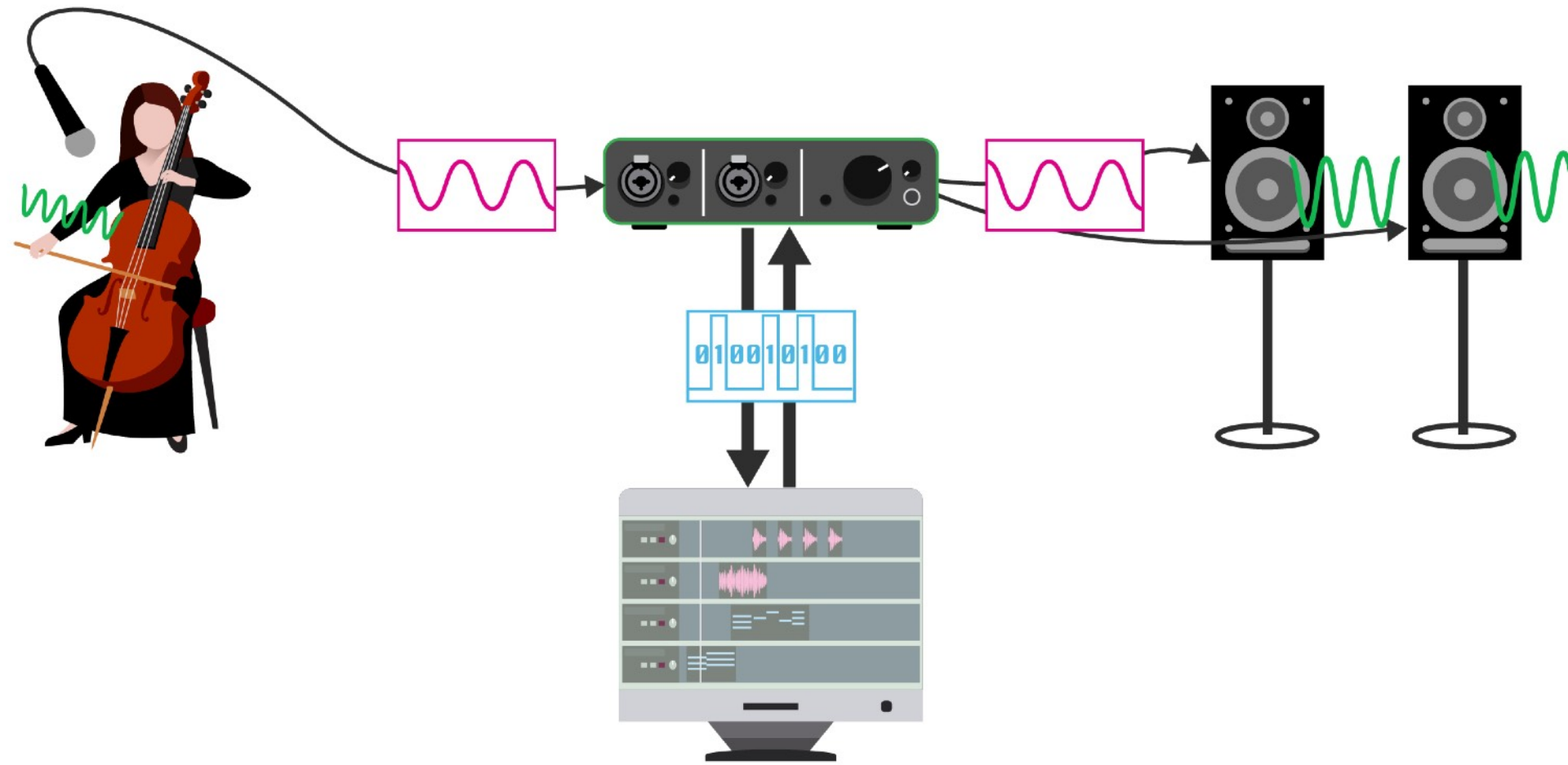
# ELECTROACOUSTIC SYSTEMS - DIGITAL

COMPUTER  
AUDIO INTERFACE  
MONITOR  
FILES

THE  
BOOK IS  
NOW  
AVAILABLE!

