

If I Had a Hammer: A Guide to Building a Community Radio Station

STUDIO EQUIPMENT

1) Mixing

a) On Air/Production Console - The Broadcast console is the heart of the on air studio/production room. It is used to mix audio signals from various sources (microphones, CD players, Turntables, tape recorders, phone hybrids etc.) . Unlike a mixer it also has remote capabilities that can be configured to mute the studio monitors and control the On-Air signs when the microphones are activated and start devices such as CD players, cart machines etc.

b) External music mixer - A mixer may be used to supplement the broadcast console for live music broadcast or production. It has equalization and signal processing capabilities that are not present in the broadcast console.

2) Monitoring

a) Headphone system – Headphones and a headphone amplifier allow the Engineer, hosts and guests to hear the broadcast when the microphones are activated and the studio monitors are muted to prevent feedback.

b) Monitoring Speakers can be used to listen to the broadcast when the studio's microphones are not muted. A power amplifier may be needed to power the speakers connected to the broadcast console.

3) Microphones and stands

Microphones are Electro magnetic, electric capacitive and electric piezo-electrical devices used to convert sound waves into electrical signals. Microphones are available for many different uses and many fine less expensive models are available.

a) Voice Microphones – Usually dynamic microphones (moving coil or ribbon)
Prices range from \$30 to hundreds of dollars.

b) Musical Instrument Microphones - Usually Condenser microphones
Prices range from \$100 to many thousands of dollars.

4) Remote Communications devices

a) Phone Interconnection System (Hybrids) These devices are used to connect phone systems to the broadcast console allowing the caller to be mixed into and to hear the broadcast.

b) ISDN/POTS/IP (for remote connection) Devices such as ISDN, POTS (plain old telephone service) and IP (Internet protocol) codecs are used to connect to remote locations. They provide high quality two-way communications between remote sites and the station's studio.

c) Satellite systems allow the studio to receive programming services from -- such as Pacifica or NPR. The typical equipment needed is a receivers, satellite dish and RF amplifier and cabling.

d) NPR PRSS/Content Depot is NPR's proprietary system for delivering programming to its affiliates. It uses a combination of hardware/software and automation to send real-time audio as well as audio files directly to the subscribing station.

5) Auxiliary equipment

a) DAT Digital Audio Tape recorders

b) CD Players and CD Recorders

c) Cassette and Reel to Reel tape recorders

d) Turntables

e) Internet streaming/Computer Files - Computers can be used to play audio files or live audio streams (such as Pacifica's KU programming) directly onto the air signal through the broadcast console.

f) Barix Exstreamer instead of computer for receiving Internet streams. <http://www.barix.com/>

6) Miscellaneous

a) Air Monitors are speakers connected to a radio receiver that let you hear your broadcast signal. They are usually located in offices/hallways in the studio complex.

b) On-air signs These illuminated signs light up when the microphones in the studio are activated.

c) Audio Patchbays and Switchers are used to manually or automatically route audio signals from one location to another.

d) Automation systems are used to play an audio file, switch a device, record a source or take a feed etc. at specific programmed times

e) Air signal processors are used to prepare (compress and equalize) the audio for broadcast transmission. They are typically part of the last stage of the broadcast chain, typically connected to the studio to transmitter link (STL) or to the exciter at the transmitter plant.

7) Room treatment

a) Soundproofing is used to prevent sounds from traveling between rooms. Soundproofing is implemented during the studio room's room design and construction.

- b) Wall Treatment is used to control the wall reflections and resonances within a room.
- c) Bass trap absorption is used to control the resonance of lower frequencies in larger rooms.

8) Wiring

- a) Cables – Power/Microphone/Line Level/Control
- b) Snakes – multi-pair version of the microphone/line level interconnect cabling.

9) Studio Rooms

- a) Air Studio
- b) Production Studio
- c) Performance Spaces
- e) Edit Rooms and Production Cubicles
- f) Interview Booth
- g) Terminal/Equipment room
- h) Offices

10) Computers

Shared Resources Internet/File-sharing/Printing

Production space on servers (storage)

Online/Offline Archiving –Stations may want to record their programming automatically and or provide the archives of that programming for their audience at a later time.

Otis Maclay has coded some UNIX freeware, which handles these functions.

An example is at <http://archive.kpft.org/> He can be contacted at omaclay@gmail.com

RESOURCES FOR CUTTING COSTS

EQUIPMENT

- Consoles

Wheatsone - Audioarts Air 2 Plus (best choice for low price)

http://www.audioartsengineering.com/audioarts_consoles.html#air2

- Microphones and cabling (inexpensive Sm-58 substitute microphones and cables)
http://www.speakerrepair.com/Merchant2/merchant.mvc?Screen=CTGY&Category_Code=microphones
http://www.speakerrepair.com/Merchant2/merchant.mvc?Screen=CTGY&Category_Code=agb_mic_cables
<http://www.speakerrepair.com/>
- Used equipment - Research before you buy! – Ask if it's working properly!
Talk to people on listserves!

