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# Multi-studio Acquisition and Installation Cost Comparison

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Purchase costs and installation expenses  
when comparing several facility solutions.

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# Introduction

## Comparing apples, oranges and peaches

### Scope

Broadcasters are looking for cost-effective studio and technical solutions. While comparing the acquisition costs for various mixing consoles, audio routers and the like is the first step in a comparative process, there is more to consider. Installation.

A few years ago, it was easy to compare various studio equipment suites because the cost of installation was pretty much the same no matter what equipment you bought. All the wiring was “point to point”, and flexible cabling systems including punch blocks, patch bays, cross-connect wiring and the like were installed, or not, at the direction of the facility engineer.

Nowadays, there are new methods of wiring equipment and studios together. Some of these new methods benefit from some labor-savings over traditional methods. Some new technology is radically different in terms of the labor required for successful implementation.

This report compares three studio wiring scenarios, giving tabular and textual comparisons of the three chief methodologies available today.

### Studio Wiring Methodologies

#### Traditional Method

Traditional studio and inter-studio wiring methods tend to be “console centric”; the audio console is the center of each studio. All audio sources and destinations are wired directly into and out of the audio console. These consoles typically have a large number of connectors, either behind the meter bridge or under the console, within the console pan. Many engineers choose to extend all these connections out to a field of punch blocks or other cable termination so that additional wiring may be done without opening the console while it's in operation.

Wiring among studios and/or between each studio and a central wiring area, or “Tech Center” is usually done with multi-pair audio cables. These cables are often terminated on both ends by more punch blocks. Cross-connect wires are then used to connect cable terminations to console inputs and outputs. This practice can result in a typical audio feed being “punched down” from 4 to 8 times on its journey from source device to the transmission path output. Even more connections occur if the Tech Center employs a central patch panel or centralized routing switcher.

Traditional studio wiring, indeed, often begins at the audio console in each studio. Most engineers can identify with the laborious job of wiring all the inputs and outputs related to a traditional audio console. Wiring sources and destinations directly to and from console

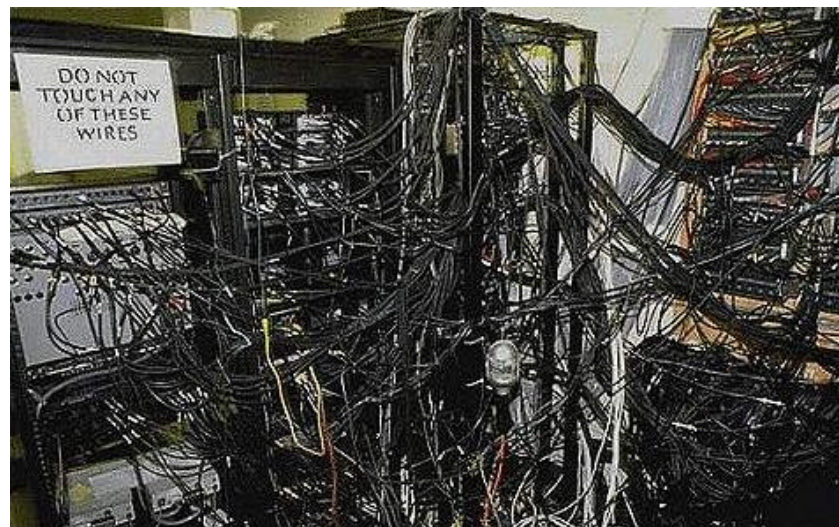
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I/O's is a bit more efficient, but is inflexible. Connecting console I/Os to equipment through punch blocks is even more laborious, but offers flexibility for future changes and additions.



Taken to its extreme, this kind of “point to point” wiring can get out of hand over the course of several years, format changes, additions or deletions to the stations in a given facility.

This photo exemplifies what can actually happen when a facility is connected using a methodology inadequate to the facility's growth needs.



Point to point wiring

A more reasonable example of traditional wiring techniques in a multi-studio facility follows. Here we see a typical Tech Center wall with dozens of punch block interconnects. Even when using a centralized routing switcher, an audio path often includes 4 or more trips through these punch block connections.



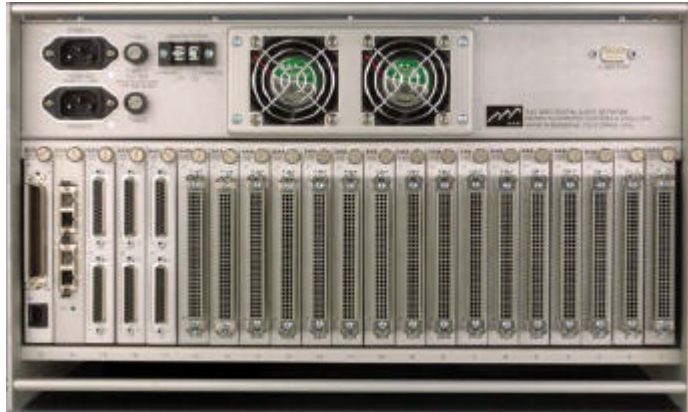
Wall of "66" punch blocks

Moreover, additions and changes down the road involve physical work, moving or adding cross-connect wiring, and documenting those changes.

#### Router/Surface Method

A new crop of audio routing switchers and add-on control surfaces emerged, beginning in the late 1990's. This class of routers is often called Time Domain Multiplex or "TDM" routers due to their internal design.

The first router/surface combinations relied on a centralized audio router to which all sources and destinations were wired, resulting in wiring technique similar to the "traditional method" described above. Later versions have incorporated "satellite" card cages designed to reduce inter-studio wiring.