TOMMASO ROSATI  
SOUND ART 





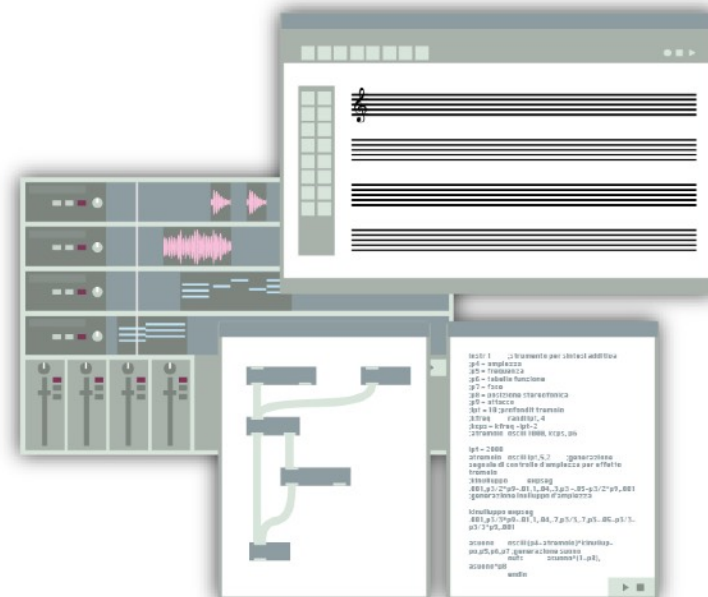
# Computer

In hardware, the computer plays the role of the brain of the digital system, because its job is to collect and process the data coming from all of the input devices and then deliver the results to the output devices.

