A NETWORK APPROACH TO THE PROBLEM OF SHARING MUSIC STUDIO RESOURCES

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Abstract: A computer music course offered at Rhodes University depends on the musical resources of a single computer-controlled studio. The setup is wasteful of music resources and difficult to monitor. Consequently, a music networking project has been initiated. The first goal of the project is to provide the same facilities as in the current studio, but to provide them at a number of remote, networked, IBM PC workstations. Users will be able to book music resources, and patch and mix their outputs from the workstations.

Introduction

For the past two years, a computer music course has been offered to fourth year music and computer science students. In the first half of the course, musicians and computer scientists learn the effective usage of a computer-controlled (MIDI-based) studio for sound creation and sequencing. In the second half, computer scientists learn about real time programming tools applicable to music sequencers. Initially, computer science and music students are paired off to work on different aspects of a music production for either the Drama or Journalism departments and have to share studio facilities. In any time block, the entire studio is utilized by one group only. This is wasteful, since often only a subset of the musical resources will be utilized by a particular group within a time slot. Studio usage has now spread, and the facility is being requested by musicians both on and off campus. Security and correct use of the equipment is difficult with such a large user group. This paper describes a music networking project initiated to solve these problems.

Requirements of the Initial Network

The hardware layout of the current studio is typical of many semi-professional studios. Because of the constant throughput of users, many of the studio setup procedures have been automated. An IOTA MIDI fader automates the mixer fader level adjustments. The main sequencer is Voyetra’s SFX running on an IBM PC. The Voyetra sequencer software incorporates a universal library which automates instrument set up at the start of a session. The initial goal of the project is to provide similar facilities at a number of networked IBM PC workstations. A user will log on to a workstation by providing a unique usercode and password. Resources will be booked via an on-screen booking sheet. Records will be kept of workstation and music resource usage. Audio inputs and outputs will be patched and mixed via an audio patch display. Only those resources booked by the user will appear on the patch screen. He or she will indicate the percentage of the incoming signal to be routed to the output of the patch point. At each of the inputs, there will be control over gain, bass and treble filtering, and parametric equalization. MIDI inputs and outputs will be patched via a MIDI patch screen. Receive channels of effects units and synthesizers will also be set via this screen. Workstation control over a Tascam 238 multitrack tape recorder will be provided. The entire front panel of the Tascam will be reproduced on screen.

Implementation of the Initial Network

The hardware configuration of the initial network is shown in figure 1. Ethernet connects the workstation and server computers. Booking, patching and tape control information will be

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transmitted over ethernet from the workstations to the server. The server has direct control over the audio and MIDI patchbays, as well as over the multitrack.

Both the audio and MIDI patch bays are being custom-built for the network project. The audio patch bay allows for mixing of signals at the patch nodes as well as volume control at these nodes. Gain and equalization controls are provided at the inputs to the patch bay. A single patch bay has 16 inputs and 16 outputs. Patch bays can be configured to provide 64 inputs and 64 outputs. Each patch bay has a pool of nodes which are assigned to patch points by an embedded processor.

Patching and equalization will be requested via MIDI system exclusive messages. Gain and equalization controls are provided by a separate 16-input unit which will be attached to a patch bay. A star configuration will be used for transmitting audio from the audio patch bay to workstations. Two lines will transmit audio from the audio patch bay to a workstation and from the workstation to the patch bay. The MIDI patch bay also has 16 inputs and 16 outputs and it too can be configured into a larger patch bay. Patching is performed by an on-board processor. Two MIDI lines radiate out from the MIDI patch bay to each workstation. One of these MIDI lines carries MIDI data from the workstation to the patch bay. This data will include the normal range of MIDI messages produced by a computer sequencer, as well as system exclusive messages. Of particular importance here are system exclusive messages to change channels on synthesizers. The other line will be used for handshaking messages from synthesizers and MIDI song position pointer and timing bytes. The length of the MIDI lines can be extended via RS422 or a fibre optic extension. The non-deterministic nature of ethernet precluded its use as a MIDI data carrier. In a master-slave configuration, ethernet is an excellent carrier of MIDI real-time data. However, in a multi-workstation environment, where large file transfer is occurring, real time response cannot be guaranteed with ethernet's CSMA/CD protocol.

The workstation booking, patching and tape control programs will be pop-up programs which remain resident with the Voyetra sequencer. The server will perform its multiple tasks under a modified version of the XNU operating system [1]. It will convert SMPTE synchronization information on the multitrack to MIDI song position pointer and timing bytes, via a tempo map derived from a MIDI file and sent to the server. Use of the Voyetra sequencer package is not prescribed by this configuration. The workstation node could be used as a booking, patching and tape control centre, while sequencing is performed on a completely separate sequencer device.

Issues arising from initial network construction
This initial attempt at networking music resources has provided pointers to a number of possible enhancements. Foremost amongst these is automated mixing. In the current system, mix level

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can be set before sequencing and changed via a pop-up screen during playback. However mixing changes are not recorded. Controlled fading will be provided via the IOTA fader box or via MIDI volume control on each synthesizer. A sequencer which incorporated ethernet control of patch bays would allow automated fading, equalization and effects processor level changes without dragging MIDI lines. A first solution could be a sequencing facility on a separate machine which would provide synchronization signals to the workstation. The workstation would record mix level changes made by a user and transmit these to the server over ethernet. Changes could be ‘played back’ or recorded over. A customized sequencer could also provide a friendlier approach to instrument selection. The hardware communications links lead to a rather cluttered hardware configuration. The configuration proposed by Burton [2] comprising a LAN with MIDI servers is cleaner. However, his proposal does not address the issue of routing audio to workstations or the indeterminacy inherent in using a LAN Lon Wolf’s mediatink protocol [3] promises to solve the clutter problem by providing a single fibre optic cable along which audio, SMPTE and MIDI signals could travel. However, it looks like the realization of this promise will take some time yet. Of particular concern is the cost of such a implementation. Another method to reduce hardware links would be to retain the current configuration and use radio transmitters and receivers for the transmission of MIDI and audio. Commercial systems are available for the short range transmission of MIDI and audio signals.

Benefits of the network approach need to be contrasted with a workstation-oriented approach as put forward by Harris [4] and realized by Jaffe et al [5]. The network approach outlined in this paper provides benefits to an educational institution with limited funding. It allows a single music resource centre to be developed incrementally and to be accessed by currently available computers.

A number of enhancements to the MIDI specification could be suggested for use in this networking environment. Explicit commands to: change MIDI channel, adjust reverb, chorus and other effects in signal processing units, and control tape decks, would facilitate the implementation of the network.

Conclusion

The system described in this paper allows for the efficient management and use of studio resources in a multi-user environment. Because of the direct links from workstations to MIDI resources, MIDI-based software can be used without change in the network environment. The incorporation of a LAN and central patcher/mixer opens possibilities for a high degree of mix and effects control. The specification and design of this system was preceded by a number of schemes to provide an elegant software interface with a clean hardware design. Optic fibre technology promises to allow for this clean hardware design and to facilitate the elegant interface. For the moment, the solution described in this paper provides easy to use, inexpensive control over a range of music resources.

References


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