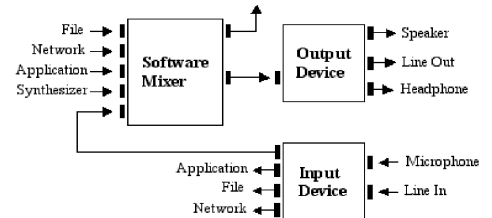


# MAT 240A - Digital Audio Programming: Sound I/O, Streaming and Plug-in APIs (Fall, 2008)

This course is a practical introduction to modern digital audio programming; it is the first part of the six-quarter MAT 240 *Digital Audio Programming* course sequence. We focus on applications development tools, libraries, and interfaces. The central topics are (1) sound I/O and LAN/WAN streaming, and (2) plug-in architectures for multimedia streaming and data processing.

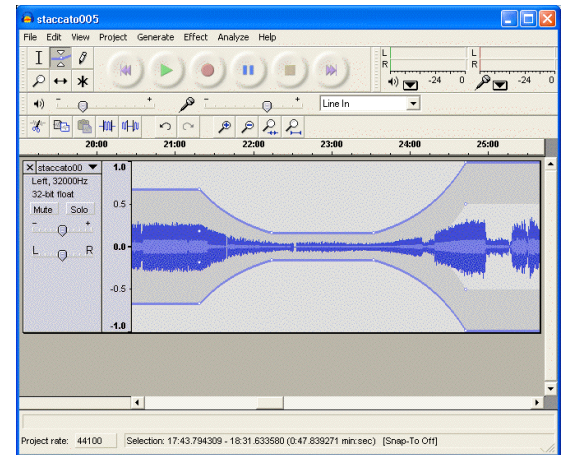


Students will read the seminal papers from the literature, as well as tutorials on recent industry standards, and will learn to use the current programming APIs and tools using several languages and development platforms. The course reader is available at the UCSB book store, and the course web site includes references and code examples. Programming assignments will be given in the C, C++, Java programming languages, and will involve digital audio code development tasks on Linux, MS-Windows, the Macintosh.

Students are expected to know the basics of digital audio signal representation and processing, and to be proficient in C, C++, or Java (Smalltalk, SuperCollider, LISP, and/or XML are a plus). Grading will be on the basis of in-class participation and programming projects.

## Course Outline

- Issues in sound and event programming
- Digital sound representations and quality
- File formats and I/O for sound and event data
- Buffers, latency, and jitter in I/O programming
- Real-time I/O and Internet streaming
- Compression formats, codecs, and players
- Browser and virtual machine plug-ins
- APIs for plug-ins to processing programs



## Instructor

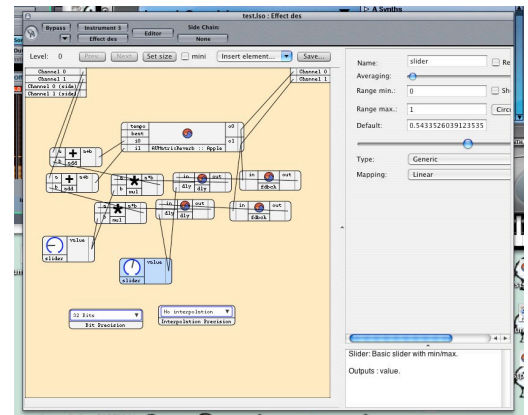
- Stephen T. Pope (stp@mat.ucsb.edu)

## Meeting time and place

- Tu/Th 10:00 - 11:50 AM
- Music 2125 (CREATE class room)

## Electronic Resources

- Course Web Site  
See <http://www.mat.ucsb.edu/240>
- Email Mailing List  
Post to [240@mat.ucsb.edu](mailto:240@mat.ucsb.edu)  
See <http://www.mat.ucsb.edu/mailman/listinfo/240>



# MAT 240A Reader Contents

## Reader Sections

### Introduction

- Digital audio background & StateOfTheArt
- Coding style and techniques for digital audio
- Software development tools and IDEs

