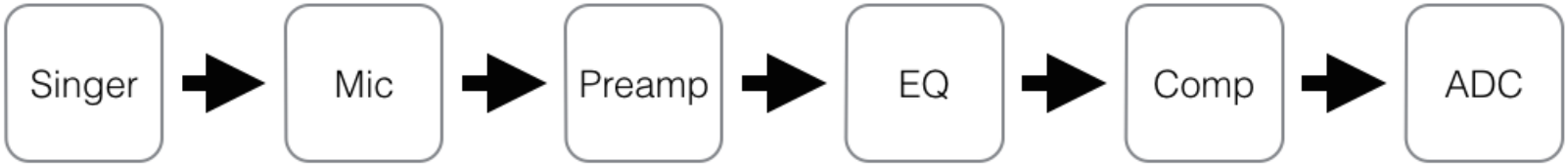
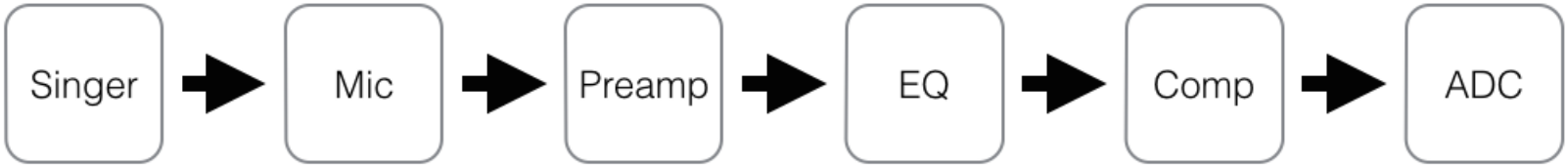
Audio Signal Flow is the path an audio signal takes from source to output

Single Vocalist Recording Signal Flow Example



- The first element in the signal flow is the vocalist, which produces the signal
- This signal propagates acoustically to the microphone, where it is converted by a transducer into an electrical signal
- Other objects may also produce sound in the acoustical environment, such as heating, ventilation, and air conditioning systems (HVAC), computer fans, traffic noise, elevators, plumbing, etc
- These noise sources can also be picked up by the microphone
- It is therefore important to optimise the acoustical signal/noise ratio at the microphone
- This can be accomplished by reducing the amplitude of unwanted noise (for example, turning off the HVAC system while recording), or by moving the microphone closer to the signal source and farther away from any noise sources, the signal/noise ratio is increased
- After the microphone, the signal passes down a cable to the microphone preamplifier, which amplifies the microphone signal to line level
- This is important because a line-level signal is necessary to drive the input circuitry of any further processing equipment down the chain, which will generally not be able to accept the extremely low-voltage signal produced by a typical microphone

