At our meeting on October 8, 2014, I was somewhat repetitious because I was having trouble keeping the overall design in my head. This description is to serve as a memory aid for me, and I expect we will use it in the documentation for the product. After I got into the high-level description I began having ideas about how to structure the various parts so that the various users would have their needs met. This gets into the design, but I decided to record my ideas here for my convenience. That makes this document less useful for end users, but more useful for maintainers.

Purpose

Show_control controls the lights, sounds, microphones and other activities supporting a live theatrical presentation. It is designed to address all levels of live theatre, from the smallest community theatre up to Las Vegas and Broadway, but our first implementations will concentrate on the needs of a well-equipped community theatre.

Outline

The center of show_control is its database, which holds all of the information needed to present a performance. This includes the dialogue, music, light cues, sound cues, microphone assignments, microphone switching instructions, list of props, how the props and sets are to be handled by the running crew, the list of characters, the list of actors, the assignment of characters to actors in each performance, and all the details of the sound and lighting equipment.

The database is divided into files based on who modifies the data, when it is modified, and theatre tradition:

Main File

The main file contains the name of the production and pointers to the other files. It includes the date of the performance, in case some characters have different actors in different performances. There is also provision for noting which pieces of equipment are not working and which actors or crew are absent, so that fall-back provisions can be invoked. This file is created by the director and stage manager, and is updated by the stage manager for each performance.

Script

The script is traditionally written by a playwright, who allows theater groups to perform his play. Often he does not participate personally in the production, particularly if he is dead. The director will generally make small changes to the script, but the bulk of it will not change between productions, including productions by other theatre groups.

The script contains the lines of dialogue, grouped into pages, scenes and acts. A line of dialogue can be uttered by more than one character, and characters can speak different words over each other. The lines may be sung instead of spoken, in which case there is a reference to the music. Along with the spoken words will be parenthetical notes describing how an actor is to deliver the character's line, and how he

is to move.

Interspersed with the dialogue are descriptions of activities that are not performed by the actors, noted as actions. These include changes in the lighting, environmental sounds such as weather and a ringing telephone, and movements of objects not caused by a character, such as a bat flying over the audience. Also noted are the entrances and exits of characters, though a character need not be on stage to deliver a line of dialogue. Anything a character does while not speaking is also noted as an action.

The script is acquired by the producer, who may have to convert it from a paper script.

Music

In a musical, the music and the words are traditionally written by different people. The music is written for the singers as notes for each voice range, with a word or syllable associated with each note. The music director sees a more complete score, with the notes for each instrument. There may also be scores for each musician, which shows only what he needs to play his instruments under the direction of the orchestra leader. Generally the music director will make small changes to the music, but the bulk of it will not change between productions, including productions by other theatre groups.

A non-musical will sometimes contain incidental music. This will be either sheet music, a sound recording, or an indication that the producer should find suitable music.

The music is acquired by the producer along with the script, and may have to be converted from paper.

Hardware, Operators and Running Crew Descriptions

Each light, microphone, speaker and projector will have a file describing how it is controlled, as will the lighting board and the sound mixing board. These descriptions will be specific to a venue and pretty much independent of the play being performed, though some productions may require special equipment, or the modification of the theater's standard equipment. An example is the house lights. They might be raised and lowered by a certain DMX command, which is issued by a certain slider on the lighting board. A cue to adjust the house lights might be sent to the light board operator, who will move the specified slider. If the light board has computer control, the command could be sent directly to the light board from the stage manager's computer.

In addition to hardware, these files also describe each operator and each member of the running crew. This allows cues to be directed to a person, or his understudy if he is absent. Thus, for example, a cue to turn the house lights on or off might be directed to a member of the running crew who is standing near the light switch.

Having understudies among the running crew and operators is important if someone becomes ill during a performance. For example, I was the sound reinforcement operator in a production of Oklahoma! in 1994. The spotlight operator became ill and had to go home. The lighting operator took her place, and I operated both boards. This can be modeled by describing the lighting operator as the understudy for

the spotlight operator, and the sound reinforcement operator as the understudy for the lighting operator. The stage manager then issued both sound and lighting cues to me.

The distinction between operators and running crew is traditional, but not really important to the control of a show. An operator sticks with his board, which is located within or behind the audience, whereas a member of the running crew is backstage, or on stage during a blackout. In community theatre even actors and crew can exchange roles: in an Amherst PTA production of The King and I, the sound reinforcement and sound effects operator also played an on-stage statue in "The Small House of Uncle Thomas".