## HARDWARE



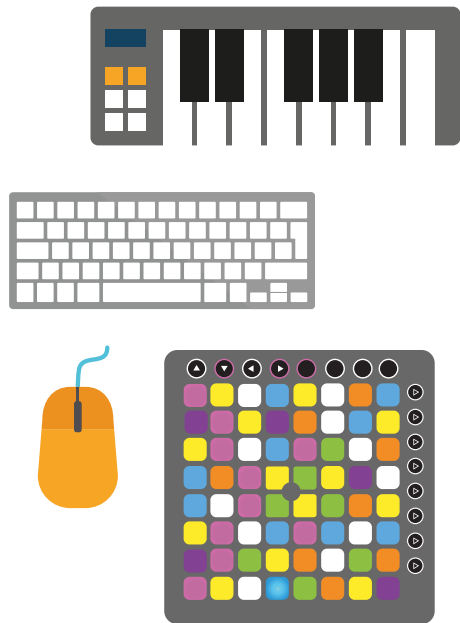
## SOFTWARE



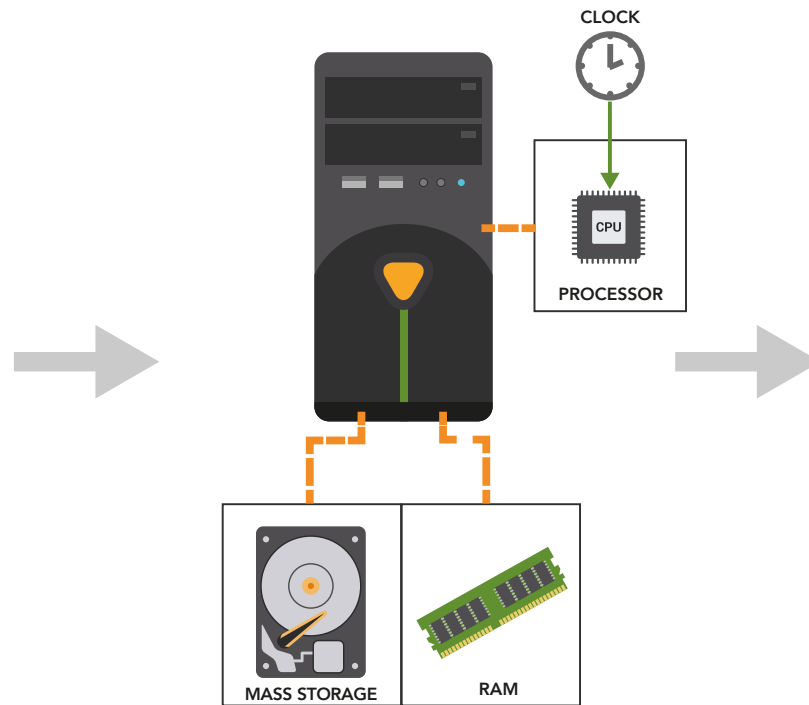
# Computer

## Hardware

### INPUT



### PROCESSING



### OUTPUT



# Computer

## Hardware Hard Disk

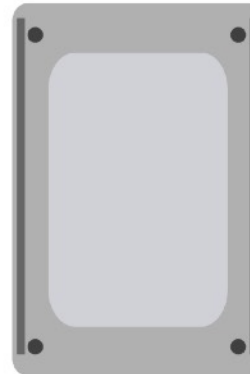
### HDD

**Hard Disk Drives** store data in a magnetized disk that is rotated and read by a head. The drives have significantly higher power consumption, greater fragility and slower speeds. However, they have lower costs and larger capacities.



### SSD

**Solid State Drives** have no rotating parts, resulting in faster read and write speeds, lower fragility, and reduced power consumption. The latter two features are critical for laptops, tablets, and smartphones, because of the longer battery lives and reduced data loss when devices are dropped.



# Computer

## Hardware Hard Disk

**Internal**

Storage is plugged directly into the computer's motherboard

**External**

A cable is needed to connect the storage to the computer



### USB

USB



A



B



MINI



MICRO



C



## Software

### Operating systems

large programs that manage the machine's hardware and software resources and provide essential services to the application software that is installed on the computer.

Windows | MacOS | Linux



### Application Softwares

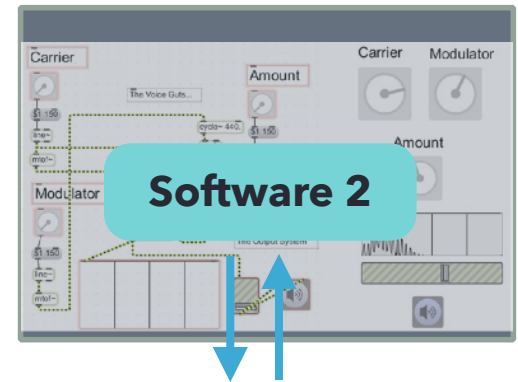
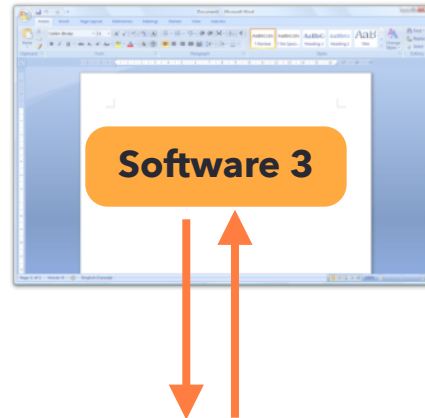
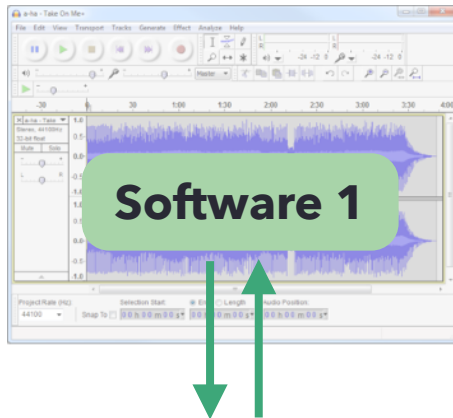
consists of all the applications we install on our computers, smartphones, or tablets that we interact with to do a particular task.