### Topic 1: Sound IO APIs

- I/O for sound and event data
- Dimensions of sound I/O APIs
- Using Sound I/O APIs on several platforms

### Topic 2: Sound Storage Formats

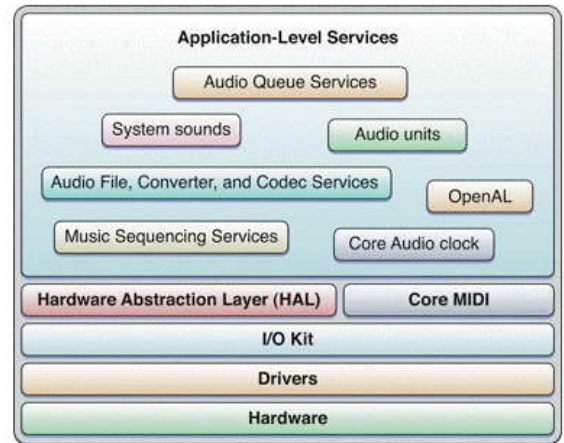
- Sound file formats intro and examples
- Real-time I/O and Internet streaming

### Topic 3: Audio Compression Formats

- MPEG & AC-3 Documents

### Topic 4: Plug-in Architectures

- Browser and OS Plug-in architectures
- Audio and media plug-in API examples



## Readings

### Introductory Readings

- Digital Audio, James Beauchamp and Robert Maher, "Encyclopedia of Acoustics."
- Digital Audio Breaks the Sound Barrier, EDN Magazine.
- Beyond the Pale: High-Resolution Audio, Richard Elen, AudioMedia.
- TOC of the Roadmap for Sound and Music Computing, S2S2 Consortium.
- List of Audio Engineering Society (AES) Tutorials.
- Emerging Technology Trends in the Areas of the Technical Committees of the AES.
- The Next Generation of Audio Communications, JAES.
- Audio Networking Applications and Requirements, JAES.
- The Software Studio in the Age of Audio Networking, JAES.
- Using Game-Audio Tools to Build Audio Research Applications, JAES.
- Clear, Efficient Audio Signal Processing in ANSI C, Adrian Freed.
- Music Programming with the New Features of Standard C++, Adrian Freed and Amar Chaudhary.
- Network Audio Links.
- Wikipedia Comparison of Integrated Development Environments.
- Freebyte's Guide to Free C++ (and C) Programming Tools.
- Tools to Make Tools links.

## Topic 1: Sound IO APIs

Apple Core Audio Overview.

Sound Cards, Voice Management, and Driver Models: Ensuring that Your Game Audio Works Optimally and Correctly, Brian Schmidt, Microsoft

Microsoft DirectX Audio Overview.

DirectX Overview Presentation Slides.

Linux OSS API Basics

PortAudio Tutorial, P. Burke, <http://www.portaudio.com/trac/wiki/TutorialDir/TutorialStart>

JACK API FAQ & Overview.

Steinberg ASIO SDK Overview

SNDLib Doc, W. Schottstaedt.

Java Sound API Docs

## Topic 2: Sound Storage and File I/O

Machine Tongues XVIII: A Child's Garden of Sound File Formats, S. T. Pope and G. Van Rossum, *CMJ* 19.1

LibSndFile API doc.

New Applications of the Sound Description Interchange Format, M. Wright et al.

Streaming Stored Audio and Video, James F. Kurose and Keith W. Ross .

UCDavis CS152 Lecture 23: Multimedia Applications, Demet Askoy

SHOUTCAST Streaming API

Code examples: lsf -- list sound files, EBICSF format header file

## Topic 3: Audio Compression Formats

A Tutorial on MPEG / Audio Compression, Davis Pan, IEEE MM.

Overview of MPEG Audio: Current and Future Standards for Low-Bit-Rate Audio Coding, K. Brandenburg & M. Bosi, JAES.

