WEEK 10

SIGNAL PATH 101

Signal Path

Why is it important to lean about Signal Path?

Production Arts professionals sometimes must meet the needs of many different artists simultaneously.

Large Audio, video and lighting systems are too complex to completely memorize. We use documentation instead. This is where Line Diagrams and similar documents come into play. Planning and documenting your signal is an important part of an audio engineers job.

Signal Path

One needs to use documentation to properly plan and execute large productions. ***Spreadsheets, Line Drawings and Block Diagrams*** are commonly used to depict signal path for many different types of A/V signals. It's important to know how devices are connected to one another if you are going to operate the system.

Everything from individual circuit boards to giant PA systems can be documented with a *Block Diagram*. Typically *Schematic Diagrams* are used for component level circuitry and *Block Diagrams* for logical views of the structure of a system. Block diagrams treat a device or system as individual components that are connected in a specific order. A schematic diagram maps the individual wires and pathways of an electronic circuit and might be needed to repair a device. But a schematic would never be required for operating the device. The block diagram fills the need of the Production Arts professional to understand the signal path and be able troubleshoot problems when operating the system.
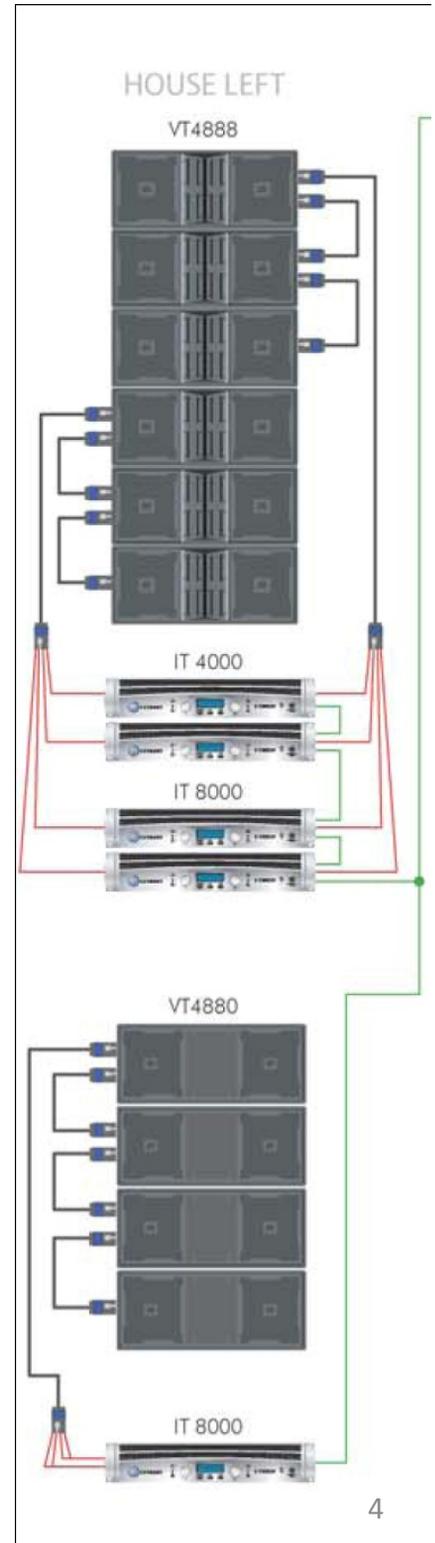
Signal Path

In this example, one side of a large stereo speaker system is depicted. For simplicity, I have used an example that uses digital networking to transport signals to different devices.

We learned about crossovers in week four. Different speaker types emit different sections of the full audio spectrum, as in HF, MF and LF. Systems use crossovers to separate the different frequencies that each speaker emits. The green wire represents the output from the crossover. One network cable can carry the low, mid and high sections as separate signals simultaneously. In an Analog system, each signal range would require it's own discreet wire path. Remember the Multi-core snakes in Chapter 8? Multicore cables help Audio, video and lighting pros transport their signals to where they need them.