Audacity | Reaper | Word



# Computer

## Software



**Operating System**  
Windows | MacOS | Linux



# Computer

## The computer language

The only language that computer uses is called **binary code**. It's based on digits that can have only 2 states: **0 1**

Number in base 10	Binary
0	0
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
10	1010
11	1011
12	1100
13	1101
14	1110
15	1111

# Computer

## The computer language

**bit** One digit only of two possible states



**byte** A group of 8 bits.



1 **kB** (kilobyte) = 1024 bytes

1 **MB** (Megabyte) = 1,048,576 byte

1 **GB** (Gigabyte) = 1,000 MB = 1,073,741,824 bytes

1 **TB** (Terabyte) = 1,000 GB = 1,099,511,627,776 bytes

# Computer

## The computer language Files

The data handled by the computer are contained in **files**

**extension** tells someone what kind of software application is needed to properly open a file.

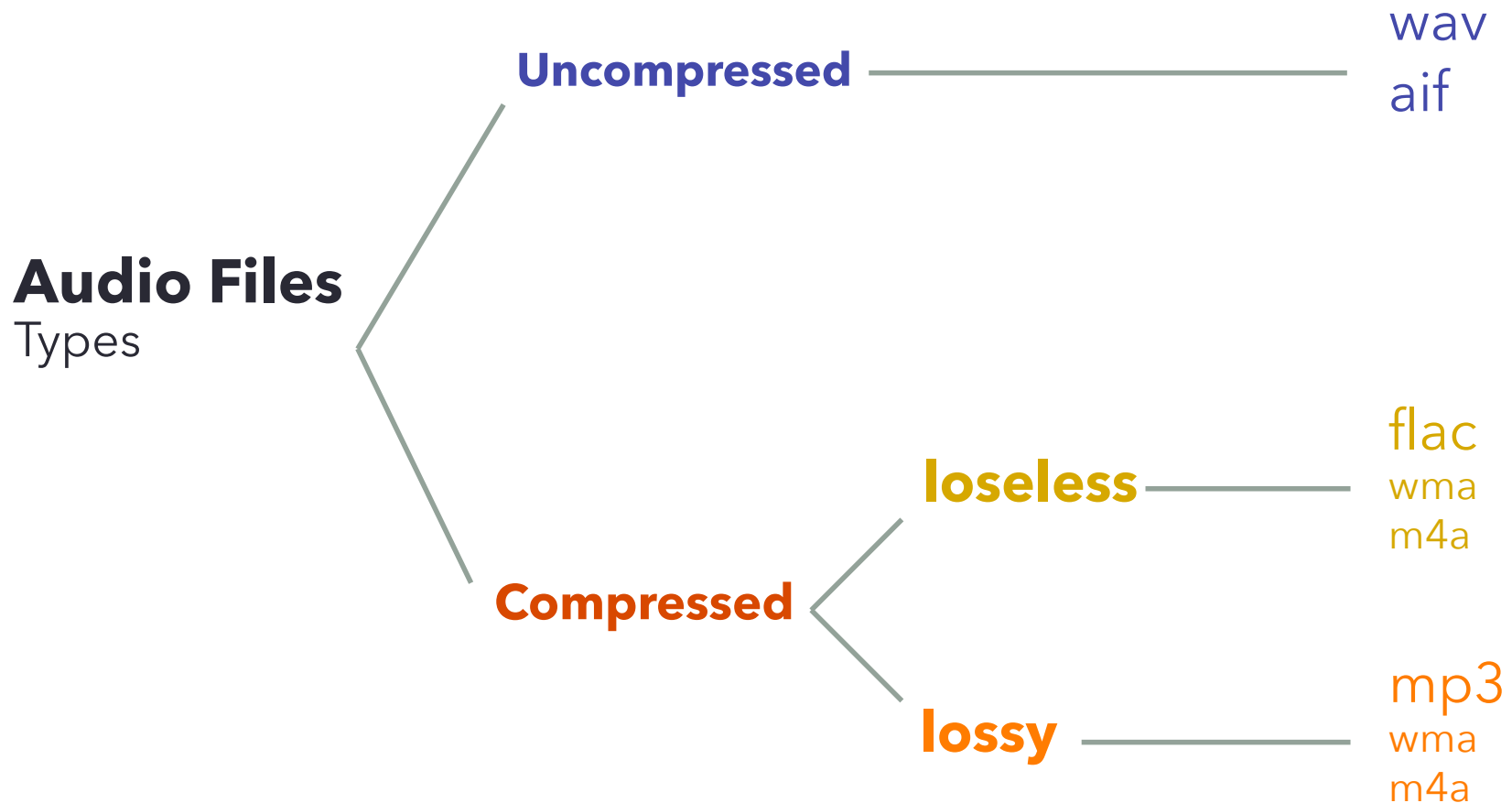
It is usually three characters



NameOfTheFile.doc	<b>Text</b>
NameOfTheFile.avi	<b>Video</b>
NameOfTheFile.wav	<b>Audio</b>