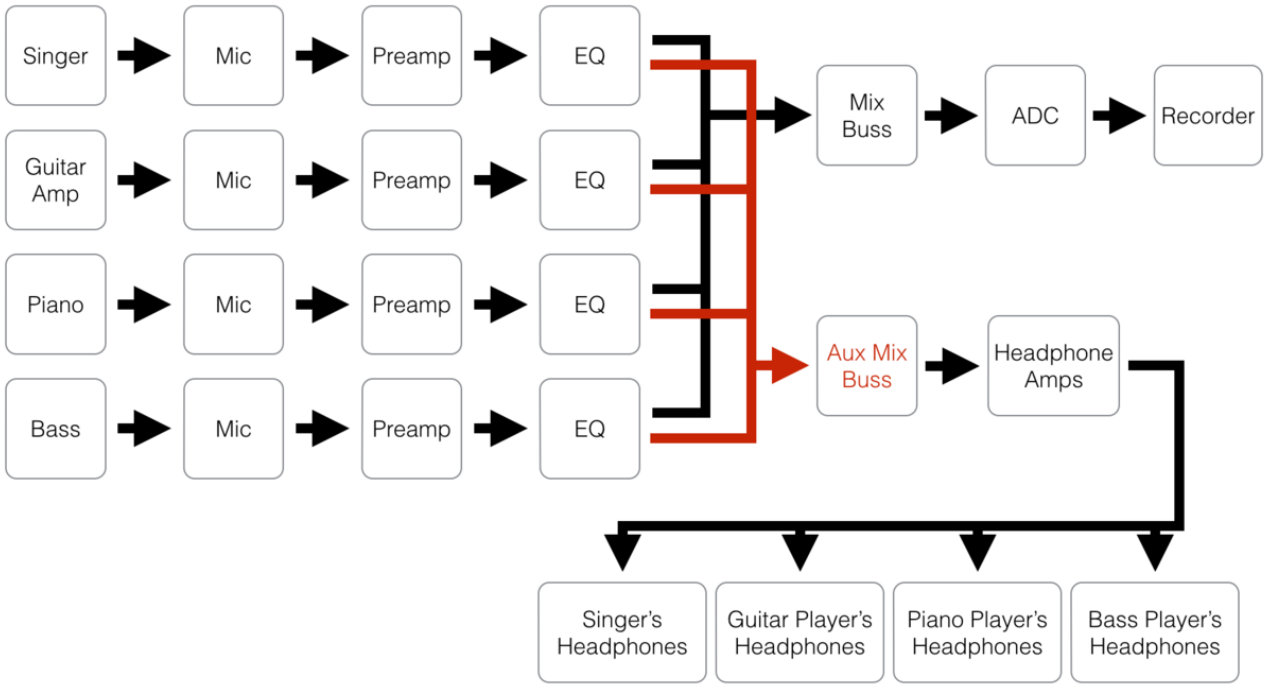
Single Vocalist Recording Signal Flow Example *(continued…)*



- For the purposes of this example, the output of the microphone preamplifier is then sent to an EQ, where the timbre of the sound may be manipulated for artistic or technical purposes.
- Examples of artistic purposes include making the singer sound "brighter," "darker," "more forward," "less nasal," etc…
- Examples of technical purposes include reducing unwanted low-frequency rumble from HVAC systems, compensating for high-frequency loss caused by distant microphone placement, etc…
- The output of the EQ will then be sent to a compressor (when required), which is a device that manipulates the dynamic range of a signal for either artistic or technical reasons
- The output of the Compressor is then sent to an Analog-to-Digital Converter, which converts the signal to a digital format, allowing the signal to be sent to a digital recording device, such as a computer.
- In Digital sound systems, this A/D conversation happens at the beginning of the chain, after the Preamplifier.

Audio Signal Flow Explained

Vocalist & Band Live Sound Signal Flow Example

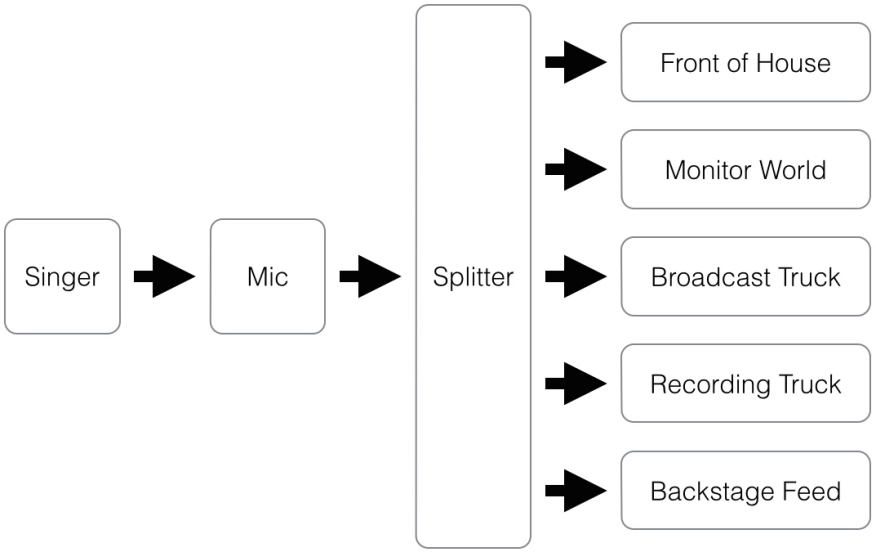


- This example traces the signal flow of a vocalist with a band performing in a venue
- The signal flow begins as in the previous example; singer/instrument, microphone or line, microphone preamplifier, EQ, and compressor
- The signal flows into a mixing board, which allows it to be routed to various outputs.
- The mixing board includes facilities for a main mix bus, which we will send to the house sound system, a auxiliary mix bus, which we will use to create a monitor mix for the singer and musicians, and an auxiliary or group mix bus, which can be used to create a second mix to be sent to live mix recording, for video camera recording, to a Broadcast TV Truck or simply to show relay