Central Audio Router/Mixer



Satellite Card Cage

While some efficiency was gained and the amount of inter-studio wiring was reduced, it's still necessary to connect all studio sources and destinations to a single terminal frame, or more often, a set of punch blocks in one location.

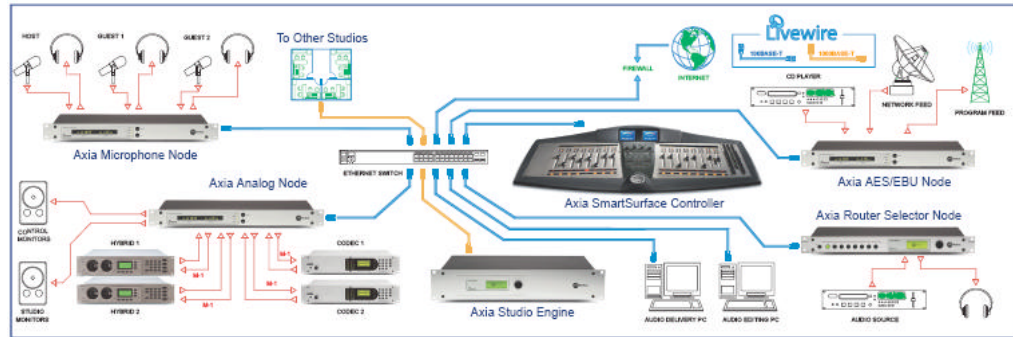


Console, Source and Satellite Card Cage Punch Blocks

Inter-studio wiring is reduced significantly – usually to just a few CAT-6 cables and/or fiber-optic cables. However, since the satellite cages and central audio routers use high-density connectors, they're still brought out to punch blocks for connection to source and destination gear.

## Audio over IP Method

First implemented commercially in early 2004, the Audio over IP method is similar to the networking of computer peripherals. Audio source and destination equipment is connected to nearby audio “nodes”. A node converts analog or AES3 audio to and from an RTP streaming format. Each node then connects to an Ethernet switch using a single CAT-6 cable. Modern Ethernet switches and protocols are employed, ensuring timely delivery of audio-bearing IP packets to their destinations. The central switch is an off-the-shelf 100/1000 Mbps Ethernet switched hub. Other studios are networked together by connecting their Ethernet switches together, in a “star” or “daisy chain” fashion, or both.



Typical connection scheme for an IP-Audio network

Audio nodes are installed near the equipment to be served, reducing cabling significantly. In this studio, for example, the longest audio cable (excluding the mic and speaker wires) is 3' 6" long. Both ends of each audio wire are visible behind the equipment, so no documentation is required. Audio wire routing is self-evident. Those who have installed this “distributed” audio network system report that installation time and materials are cut dramatically over other methods.



An analog audio node interfaces equipment in this rack to the network.

Installation of an IP-Audio network represents a departure from the other methodologies. Resembling a computer LAN in its topology, an IP-Audio network completely eliminates a number of usual pieces of hardware traditionally associated with multi-studio installations. Patch bays, distribution amplifiers, punch blocks, multi-pair cables, heavy-duty cable trays, all wall space previously devoted to intermediate connection systems, and more are not needed. Moreover, the planning and installation of these items is also eliminated.

Virtually all audio connections are made with no need for field soldering and field connectorization. Most equipment connections are literally “plug and play” using off-the-shelf adapters and cables. PCs used for audio recording or playback may be connected directly to the IP-Audio network without audio cards or GPIO devices.

Once the local audio I/O connections are in place, configuration of audio routing, paths and assignments is made with a graphical web browser interface.

Each studio connects to the Tech Center using from 1 to 4 CAT-6 Ethernet cables.

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# Comparison

## Traditional, TDM Router/Surface & IP-Audio Network

### Audio Wiring Materials for a Typical 4-Studio Facility Plus Tech Center

Materials	Traditional Wiring	TDM Router/Surface	IP-Audio Network
CAT-6 cable or fiber	0	\$ 200.00	\$ 600.00
Multi-pair audio cable	\$ 2,800.00	\$ 1,600.00	0
Punch Blocks and wiring guides	\$ 1,600.00	\$ 800.00	0
Distribution Amps	\$ 2,400.00	0	0
Central Audio Router or Ethernet switches	\$ 60,000.00	\$ 120,000.00	\$ 18,000.00
Satellite Router Cage or Audio Nodes	0	\$ 60,000.00	\$ 32,300.00
Audio Console/Surface	\$ 76,000.00	\$ 104,000.00	\$ 68,000.00
Audio cables & connectors for studio and Tech Center equipment	\$ 900.00	\$ 900.00	\$ 1,200.00
Total Equipment cost for consoles, routing & wiring	\$143,700.00	\$287,500.00	\$120,100.00

## Audio Wiring Labor for a Typical 4-Studio Facility Plus Tech Center

Task	Traditional Wiring	TDM Router/Surface	IP-Audio Network
Studio: Source/Destination equipment to punch blocks or nodes	96	96	32
Studio: Console to punch blocks	32	0	0
Studio & Tech Center: Multi-pair cable runs and terminations	48	0	0
Studio & Tech Center: CAT-6 cable terminations	0	16	16
Tech Center: Central Audio Router to punch blocks	32	32	0
Tech Center: Source/Destination equipment to punch blocks or nodes	24	24	4
Tech Center: Distribution amps to/from punch blocks	8	0	0
Programming of audio router or nodes and consoles	4	16	16
Total labor hours	244	184	68
Installation labor expense	\$12,200.00	\$9,200.00	\$3,400.00
Total equipment and labor	\$155,900.00	\$296,700.00	\$123,500.00