NameOfTheFile.mp3	<b>Audio</b>

# Computer

## The computer language Audio Files



## Computer

## The computer language MP3 Audio Files

# MP3

MPEG-1 Audio Layer III

Introduced in 1997, MP3s revolutionized music by enabling easy distribution with good audio quality and small file sizes. The compression level, set by the **bitrate**, directly affects audio quality. A higher bitrate results in better sound. MP3s could be easily distributed online and stored in portable devices.

We can choose a **constant bitrate (CBR)** for uniform quality or a **variable bitrate (VBR)** that varies the bitrate based on the waveform's complexity, optimizing file size and quality.

**MP3**  
**BITRATE**

SUFFICIENT  
**128**  
Kbps

GOOD  
**192**  
Kbps

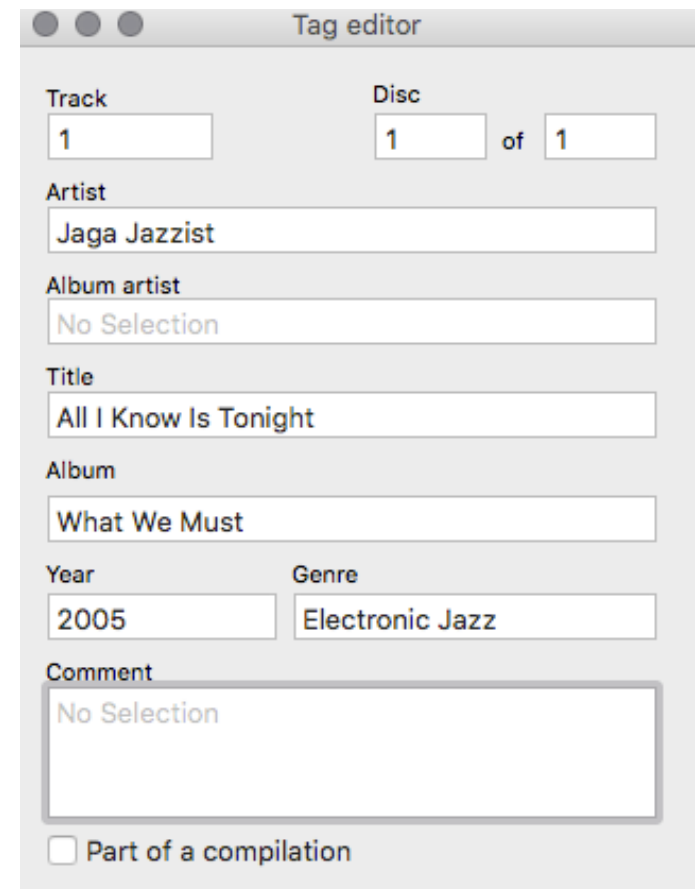
GREAT  
**320**  
Kbps

## The computer language MP3 Audio Files

# MP3

MPEG-1 Audio Layer III

MP3s feature **ID3 tags**, allowing storage of metadata like title, artist, album, genre, and track number. This metadata is displayed during playback, enhancing the listening experience.