Prepared by Bruno Silva

Audio Signal Flow Explained

Broadcast Performance Signal Flow Example



- In this example, we will explore the signal flow of a hypothetical rock concert
- For our example, this concert not only has a live audience, it is also being broadcast on live TV, and it is being recorded, with copies of the recording being sold to the public immediately after the concert is over
- The signal from each microphone is therefore being sent to several places; the house sound system, the in-ear & stage monitor system for the performers, the broadcast system, the recording system, and backstage areas so that people can hear the performance while outside the performance area (Show Relay)

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Broadcast Performance Signal Flow Example *(continued…)*

- The house sound system will be controlled from the "Front of House" (FOH) position, also called the “Mix position." This position is usually located behind the audience.

Broadcast Performance Signal Flow Example *(continued…)*

"Front of House" (FOH) position, also called the "Mix position"

Broadcast Performance Signal Flow Example *(continued…)*

- The in-ear or stage monitors systems, are controlled by a monitor mix engineer located in the wing on one side of the stage
- It is necessary that the monitor mix engineer be able to communicate with the performers, so being in close proximity to them is essential
- The monitor mix position is often called "Monitor World"

Broadcast Performance Signal Flow Example *(continued…)*

Mix position "Monitor World."

Broadcast Performance Signal Flow Example *(continued…)*

- The broadcast mix will be controlled from a broadcast truck, located in the parking lot behind the performance venue.

- The audio and video will be recorded in the truck.

Broadcast Performance Signal Flow Example *(continued…)*

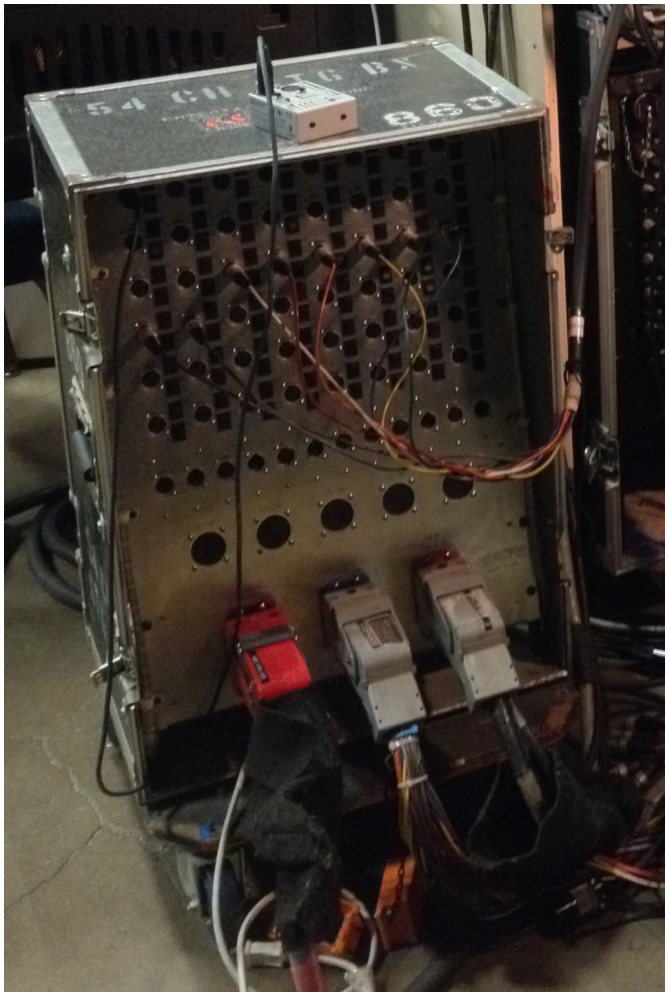
- In order to have multiple recording systems also in different locations, we need to split the audio signal.
- To split Analogue Audio Signals, we will need a Microphone Splitter. It can be Active or Passive
- To split Digital Audio Signals, we will need Stand Alone or Networked MADI Devices
- The Analogue Microphone Splitter serves several purposes; it will split the signal 2,3 or even 5-ways
- If it is an Active Splitter, will also provide phantom power for condenser microphones and active DI boxes, and it will provide isolation between all the outputs, preventing ground loops.
- Preventing ground loops is an extremely important function, as the severity of ground loops typically increases with distance.
- In a large network of interconnected sound systems, such as the one in this example, ground loops could become dangerously severe. Isolation to prevent ground loops is therefore vitally important.
- Let's begin by tracing the signal path from the splitter to the audience
- The signal leaves the splitter and travels to the Front of House position to the Mixer
- When using Analogue Mixing Console is via an Audio multicore cable
- When using a Digital Mixing Console System, the signals are processed and routed by units which are remotely controlled via Network or Fibre Cable
- On Analogue systems, once the signal reaches the Mixer, the still-mic-level signal enters into a microphone preamplifier, which boosts the signal voltage to line level.
- For this example, the microphone preamplifier is built into a mixing board
- In case we are using Digital Mixing Systems like the Avid S6L, the Preamplifier is physically located in the Stage Racks, which is then remotely controlled on the Sound Console