The files describing hardware are created by the technical people at the theater, and are updated by them when new equipment is acquired and old equipment is retired. The files describing the running crew and the operators are created by the producer and stage manager.

Characters

Each production will have an actor assigned to each character. A character can be played by different actors in different scenes or in different performances of the same production. An actor can play more than one character. An actor may have an understudy.

Cues

Connecting the script with the hardware and running crew is the cues. When the script calls for a cue to be performed, the cues file describes how to execute that cue in terms of issuing instructions to backstage people or directly controlling hardware. An example is the beginning of the show. When the stage manager signals that the show is to start, the light board operator is told to lower the house lights, the sound effects operator is told to play the recording of the safety announcement, and when the safety announcement is finished the curtain puller is told to open the main curtain. Any or all of these three actions can be done by a machine under control of the sequencer rather than by a person.

The cue descriptions are kept in a separate file because they are mostly specific to the play being performed and the equipment and personnel available in the theater. For example, you might have a member of the theater's management speak to the audience and give the safety announcement rather than using a recording.

If a cue specifies that a backstage actor is to speak into a microphone, or that a bell is to be rung on-stage, there is provision for a fall-back recording in case of equipment failure. If a cue specifies that a certain member of the running crew is to open the main curtain, for example, there is an alternative person specified in case the regular person is unexpectedly absent. This is in addition to the understudy specified for the absent person, because having just an understudy may not be flexible enough if various actions need to be assigned to different people based on where they are. The designers can specify multiple fall-backs, in case there are multiple equipment failures and absent persons.

Cue names are in the script, but the list of actions each cue performs are in the cues file, selected by name. The list can include actions that are to be performed together, such as closing the curtain and raising the house lights. It can also include actions that are to be performed in sequence, such as lightning followed by thunder. Within this structure the ability to wait for a definite length of time will be useful, such as starting to close the curtain, waiting two seconds, then starting to raise the lights. If it is necessary to wait for an event, the cue can be divided in two, and the stage manager can signal when to start the second part.

An activity may have to be carried out by multiple people, such as taking a prop from an actor when he exits the stage, or moving a microphone from one actor to another.

Users

The design is guided by considering who will be using the program.

Playwright

The playwright creates the script using a modified version of Trelby, which outputs the script in the format used by show_control. If the script is only available on paper, the script file is created by the producer. In addition to the dialogue the script contains general instructions: sets, props, costumes, lighting and sound.

Director

The director reads the script to see what actors he needs to perform the play. As he casts the play he enters actor information into the characters file. He may find that some actors are available for only certain performances, in which case he will assign different actors to a character depending on the date of the performance.

Actors

The actors need to know when they enter, how they move, when and what they speak or sing, and when they exit. This information is extracted from the script and the character assignments. Some actors want to see the whole script, with their own exits, entrances, actions and dialogues highlighted. Others just want to see what they are to do, and the cue preceding each activity. When an actor is backstage he may be giving up or receiving a microphone. An actor can also deliver a line from offstage, though this is usually just before an entrance or just after an exit.

Stage Manager

The stage manager needs the complete script, with instructions for the running crew, the operators and (if he is reading from a tablet) the computer-controlled boards. During a performance he follows the script and calls cues to the people and computer-controlled boards. If an actor is unexpectedly missing,

he will assign someone else to perform the missing actor's characters. Similarly, if a practical fails he will specify that the fall-back recording is to be used instead. While some failures or absences can be anticipated in the design of the show, the stage manager will need to have access to all the files used by the director and the various designers to handle extreme cases. Remember that "the show must go on".

In some productions the operators will call their own cues, in which case these can be eliminated from the stage manager's script, or just noted for his information.

Lighting Designer

The lighting designer constructs the lighting cues based on the descriptions in the script. For example, if the script says that stage left is to be outdoors but stage right is an interior, he will determine that certain lights are provided with gels of an appropriate color and aimed at certain parts of the stage to give this effect. He will then specify that this cue will set certain lights to certain intensities.

The lighting designer will set up all the lights during "move-in", then program the cues. During "tech run-through" he gets to test all the cues in order, and adjust the intensity, color and direction of each instrument to get the effects he wants. The information about the placement of the lights is captured in the hardware control files, and the information on how they are used is captured in the definition of each lighting cue.