HOUSE LEFT
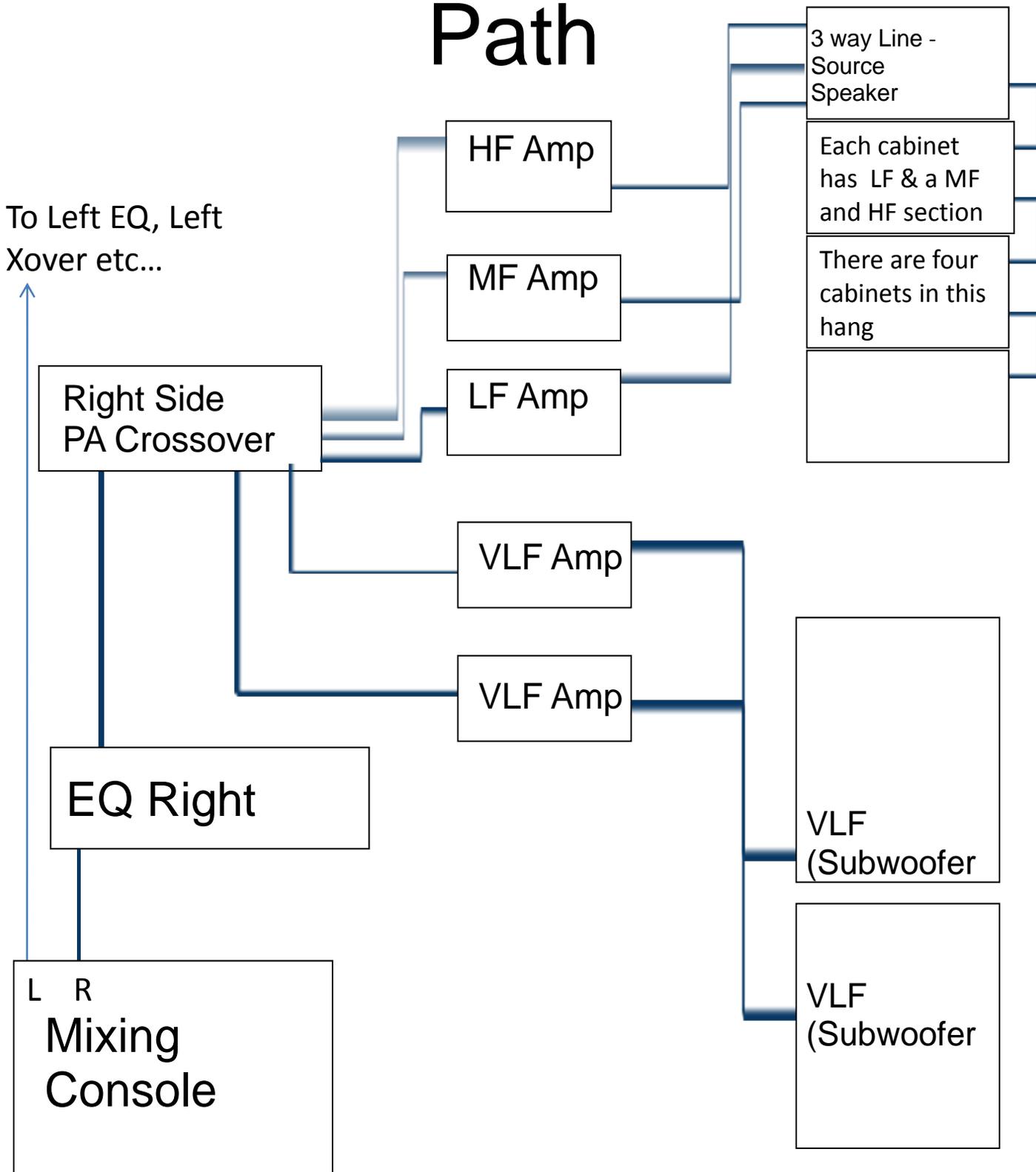VT4888
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Signal Path
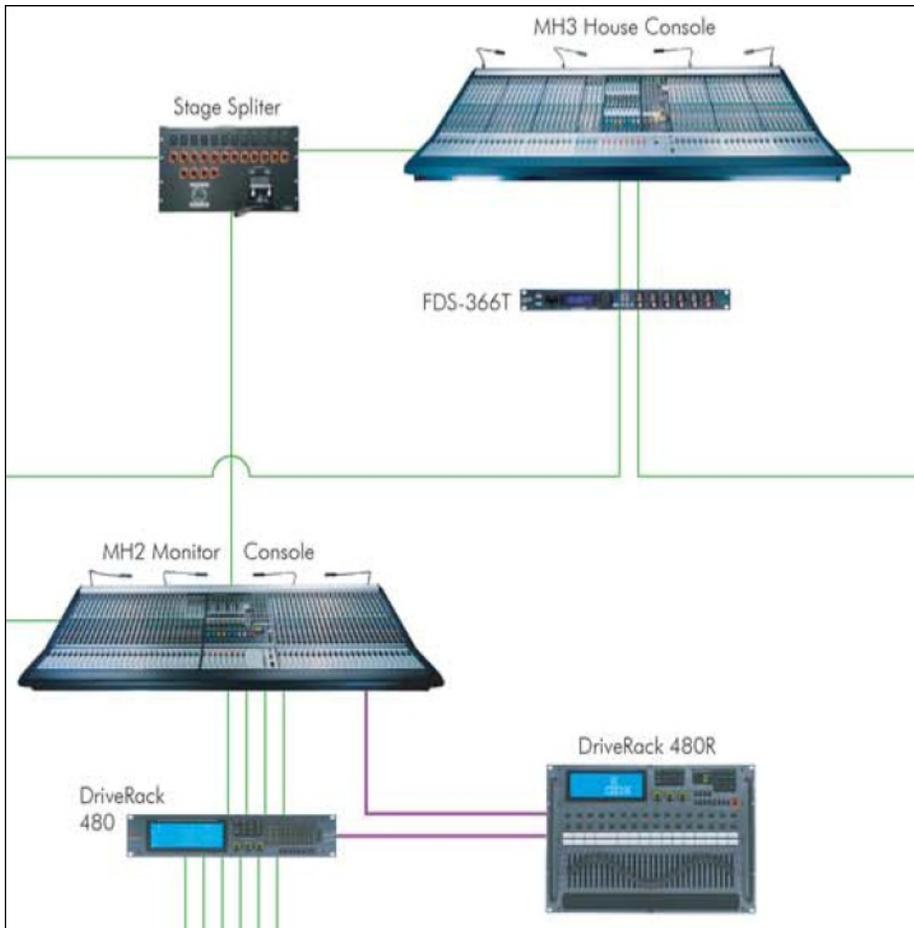
In this example, the FOH console and the Monitor Mix console are connected via a snake. And again, to keep the view simple I have used an example that utilizes analog consoles and a ***digital stage snake***. Digital snakes and digital networks transport large numbers of discreet signals in very small wires and eliminate the need for an individual pair of shielded, twisted wires *for every single signal on the stage!* It's still very common to use copper snakes in the industry though.