Broadcast Performance Signal Flow Example *(continued…)*

- It is typical for a mixing console to include a line Trim/Pad after the preamplifier. This allows the amplitude of the now line-level signal to be adjusted
- This may be done for artistic or technical reasons
- A typical application for the line trim is attenuating signals that were intentionally amplified too much by the microphone preamplifier
- Over amplifying the signal can cause the preamplifier to distort, which can under certain circumstances produce a desirable sound
- After the line trim, the signal is processed by the mixing board's EQ, filter, compressor, limiter, de-esser, delay, reverb, and any other signal processing features the mixing board has available and that the mix engineer chooses to use
- The processed signal is then sent to the mix bus, where it is combined with all the other signals coming from the stage
- The balance of signals is controlled by faders
- The mix is then routed to one of the mixing boards outputs, and flows into a loudspeaker controller or loudspeaker management system
- This device processes the signal to optimise it for the sound system installed in the performance venue
- It then flows into a rack of amplifiers, and then to the loudspeakers when the loudspeakers are passive
- When we are using active loudspeakers, the signal flows directly from the loudspeaker management without the need of going through amplifiers
- Loudspeakers are called active when they have its amplifier built-in. Therefore they require 2 cables, one for power and the other for signal
- Active loudspeakers are also heavier
- Passive loudspeakers, only need the signal cable and are generally of lighter weight, because their amplifiers are outside.

Broadcast Performance Signal Flow Example *(continued…)*

Analogue Passive Splitter



Network Analogue Active Splitter

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Broadcast Performance Signal Flow Example *(continued…)*

MADI Fiber Unit

MADI Coaxial Unit

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Broadcast Performance Signal Flow Example *(continued…)*

- At ROHM, we also record the Audio and Video in our own systems.
- We record the Audio directly onto Pro Tools using a Mac Pro connected to the FOH Avid S6L sound console via AVB Network
- We also split the signal to be recorded onto another Pro Tools system in the Mixing Room, using an Optocore MADI (digital audio) unit, connected to the engine of the FOH Avid S6L using BNC or Coaxial connectivity
- As a second backup, we record the direct split from the channels on the Avid S6L stage rack, onto a Sound Devices which is located in the Mixing Room
- The Sound devices are connected via MADI cable (BNC or Coaxial)
- In Theatre 2 (ROHMA), we use one Sound Devices Recorder connected to the FOH DiGiCo Sound Console, via MADI (digital audio), using BNC or Coaxial connectivity.