Lighting Operator

During each performance the lighting operator runs the light board, under the control of the stage manager. For each cue called to him by the stage manager he needs to know what to do with the controls on the light board. This might mean moving a slider or pushing a button. If the stage manager is working from a computer-based sequencer, and the lighting board can accept commands from a computer, the job of the lighting operator can be completely automated. However, the lighting designer might wish to observe each performance and made slight changes to the cues.

In some productions the lighting operator may call his own cues. In that case he will need a complete script with the lighting cues noted on it. If the light board is computer-controlled, the lighting operator will just need to follow the script so that the cues will be executed at the right time.

Spotlight Operator

The spotlight operator uses his hands and eyes to aim and operate his spotlight. The job is hard to automate because the light must track an actor. Traditionally, a spotlight operator takes his cues from the stage manager because he needs his eyes and hands to manipulate his spotlight. A production may have more than one spotlight, and therefore more than one spotlight operator.

Sound Effects Designer

The sound effects designer constructs the sounds, other than those made by the actors. For example, if

the script says that a telephone rings, he may put a telephone bell on stage and specify in his cue that the sound effects operator is to close a relay to cause the ringer to sound. A more complex sound, such as thunder that accompanies lightning, would be constructed in consultation with the lighting designer.

The sound effects designer will use "tech run-through" to adjust the speakers and the sound fed to each speaker for each cue. The information about placement of each speaker is captured in the hardware control files, as is the wiring of each speaker and microphone to the mixer, and the settings of the mixer controls.

Sound Effects Operator

The sound effects operator will cause sounds to be made, either recorded or practical, when cued by the stage manager. If the stage manager is working from a computer-based sequencer, and the sound effects player and practicals can accept commands from a computer, the job of the sound effects operator can be completely automated. However, the sound effects designer may wish to observe each performance, and adjust the cues in real time.

In some productions the sound effects operator may call his own cues. In that case he will need a complete script with the sound cues noted on it. If the sound effects player and practicals are computer-controlled, the sound effects operator will just need to follow the script so that the cues will be executed at the right time.

Sound Reinforcement Designer

The sound reinforcement designer will figure out how to use microphones, either on stage or attached to each actor, to amplify the actors' voices. He will decide when each microphone will be turned on and off, and how to set its equalizer controls and volume control. These are microphone cues, which are captured in the cues file and called for from the script. During "tech run-through" he will make sure each actor can be heard. Often, the sound effects designer will use the same speakers and mixer as the sound reinforcement designer.

Sound Reinforcement Operator

The sound reinforcement operator will switch microphones on and off based on cues from the stage manager. If the stage manager is working from a computer-based sequencer, and the sound mixing board can accept commands from a computer, the job of the sound reinforcement operator can be completely automated. However, the sound reinforcement designer may wish to observe each performance, and adjust the cues in real time, particularly the equalization.

In some productions the sound reinforcement operator may call his own cues. In that case he will need a complete script with the microphone cues noted on it. If the sound board is computer-controlled, the sound reinforcement operator will just need to follow the script so that the microphones will be switched on and off at the right time.

We will have a tool which will examine the script to determine which microphones to assign to each actor, then insert microphone cues into the script and create the microphone cues file. The cues include moving a body microphone from one actor to another, an activity that the stage manager will assign to a member of the running crew, or to the two actors.

Running Crew

Members of the running crew need to know what they are to do on each cue called by the stage manager. Examples include removing a particular set piece to a spot allocated for it off stage, slapping two pieces of wood together to make a special sound, moving a curtain, helping an actor with a costume change, handing an actor about to enter his prop, and moving a body microphone from one actor to another.

These actions are captured in the cues files. They are created by the director, stage manager, lighting designer, sound effects designer and sound reinforcement designer. If a member of the running crew is unexpectedly absent, the stage manager will note that and the cues will be directed to the fall-back person.

In some productions there will not be a stage manager calling cues, so each member of the running crew will need a script with his activities highlighted, just like an actor.

Software Design

The software is structured to meet the needs of each of the above individuals. Note that the above descriptions of users are of roles; a single person may fulfill more than one role. For example, the sound effects designer is often the sound reinforcement designer, the sound effects operator is often the sound reinforcement operator, and sometimes one person performs all four roles. Nevertheless, we keep the roles separate to help focus the software on the separate needs.

We will need editors for the various files noted above. We can use a modified Trelby to enter the script and write its XML file. The other XML files can be created using a generic XML editor, if there is such a thing, or written by hand until we get around to writing our own editors.