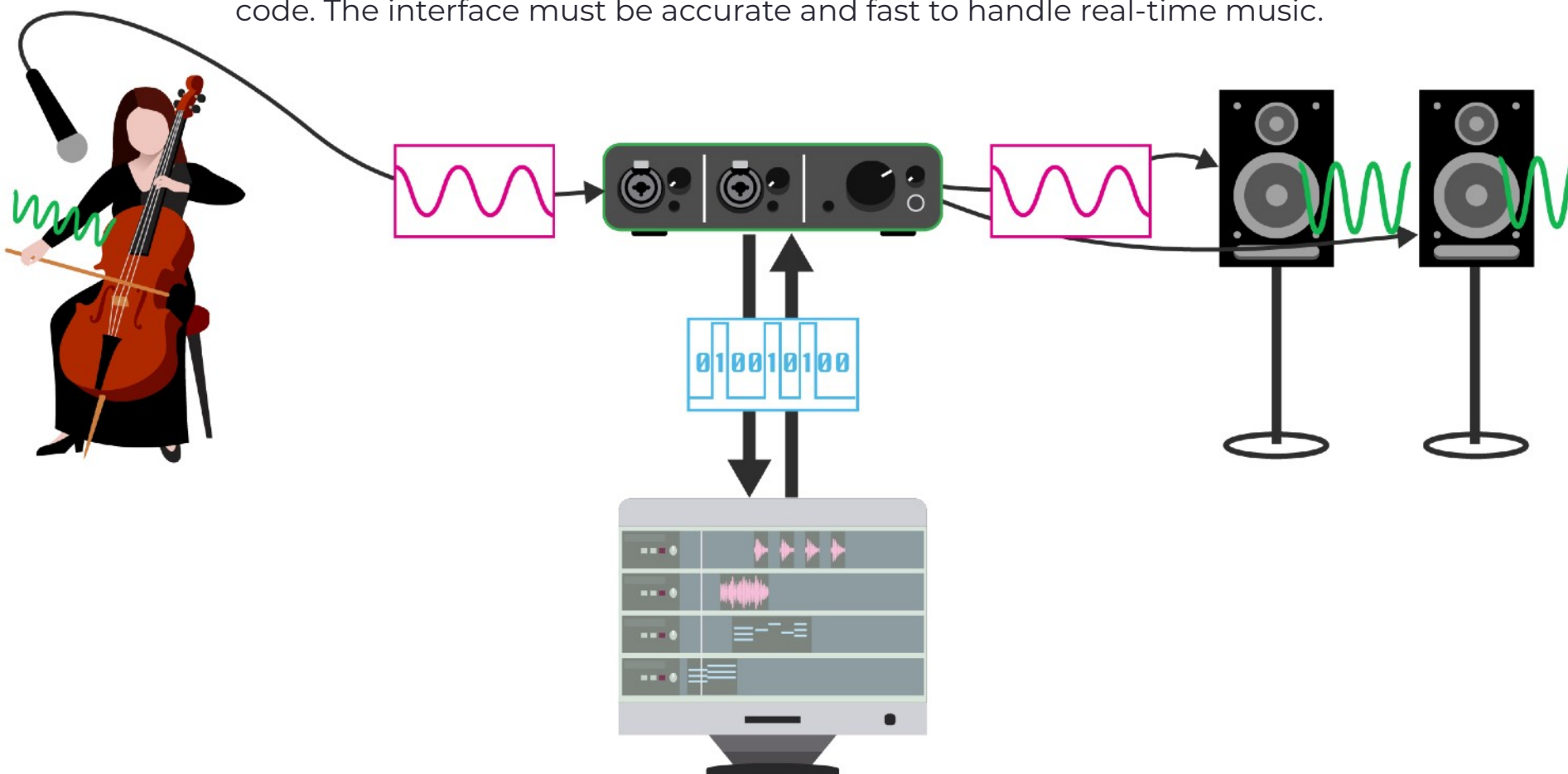


The screenshot shows a 'Tag editor' window with the following fields and values:

- Track: 1
- Disc: 1 of 1
- Artist: Jaga Jazzist
- Album artist: No Selection
- Title: All I Know Is Tonight
- Album: What We Must
- Year: 2005
- Genre: Electronic Jazz
- Comment: No Selection
- Part of a compilation

# Audio Interface

An audio interface is crucial for music production and performances, converting analog signals to digital signals for the computer and vice versa. These conversions are essential as computers only process binary code. The interface must be accurate and fast to handle real-time music.



