Unified Show Control

Ben Burwell

http://www.benburwell.com/

ben@benburwell.com

Table of Contents

Executive Summary

In modern live entertainment productions, technology has played an increasingly large role over the past years. Today, in large productions, there may be three or more consoles in use, each coordinating a particular technical aspect of the production. This is necessary for programming the show into each console—having one console to control all of the rigging, sound, lighting, video, and pyrotechnics would not be feasible given the current design process as well as in terms of hardware specialization.

However, in running shows, the only thing being done on each console is pressing a cue advance button when the appropriate signal is given to the console operator by the stage manager. In applications that require precise cue timing, this is impractical.

Unified Show Control eliminates the need for guesswork in cue timing by using existing, prevalent hardware links to network consoles to a master cue controller. Each individual console still retains absolute control over its realm of attributes, but the remote Unified Show Control system can fire cues on the individual consoles, thereby providing machine synchronization and automation of cue sequences.

Unified Show Control, or USC, is a software program that can be run on Windows- or Macintosh-based computers that allows cues to be programmed in the USC environment that will in turn execute a series of cues on any of the consoles that have been connected to it. For example, in a theatrical production, a complex scene shift containing two sound cues, three rigging cues, five light cues, and two video cues, all timed off each other, could be programmed into the USC software as a single cue, requiring only a single button press rather than twelve.

This product would be largely targeted toward theatres that produce technically complicated shows, as in relatively technically simple shows, the USC system could unnecessarily complicate the technical rehearsal process. There are many such venues in the US, and the entertainment technology device industry is very large—forecasted to be valued at $64.5 billion in 2013—and growing steadily despite the harsh economic climate.

Overview

Introduction

Unified Show Control is a computer program with the primary objective of synchronizing cueing in modern entertainment systems and creating automated cue sequences. For example, while previously a scene shift may have required twenty or more cues to be manually fired depending on when previous cues had completed, Unified Show Control can make the scene shift into one cue by synchronizing the actions of all the systems in use.

Unified Show Control does not negate the need for individual console operators in certain positions. For safety concerns, rigging and pyrotechnics consoles should always have dedicated operators as a fall back in case the USC system fails. Depending on the needs of the production and staffing availability, each other console may or may not require a dedicated operator. Due to the added step of programming USC cues in addition to programming lighting, sound, rigging, and pyrotechnic cues, the USC system is only practical for use in largely technical shows that require precise synchronization.

The USC system is made up of several elements. The software layer is responsible for generating the necessary MIDI data for output to consoles. The software will be available for various types of modern computers and should not require the user to make system upgrades to implement. The software layer will communicate by a USB cable to the USC interface box. This box takes the USB input cable and provides several MIDI output ports for various consoles to be plugged into. There are also several input ports for receiving data back from controlled devices. This interface box will then be connected by existing technologies to the various consoles (i.e., standard MIDI cable to connect devices).

Abbreviations and Definitions

USC	Unified Show Control
MIDI	Musical Instrument Digital Interface
MSC	MIDI Show Control
USB	Universal Serial Bus
USITT	United States Institute for Theatre Technology
DMX512	Digital Multiplex

Networked Device In the context of USC, a Networked Device is a device that is connected to the USC software via a hardware link.

Background

Modern entertainment relies heavily on technology to create and control stunning effects, including but not limited to lighting, sound, rigging, video, and pyrotechnics. Each of these departments typically has a console to control attributes of the system and store the values of the attributes in cues which can be later recalled in sequence by a single button to advance to the next cue. For example, a simple lighting cue could consist of stored levels of three different lights, with the first fixture being at 80% intensity, and the second and third at 50%.

In the initial programming phase, isolation of the consoles to control specific subsystems is useful; it would not make sense to try to have one piece of equipment to control every single attribute in the entire venue, as the number of these would routinely reach into the thousands. In addition, it would not be feasible to have one console to control each of the lighting fixtures as well as the levels of each speaker and microphone in use in the venue; the hardware must be more specialized for each particular application. However, during performances when the consoles are being used solely for cue playback, having several people sitting at their individual console and advancing cues for only their respective departments is not practical.

In modern entertainment productions, there are often many cues that must be synchronized across various systems. For example, in a music concert, there could be a light cue that is to be fired at the same moment as a pyrotechnic cue. Following current protocols, a stage manager would use an audio communication system to orally cue the pyrotechnics operator and the lighting operator who would then each press the cue advance button on their respective consoles at hopefully close to the same time[1].