Sound cues can be played by Linux Show Player or Cue Player until we write our own player. Light cues can be played by Cue Player Lighting until we write our own.

The tool to assign microphones can be based on allocate_microphones.

If the stage manager runs the show with the aid of a computer he will use the sequencer. It uses the database to display the dialogue and actions, and the names of the cues to be issued. The stage manager tracks the progress of the performance, calls cues over his intercom to the crew and operators, and his computer issues cues to computer-controlled equipment. If the stage manager does not use a computer, the script with all the cues is printed for him.

In some productions the calling of cues is divided between the stage manager and the operators. In that case the operators might have their own computers, which would contain the complete script and their cues. For computer-controlled boards, the operator's computers would issue cues directly to their boards based on the tracking of the script by the operators. If a board is not computer-controlled the operator could work from a printout of the script with his own cues noted on it. A mixed situation is also possible, where the computer controls some of a board's functions, but the others are manual. For example, a sound board may allow a computer to control its mute switches but not the aux send levels.

Modularity of the data is important so that information can be used in subsequent productions. The script and music files should be reusable in the same way that paper scripts and sheet music are reusable. The descriptions of how hardware is controlled can be carried intact to the next show in the theater. The connection between the two is the cue files. A skeleton cue file can be created from the script, with the actions to be filled in by the designers. For microphones, a complete microphone assignment can be created automatically from the script, and then tweaked as necessary by the sound reinforcement designer. We will have default actions for certain common cues, such as blackout.

Modularity of the programs is also important, so that the various parts can be developed and improved independently. We will need a well-documented protocol to communicate between the modules, which will run as independent processes, on the same or different computers. For the modules which must communicate during a performance we can use MIDI or OSC, with the rule that any command not understood by the receiver is to be ignored. The editors communicate with each other and with the sequencer using XML files. When modifying an XML file, anything not understood needs to be passed through without change. This will let us add new things to the XML schema without having to modify all the editors.

The stage manager needs to be able to say that the performance has "jumped" to a particular place. This can happen when an actor forgets a line, and the other actors help him recover—a page of dialogue can be skipped. The operators and running crew need to be able to deal with this when the stage manager recognizes it.

There also needs to be a provision for an emergency. At any point in the presentation, the stage manager can signal that there is an emergency. The house lights come up, the noises stop, the actor's microphones are muted, the stage lights are replaced by work lights, and an announcement is played or the stage manager's microphone is routed to the speakers. Each operator, member of the running crew, and computer-controlled board needs to know what he is to do if the stage manager gives the "emergency" cue. This cue, like "blackout", can also have a default set of actions.

It is probably best to describe people as "light board operator" and "curtain puller". These roles can then be assigned to individual people, with fall backs identified. Structuring the software this way will make last-minute substitutions easier.

Range

We want to be able to support a wide range of theatre groups. The smallest is the one-man show, where an actor is also the stage manager, and all the equipment is computer-controlled. In such a case the actor will need to track the progress of his performance on his tablet, and his computer will issue cues as needed. It is conceivable that it might someday be possible to have a fully-automated stage manager: a computer which can track the progress of the performance using a camera and microphone. That is currently beyond the state of the art, but we should not preclude the ability to add it someday.

A very large production would have understudies for every position, backups for every conceivable failure of people or machines, and spare parts handy to replace anything critical during a performance. Our ambition does not extend to performing the launch of a NASA rocket, but we should have provision in the software to reach well beyond the capability of community theatre in case someone wants to make the effort.

The focus of our implementation is on a well-equipped community theatre. A good example is the Amato theater in Milford, NH. The theater was built for the American Stage Festival, a professional theater group which could not make the economics work. It is now part of the Souhegan Valley Boys and Girls Club, which uses it for their own productions and also allows local community theatre groups to use it. It has wings, fly space, a wide and deep stage with curtains, and theater seating. There is a catwalk over the audience, lights, speakers, and body microphones.

An example of a more typical community theater is the Jewish Federation of New Hampshire theater in Manchester, NH. The space is also used as a gymnasium, so it does not have theatre seating. Speakers, lights and microphones are brought in for a production. It has no wings and no fly space.

Another dimension of the range is the use of computers during a performance. At one extreme it should be possible to print everything needed by every person participating in the performance on paper. At the other extreme, all of the lighting, sound and curtain pulls might be controlled by the stage manager's computer.