# Audio interface

## Internal

Internal sound cards, designed primarily for the general audio needs of a computer such as listening to music or making conferencing calls, have lower quality and few inputs and outputs.

## External

External audio interface can be specifically designed for musical uses and therefore have higher quality for preamplifiers, and analog-to-digital (ADC) and digital-to-analog (DAC) converters. They also can have more input and output ports

The value of an audio interface is related to:

:: **number of inputs and outputs**

:: **type of input** (i.e., combo, instruments, etc.) **and output** (i.e., balanced, unbalanced, XLR, RCA)

:: **converter quality** (A/D and D/A)

:: **preamplification quality**

:: **Maximum sample rate** (96kHz in the professional audio interfaces)

:: **Maximum bit depth** (48-bit in the professional audio interfaces)

# Audio interface

## input

combo analog input (XLR-TS)

## gain

adjusts the preamplification of the input signal, essential for mic level such as those of microphones

## +48V

activates the phantom power (+48V), essential for condenser microphones

## inst or Hi-Z

switches between an instrument-type signal with high impedance (guitars or electric basses) and mic level signals with low impedance (microphones)

## phones

controls the output volume of the headphones

headphones output

## master vol

controls the output volume of the main outputs

## USB

communicates with the computer via USB

## balanced

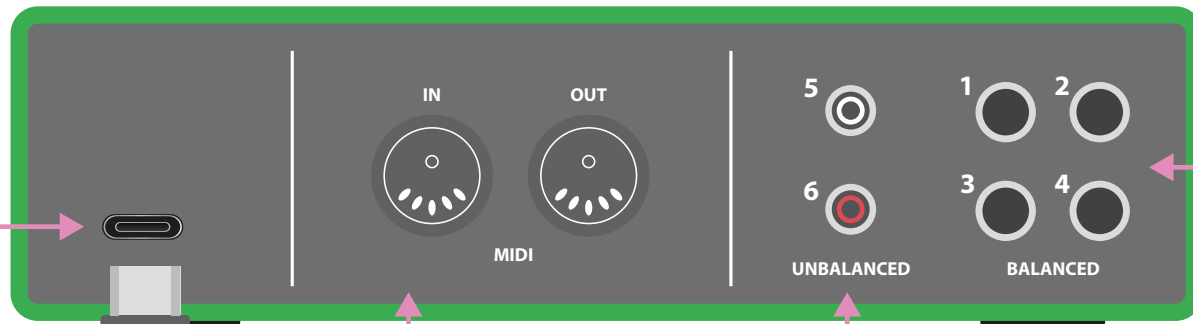
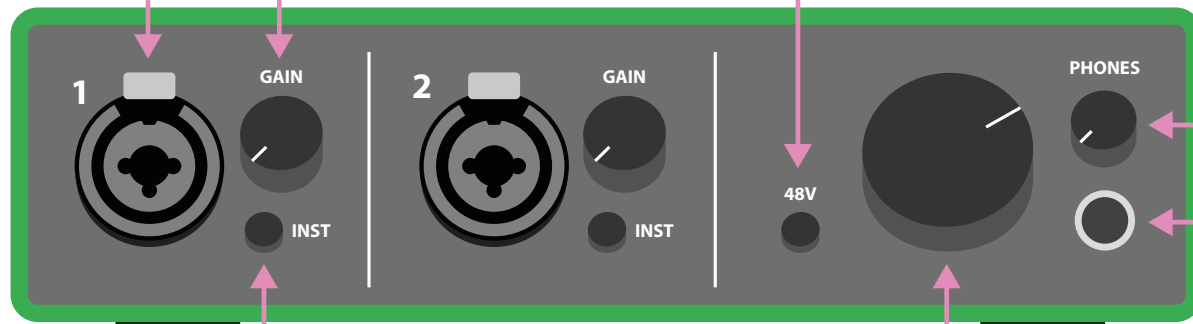
balanced outputs via TRS cable (3-pin)

## in/out MIDI

MIDI input and output (digital) via MIDI cable (5-pin)