Many modern entertainment control consoles already implement MIDI input and output and support the MIDI Show Control (MSC) protocol, including lighting consoles

[1] http://www.hstech.org/prodteam/stage.htm

manufactured by Electronic Theatre Controls,[2] and sound mixers manufactured by Roland[3] and Yamaha[4]. MIDI Show Control is a standard maintained by the United States Institute for Theatre Technology[5] (USITT), a widely recognized professional organization in the field of technical theatre, and is thereby standardized across manufacturers and devices. However, disadvantages of MIDI include the relatively short cable runs before signal degradation—around 50 feet with high-quality cable[6]—though this could be overcome using existing technologies such as MIDI over IP, also known as MIDI over Ethernet.[7] For comparison, DMX512, the communication protocol—used by most modern lighting consoles to send dimming information to the dimmer array and other attribute information such as color and template to some automated lighting fixtures—has a safe practical cable run distance of around 1500 feet, and a theoretical maximum of over 3200 feet.[8]

Though MIDI is gaining prominence in the theatrical world, it must be made clear that it is not a very flexible communication protocol and serves a very limited purpose in the realm of cueing. Unlike DMX512 which transmits detailed level information about each control parameter in a lighting system, MSC only plays back existing cue information. Its commands include GO, STOP, RESUME, TIMED_GO, LOAD, SET, FIRE, ALL_OFF, RESTORE, RESET, and GO_OFF, many of which would be implemented in the USC software.[9] It is not possible to obtain information about the cue list given the current state of the MSC protocol, so cue information would need to be entered into the USC console by hand, though this should not be a significant burden. As many consoles that have MSC functionality also have the ability to export the show file for viewing or editing on a computer, it is possible that in future versions of USC, a show file containing pertinent cue information could be imported into

---

[2] http://www.etcconnect.com/docs/docs_downloads/techdocs/ETC_MIDI_1992_Editted.pdf

[3] http://www.rolandsystemsgroup.net/en/0114.htm

[4] http://www.soundonsound.com/sos/oct02/articles/yamahaaw16g.asp

[5] http://www.usitt.org/Resources/Standards2/ListofStandards

[6] http://www.sweetwater.com/expert-center/techtips/d--06/28/2000

[7] http://openmuse.org/transport/mip_intro.html

[8] http://www.usitt.org/Resources/Standards2/DMX512/DMX512FAQ

[9] http://www.richmondsounddesign.com/docs/midi-show-control-specification.pdf

USC to reduce data entry time. However, this import functionality would need to be tailored to specific manufacturers' formats and would thus not be universal to all devices.

Market Analysis

Needs Analysis

The USC system is designed to be employed in larger venues where technically complicated shows are produced. The breadth of the entertainment industry is enormous, and there are hundreds of venues in the United States alone in which this product could be successfully implemented. From the forty Broadway houses to countless Las Vegas venues, to local community and regional theatres, to theme parks and cruise ships, the USC system could be used in countless different situations.

It is difficult to determine just how many customers would purchase this product, but there are at least 110 major theatres in the United States alone (40 Broadway houses, 70+ League of Resident Theatre, or LORT houses[10]) that would definitely have the resources to purchase at least one copy of the software. The entertainment technology industry is very much based on word-of-mouth for equipment recommendations, so by directly marketing to these large venues, the USC would eventually trickle down to smaller houses as well. Smaller houses could also be targeted by going to industry conferences such as USITT.

The entertainment industry is very financially lucrative from a technology standpoint. There are always venues and companies looking to upgrade their equipment, even in the harsh economic climate we currently face. In 2008 during the height of the recession, BCC Research projected that the market for entertainment technology devices would reach $64.5 billion by 2013.[11]

Since the primary component of the USC is the software, which has a low unit cost to manufacture, a competitive pricing scheme could be implemented. A free version will be

[10] http://lort.web.officelive.com/members.aspx

[11] http://www.bccresearch.com/report/entertainment-technologies-market-ift067a.html

offered that limits functionality to thirty cues. Purchasing a $199 license key will unlock the creation of unlimited cues.

Requirements

Actors and Use Cases

The Unified Show Control system requires several steps to be properly configured for use in each show. Several roles must be fulfilled in order to set up the console properly. Depending on the size and needs of the production, these roles may be fulfilled by several people each, or one person may fulfill all of the roles him or herself.