My PA System Signal Path

3 way Line - Source Speaker

Each cabinet has LF & a MF and HF section

There are four cabinets in this hang

HF Amp

To Left EQ, Left Xover etc...

MF Amp

LF Amp

Right Side PA Crossover

VLF Amp

VLF Amp

VLF (Subwoofer

EQ Right

VLF (Subwoofer

L   R

Mixing Console

This is a simplified line diagram of the signal flow in my PA System

Signal Path

So it does not mater whether you use digital networks or copper wire. In fact the two are often used in conjunction with one another. The point is to be able to send signal levels to the places in the venue where they are needed.

As we learned before, the documentation for assigning these paths is done using line drawings and spreadsheets.

Signal Path

One must be careful to consider the following when you are creating or documenting your signal path.
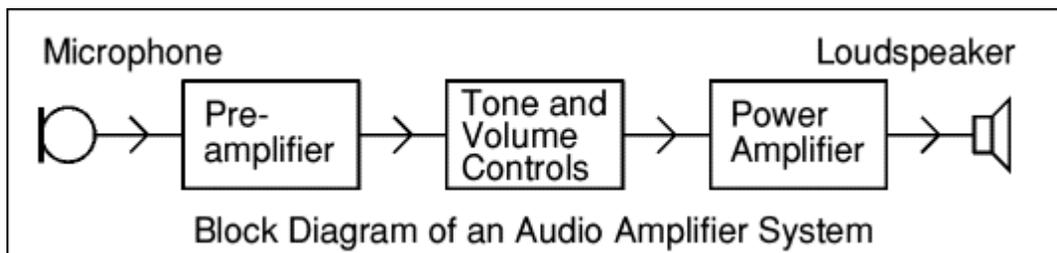
- Signal type is closely tied to a specific cable type by the way the cable is engineered. As we learned in Chpt 8, impedance, shielding and balanced circuits all play different roles for different types of signals.

- The sexual conventions of connectors concerning Input and Output must be observed as well. In modern systems, mismatches can be rectified with gender benders. But there can be many cases where a simple adapter is not available so careful planning helps avoid moments like that.

Signal Path

As you can see, cable resources and the distribution of particular types of cable are one factor in considering signal path. Forgetting to factor in a specific signal path or leaving out a location where signal flow is needed can severely undermine your program. Cable resources for production vendors is usually limited. Copper, multicore wire is very expensive so production companies don't buy "extra". They plan for an limited amount of flexibility in cable setup in order to save money. Careful planning therefore is paramount when preparing your line diagrams. As a word of advice, I would point out that this is precisely the moment to use your new found understanding of the collaborative process. Show your work to your peers for review and get their opinions when you are planning signal path. Constructive criticism is *invaluable and someone else might spot a mistake or make a good suggestion!*

Signal Path

Here is an example of a simple
Block Diagram or Line Diagram.

Block Diagram of an Audio Amplifier System

Signal Path

Here is an example of a Circuit Diagram paired with a Line Drawing of the circuit, laid out on a *Stripboard* kit.

Adjustable Timer Circuit

Circuit Diagram

Component Layout on Stripboard

Signal Path

Here is a simple line diagram of distributed PA system. Notice that no attention has been paid to connector or wire conventions in this drawing. It's purpose is to illustrate the devices and their interconnectedness. This technical drawing would have been accompanied by a spreadsheet that had corresponding descriptions of connectors and cabling to the labels on the drawing.

Signal Path

Defining your signal path may be as simple as saying I want vocal number 1 in channel 12 and I want vocal number 2 in channel 25. Or I want the Stereo Left output to use snake return 2 to stage. At it's simplest level, planning signal path is important to the A/V professional. Why?

- Troubleshooting problems
- Unexpected additions
- Backup contingencies for seamless performances

Signal Path

- Troubleshooting problems

Troubleshooting cabling problems is something that all successful professionals master. Having the ability to quickly identify problems and solve them is the kind of skill that will keep you employed constantly. Trouble with signal path and cabling particularly is going to happen on a regular basis. Because these systems are portable and get handled, disconnected and reconnected and generally get dragged around all the time. A few will break occasionally. Plan for it. Add spares and take extra cables when ever you can. Don't get lazy!

Signal Path

- Unexpected Additions

The nature of performing arts dictates that one must be ready for changes of any nature. If you are a sound engineer for instance, you must be prepared to move microphones, change mics, or add mics. Or possibly all three things at once! Pros are ready for the demands of the artists. Never put yourself above the demands of the talent. Our crafts, skills and even our own artistic input is useless without the performers. Support the performers and allow them to be the best that they can be.

Signal Path

- Backup Contingencies

Live performance doesn't have a rewind button. It's important to perform your job during a live performance as seamlessly as possible. Because modern performance scenarios are heavily invested in technology, one must include back contingencies to ensure that a performance is not halted by an electronic failure.

Conclusion

Signal Path is as important to the process of supporting performance as any other aspect of supporting the performing arts. Production Arts professionals must use their expertise to accommodate the widest number of variables possible. Understanding which kind of signals use what kind of cabling is one of the underlying professional abilities that you must develop. Planning and documenting signal path are at the heart of a ensuring your performers have a good performance.