Design and Implementation of AC-3 Coders, Steve Vernon, Dolby

## Topic 4: Plug-in Architectures

Wikipedia: Plug-in (computing)

Audio Unit Development fundamentals.

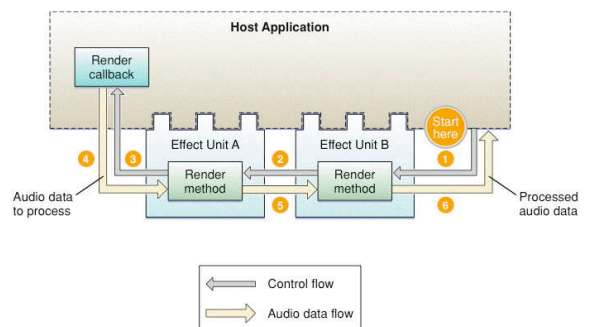
Steinberg VST Plug-in SDK Doc.

Linux Audio Plug-ins: LADSPA, Dave Phillips, O'Reilly.

Writing Browser Plug-ins in Java, Javasoft.

## Additional References

See web site and course code ZIP archive.



# MAT 240A

## Code Archive

- IO APIs
- Documents
- Example Apps
- MIDI
- MP3
- Networking
- Plug-in APIs

▼ AudioAPIs	⊕	67.1 MB
▶ ASIOSDK2	⊕	1.4 MB
▶ jack-0.109.2	⊕	3.7 MB
▶ JavaSound	⊕	4.9 MB
▶ libsndfile-1.0.17	⊕	12.7 MB
▶ Linux	⊕	5.2 MB
▶ Mac Carbon	⊕	1 MB
▶ Mac_CoreAudio	⊕	7.5 MB
▶ MS-DirectSnd	⊕	477.7 KB
▶ nas-1.9.1	⊕	6.5 MB
▶ portaudio19	⊕	5 MB
▶ rtaudio-4.0.2	⊕	1.1 MB
▶ SDL	⊕	4.1 MB
▶ sndlib	⊕	6.1 MB
▶ JackOSX.0.77.pkg	⊕	6.7 MB
▶ Documents	⊕	82.8 MB
▶ ExampleApps	⊕	63.8 MB
▼ MIDI	⊕	2.8 MB
▶ portmidi	⊕	2.1 MB
▶ rtmidi-1.0.7	⊕	748 KB
▼ MP3	⊕	8 MB
▶ bladeenc-0.92.0	⊕	1.6 MB
▶ libid3tag-0.15.1b	⊕	2.5 MB
▶ libmad-0.15.1b	⊕	3.2 MB
▶ MP3.com-ios-api	⊕	144.3 KB
▶ lame3.83beta.tar.gz	⊕	276.7 KB
▶ mp3_stuff.html	⊕	10.6 KB
▶ mp3tools-1.1.tar.gz	⊕	34.8 KB
▶ mpg123-0.59r.tar.gz	⊕	155.3 KB
▼ Networking	⊕	10.8 MB
▶ jrtp lib-3.7.0	⊕	7.2 MB
▶ librtsp-0.1	⊕	493.8 KB
▶ rtptools-1.18	⊕	804.5 KB
▶ XStreamRipper.app	⊕	2.4 MB
▼ Plug-ins	⊕	83.1 MB
▶ iTunes Visual SDK	⊕	509.9 KB
▶ Mac_MIDI-plugin	⊕	436.8 KB
▶ Netscape	⊕	4.4 MB
▶ SoundJam_MP_Dev_Kit	⊕	2.7 MB
▶ UglyVSTi X v0.2	⊕	2.7 MB
▶ vst_hosts	⊕	73.3 KB
▶ vstsdk2.4	⊕	21.1 MB
▶ vstsdk3	⊕	50.1 MB
▶ wa502_sdk Folder	⊕	829.4 KB
▶ Sounds	⊕	16.2 MB