Technician

The system is designed to be installed and maintained by a Technician. The Technician physically installs the required hardware and ensures that the USC system is communicating correctly with networked devices. Thus, the Technician will deal primarily with the physical layer of the USC system, and also deal with Device Patching in the software layer. The Technician is expected to have a general knowledge of MIDI and MSC, as well as each of the devices he or she is configuring for use with the USC system.

To set up a functioning USC system, the Technician would first install the USC software on a computer in the control booth. Next, he or she would need to connect the USB-MIDI interface hardware to an open USB port on the host computer. Each networked console must then be connected via a standard MIDI cable to the interface box.[12] Once the USC network has been physically created, the Technician must enter the Device Patching options in the USC software in order to match each networked device to a particular function within the software. For example, a sound console would be patched to the Sound Console function in the USC options (see Fig. 2).

[12] Note that, if desired, third-party solutions could be implemented here if the distance from console to interface box exceeds the maximum MIDI cable run. However, as most consoles are expected to be located in the same booth as the USC console, this should be largely unnecessary.

Programmer

The Programmer is responsible for creating the cue sequences in the USC software. This actor is the heaviest user of the software interface, as this is where cues are created. The Programmer does not necessarily have in-depth knowledge of the underlying technology of the USC, but is familiar with the cueing process. The Programmer will commonly perform the following actions:

- Create cues
- Delete cues
- Fire cues (a specific cue, the next sequenced cue, or the previous sequenced cue)
- Stop cues
- Add device actions to a cue
- Remove device actions from a cue
- Adjust timing of device actions within a cue
- Edit cue meta-data (name, display color, number)

For example, a workflow could be similar to the following: Create a cue called "Transition 1" and add a light cue and a sound cue that fire right away, a rigging cue that fires 5 seconds later, followed by a sound cue at 10 seconds, and a light cue at 12 seconds. To try out the sequence, the Programmer will fire the cue. While watching the resulting action on the stage, he or she notices that the second sound cue is a bit too late and stops the cue execution in order to change the sound cue to fire at 9.5 seconds. The Programmer could then replay the cue to check the new timing.

Stage Manager

The Stage Manager is the end user of the USC system that has been configured by the Technician and the Programmer.[13] The Stage Manager will only perform one action—fire cues. Of course, system failures or show glitches may require the Stage Manager to stop cues as well, but at that point the Stage Manager is becoming more of a Programmer. The Stage

[13] Note that here, Stage Manager is used to refer to the person operating the console during performances, who is likely to be a member of the Stage Management department; in this context, Stage Manager does not necessarily refer to the Production Stage Manager.

Manager is responsible for the operation of the USC console during show performance and possibly during rehearsals.

Requirements

The Unified Show Control system's requirements include the following:

- Support for Mac OS X 10.6 and higher, Windows XP and higher
- Very fast performance to decrease latency in cue firing
- Extremely reliable performance to prevent dangerous system crashes
- A user interface designed for use in darkened environments (darkened screen, light colored text) — should be customizable by the user
- Full compliance with applicable standards, including MIDI and MSC
- Multi-lingual user interface (English, Spanish, and French at first)

Deliverables

The Unified Show Control system consists of several parts. The software will be available for free download on the internet as well as boxed in stores and for online order, and will offer limited functionality until a license key is entered by the user. The license key may be purchased online for software that has been downloaded, and will come with the disc for boxed versions.

Design

User Interfaces

The USC software has two main areas, the cue programming area and the configuration area. The configuration area is used by the Technician to set program options and enter device patching information. The cue programming area should be the most used area in the entire system. It is where USC cues are created and run, and is used by both the Programmer and the Stage Manager.

Keyboard Operation

In order to provide an easy and quick interface to use during shows, the USC software will support several hotkeys to perform specified actions. To advance a cue, the user must simply press the space bar. If no cue is selected, the first cue in the list will be selected. The selected cue will then be executed, and the following cue then selected in order to load it for playback. In order to stop execution of all cues, the user must only press the period key. This will immediately halt execution of all cues currently in playback.

Configuration Area

The configuration area will be a window containing tabs for Display Options, Device Patching, and Licensing.

Display Options

The Display Options tab will contain controls for changing the colors of the cue list, as well as options for cue naming and numbering schemes, as shown in the mockup below.