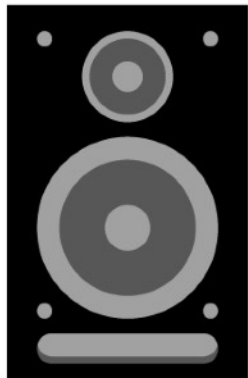
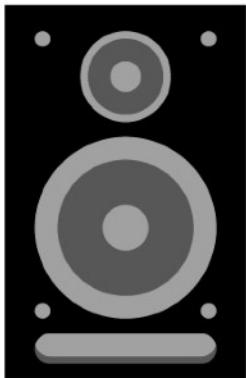
## unbalanced

unbalanced outputs via RCA connector (2-pin)



# Monitor and Headphones

Once the output signal leaves the audio interface, it's analog again as it heads to studio **monitors** or **headphones**. Studio monitors are high-quality, full-range speakers, typically active and positioned to form an equilateral triangle with the listener. The room's acoustic design, including size, wall shape, materials, and reverberation time, is crucial for accurate sound.



# Monitor

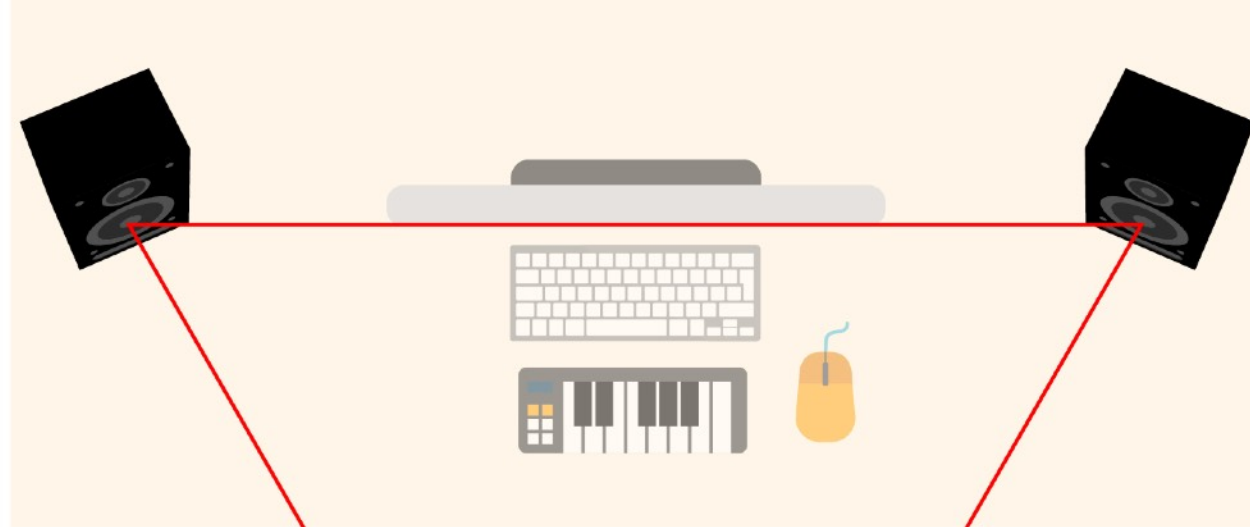
## Speakers

**Active**

Amplified

**Passive**

Not amplified



**near-field**

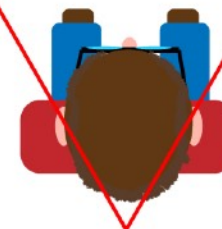
monitors for short-distance listening  
(about 150 cm or 3-5 feet)

**mid-field**

monitors for medium distances  
(150-250 cm or 5-10 feet)

**far-field**

monitors for spaced listening  
(more than 250 cm or 10 feet)



# PLAY WITH SOUND

MANUAL FOR ELECTRONIC  
MUSICIANS AND OTHER SOUND  
EXPLORERS



TOMMASO ROSATI  
TIMOTHY HSU

A Focal Press Book

ROUTLEDGE

T H E  
BOOK IS  
NOW  
AVAILABLE!