INFORMATION

Mail List-servers

- PUBTECH - The Public Radio Tech Discussion List - <http://www.pubtech.org>
<mailto:pubtech-admin@wduq.org>
- LETI - Prometheus Radio - <http://lists.prometheusradio.org/listinfo.cgi/leti-prometheusradio.org> Leti@lists.prometheusradio.org
- GRC - Grass Roots Radio Coalition - grc@maillist.peak.org

Organizations for Affiliation

- Pacifica
- NPR
- NFCB
- GRC

Creating relationships with other stations Go out there and make friends!

INTERNET AUDIO STREAMING

Internet streaming is an easy way to get your programming out to people who cannot receive your broadcast signal. It allows a station to reach listeners in other geographic locations or when

conventional radio is unavailable like in the workplace. Some stations use Internet Streaming to supplement their broadcast signal and other stations use it as their main delivery system. The following is the Hardware/Software/Services and considerations needed to perform Internet Audio Streaming.

- Stream Source - The streams source sends a single digital audio stream to the server, which then distributes the stream to the client computers across the Internet. A computer running streaming software or a Barix Instreamer (see below)
- Streaming Server - Typically located at an Internet Service Provider the Streaming Server connects directly to clients across the Internet. There will be ongoing service costs involved with running a stream server. The cost amount will be largely related to the amount of bandwidth used per month.
- Bandwidth - The total sum of the connection speeds the listeners are demanding from you at any particular time and/or over a time period (monthly).
- Automation to control programming
Winamp/Itunes (free)
Campcaster (linux open-source) http://www.campware.org/en/camp/campcaster_news/
Sam Broadcaster (commercial) <http://www.spacialaudio.com/index.php?page=sam-broadcaster>
- Resolution/Quality The higher the bitrate the better the streamcast will sound and the more bandwidth the stream server will use. Dial-up listeners will not be able to listen reliably to a stream with a bitrate over 24Kbs

Suggested resolutions:

- 24Kilobits/Second with a 22KHz sample rate) Mono (low quality)
- 32Kbs/22Khz Mono (better quality)
- 64Kbs/44KHz Mono
- 64Kbs/22KHz Stereo
- 128Kbs/44KHz Stereo
- Otis Maclay has coded for Pacifica a series of free server-based UNIX tools that allows a single stream source to be converted to various resolutions for distribution on a Shoutcast or an Icecast server. This allows a station to use a Barix Instreamer to send a single high quality stream to the Maclay Pontifiserver to be down-converted for different uses. omaclay@gmail.com
- Considerations - Bandwidth can be expensive. As your listenership grows, your bandwidth cost will grow as well. Monitor it at least once a week and check your usages with your ISP. There are also royalty considerations for streamcasting copyrighted

material over the Internet. The fees and record keeping practices are still being negotiated.

- Administration of the programming/Streaming. Personnel.
- Promotion on website etc. Think creatively to get the word out.

REMOTES

Typical Equipment Needed

- Portable Mixer
- Microphones
- Headphone and Headphone amp
- Cabling:
 - Microphone – single /snake
 - Line
 - Ethernet
 - Power – surge protectors/splitters
- Audio adaptors
- Recorders Flash/Computer/Analog
- CD player
- Telephone Hybrid (very optional)
- Transmission Device

ISDN/POTS/IP/Internet Streaming

ISDN codecs provide duplex (two-way) high quality communications. It uses special phone lines, which may be costly and may take one to several weeks for the phone company to install. ISDN is fairly reliable. This technology is being phased out due to newer technologies becoming readily available. Two ISDN codec's are needed one at the remote site and one at the studio.

POTS (Plain old telephone service) codecs provide lower quality duplex communications than ISDN using a regular analog telephone line. If the telephone line is routed through a PBX (Switchboard) the quality may suffer or the remote device may not connect to the unit at the studio. The reliability of the POTS device depends on the quality (noise) of the phone line/wiring/network. Digital phone lines are not supported and may damage the POTS codec. Two POTS codecs are needed, one at the remote site and one at the studio site.

IP Codecs like the Comrex Access can provide high quality duplex communications using readily available transmission mediums such as

Wired Internet, POTS or wireless technologies such as WIFI, and cellular phone services like 3G and Edge. The units are fairly expensive to purchase but fairly inexpensive to use. Reliability depends on the reliability of the Internet, POTS or wireless service.

Computer Internet Streaming can provide simplex (one-way) communications between the remote site and the studio site. The following will be required for Internet streaming.

- 1) Computer- Preferably a laptop
- 2) Software (Winamp plug-ins –Oddcast- Nicecast (Mac))
(An Icecast or Shoutcast Server may be needed for Winamp and Oddcast transmission. Nicecast has a built in server that can be used to connect to a client or clients.)
- 3) Internet Connection Wired/WIFI (may not be very reliable)
- 4) USB/Firewire Audio interface to interface to the computer (laptop) is optional.

OR

- 5) Barix instreamer instead of streaming computer <http://www.barix.com/>
These little interfaces accept audio and will stream to a barix Exstreamer directly or to an Icecast or Shoutcast Live365 server using a broadband wired (Ethernet) Internet connection. They are easily configured using a computer's web browser. The reliability of these devices depends on the connection to the Internet at both ends and the Internet traffic in-between.

Jon Almeleh
National Technical Director
Pacifica Radio
sirius@pacifica.org