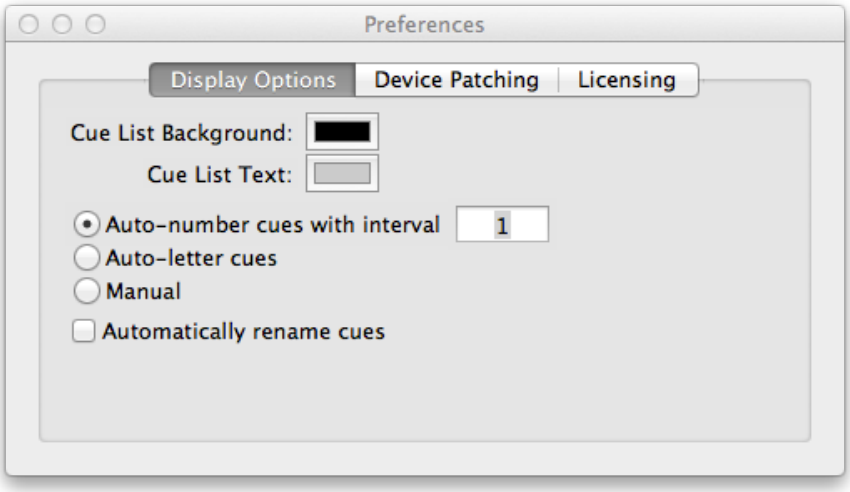

Fig. 1 — The Display Options tab of the Preferences window (mockup).

Device Patching

The Device Patching tab will include drop down menus to assign networked devices to particular patch ports. For example, a network could contain three devices, a light board, a sound board, and a media server to run video effects. In this window,

the user would patch each device to the proper program port, i.e., tell the program which networked device does what.

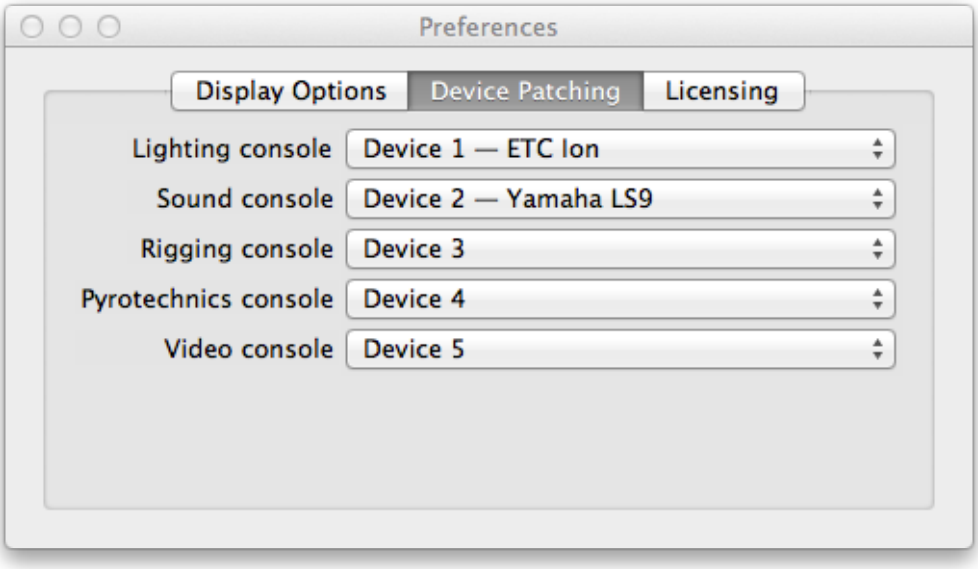

Fig. 2 — The Device Patching tab of the Preferences window (mockup).

Licensing

The Licensing tab is where the user can view the licensing status of their product (e.g. if it is operating as the free version or the paid version), and enter the license key that has been purchased in order to unlock unlimited cue creation.

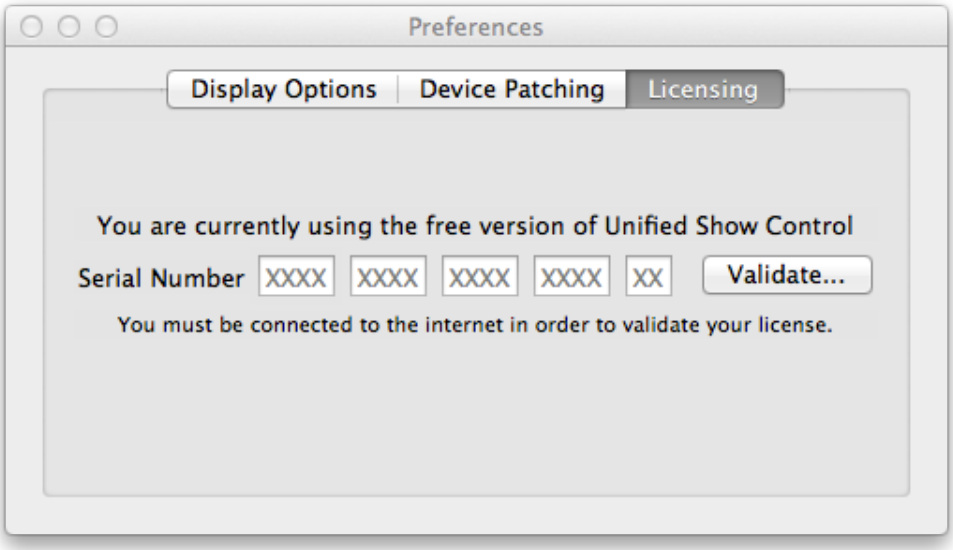

Fig. 3 — The Licensing tab of the Preferences window (mockup).

Cue List Display

The Cue List display is split into two vertical sections. The leftmost contains a list of all of the cues in the show file ordered by letter or number, whichever is selected by the user in the Display Options tab of the Preferences window. Each cue in the list could have a name or label specified, and could be given a colored background to provide some sort of grouping or warning as defined by the user. In the right hand column, the cue is detailed. At the top of the detail screen, there is a text box where notes about the cue can be entered, such as a brief description, etc. Below, there is a workflow area where actions can be dragged in from the Action Palette and used to create a timeline view of the cue's execution.

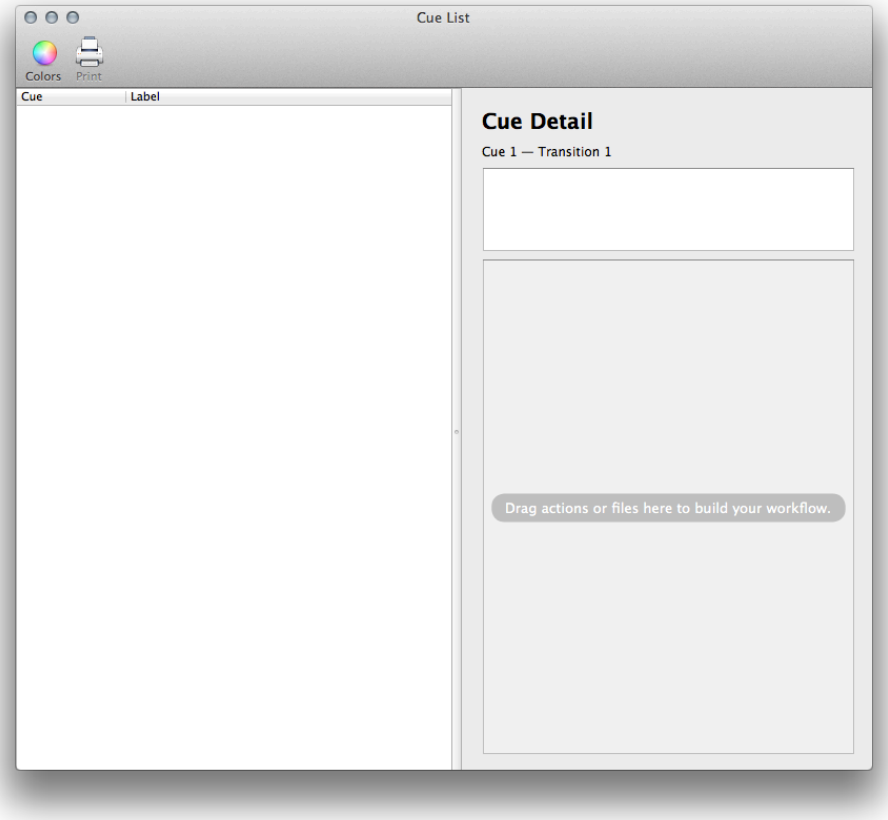

Fig. 4 — The Cue List window (mockup)