

SYLLABUS
MPATE-GE 2632: Introduction to Streaming Audio

Steinhardt School of Culture, Education, and Human Development
Music and Performing Arts
Department of Music Technology

Instructor: Dr. Schuyler Quackenbush
Audio Research Labs
www.audioresearchlabs.com
Email: schuyler.quackenbush@nyu.edu
Office Hours: After class and as indicated on NYU Brightspace page

Course Description

MPATE-GE 2632: Introduction to Streaming Audio is a graduate-level introductory course on the architecture and components needed to create a streaming audio service. Major components studied will be audio coding, communicating via IP sockets, streaming audio server, network architecture, streaming audio client. Aspects of real-time performance and minimization of end-to-end latency will be considered.

Topics include:

- Networked client/server architectures.
- Internet packet communication protocols.
- An example streaming audio service: IceCast demonstration.
- Communicating audio signals via the Internet, including TCP and UDP IP under conditions of network congestion, packet jitter and packet loss.
- Real-time audio I/O and real-time audio coding and real-time network communication. This will make use of multi-threaded programming.
- Perceptual audio compression as may be used in streaming audio encoders and decoders
- The class will collaborate on creating their own streaming service using PortAudio, Vorbis and Sockets libraries and the C programming language.

Prerequisites

Proficiency in C/C++ programming such as that from MPATE-GE 2618: C Programming for Music Technology.

Class Times

MPATE-GE 2632 meets on Tuesday 12:00- 1:40.

Office Hours

Weekly office hours will be immediately after the Tuesday lectures at a location at a public space near classroom or lab. Alternatively, as indicated in Office Hours link on NYU Brightspace page.

Class Materials

All class materials are available at the NYU Brightspace course website:

- Resources
 - Lecture slides as PDF
 - Any other course material
- Assignments
 - Problem description and any associated source code and data
 - Final project information

Problem Sets

Problem sets will be distributed via NYU Brightspace Assignments. Each will have a posted due data. All problem sets will be done collaboratively by the class. Parts may be done in class, other parts with students collaborating on their own. Students should post completed assignments via the same NYU Classes Assignment mechanism.

Final Exam

The course does not have a final exam.

Grades

Final grades for the class will be determined from student's

- work on problem sets (which may be in class where the entire class works together, or in student groups outside of class)
- final class project

Student class participation will be evaluated for each class, student work on problem sets will be evaluated for each problem set.

The instructor will post interim student evaluation (for class participation and problem sets) after each problem set is completed and evaluated.

The following weights will be used to determine a student's grade:

Problem Sets:	75%
Final project	25%

The instructor will post grades for each assignment and final project on the NYU Brightspace Gradebook.

Books

No textbook is required. Instructor will provide all written information.

Course Outline

The instructor may modify the course outline or course problem sets as he deems appropriate to enhance the course. Students are welcome to submit suggests on changes to the course outline or course problem sets.

- Overview and use of Icecast, a commercial streaming server
- Overview of networked client/server architectures
- The OSI 7-layer model of Internet communications
- Physical layer communications (i.e. bits on a wire)
- Ethernet frame communications
 - MAC address
- Internet packet communication protocols
 - IP address
- TCP and UDP packet communications
 - Ports
- TCP IP transmission throughput optimization and management of network congestion.
- UDP IP transmission, reliability, packet jitter and packet loss.
- Real-time audio I/O and real-time audio coding and real-time network communication.
- Multi-threaded programming
- Perceptual audio compression as used in streaming audio encoders and decoders
- The class will collaborate on creating their own streaming service using LibSndFile, PortAudio, Opus audio codec and Unix Sockets libraries and the C programming language.
 - UDP Source Client (audio encoder)
 - UDP Server (can server multiple clients)
 - UDP Client (audio decoder)

Statement on Academic Integrity

Students are expected-often required-to build their work on that of other people, just as professional researchers and writers do. Giving credit to someone whose work has helped you is expected; in fact, not to give such credit is a crime. Plagiarism is the severest form of academic fraud. Plagiarism is theft. More specifically, plagiarism is presenting as your own:

- a phrase, sentence, or passage from another writer's work without using quotation marks;
- a paraphrased passage from another writer's work;
- facts, ideas, or written text gathered or downloaded from the Internet;
- another student's work with your name on it;
- a purchased paper or "research" from a term paper mill.

Other forms of academic fraud include:

- "collaborating" between two or more students who then submit the same paper under their individual names.
- submitting the same paper for two or more courses without the knowledge and the expressed permission of all teachers involved.
- giving permission to another student to use your work for a class.

Term paper mills (web sites and businesses set up to sell papers to students) often claim they

are merely offering "information" or "research" to students and that this service is acceptable and allowed throughout the university. THIS IS ABSOLUTELY UNTRUE. If you buy and submit "research," drafts, summaries, abstracts, or final versions of a paper, you are committing plagiarism and are subject to stringent disciplinary action. Since plagiarism is a matter of fact and not intention, it is crucial that you acknowledge every source accurately and completely. If you quote anything from a source, use quotation marks and take down the page number of the quotation to use in your footnote.

Consult The Modern Language Association (MLA) Style Guide for accepted forms of documentation, and the course handbook for information on using electronic sources. When in doubt about whether your acknowledgment is proper and adequate, consult your teacher. Show the teacher your sources and a draft of the paper in which you are using them. The obligation to demonstrate that work is your own rests with you, the student. You are responsible for providing sources, copies of your work, or verification of the date work was completed.

Students are responsible for understanding the concept of plagiarism, and knowing and understanding the contents of the University "Statement of Academic Integrity"
http://steinhardt.nyu.edu/policies/academic_integrity

Plagiarism will immediately result in a failing grade in the course and the student will be reported to their school's academic Dean.

Students with Disabilities

Academic accommodations are available for students with documented disabilities. Please contact the Moses Center for Students with Disabilities at 212-998-4980 for further information.

Appendix A - Graduate Scale and Rubric

Steinhardt School of Education Grading Scale

There is no A+	
A	93-100
A-	90-92
B+	87-89
B	83-86
B-	80-82
C+	77-79
C	73-76
C-	70-72
D+	65-69
D	60-64
There is no D-	
F	Below 60
IP	Incomplete/Passing
IF	Incomplete/Failing
N	No Grade

Letter Grade Rubric

A—Outstanding Work

An "A" applies to outstanding student work. A grade of "A" features not simply a command of material and excellent presentation (organization, coding, asset management etc...), but importantly, sustained intellectual engagement with the material. This engagement takes such forms as shedding original light on the material, investigating patterns and connections, posing questions, and raising issues.

An "A" assignment is excellent in nearly all respects:

- It is well organized, with a clear focus.
- It is well developed with content that is relevant and interesting.
- It fulfills all the technical and creative requirements of the assignment.
- It demonstrate a clear understanding of the material discussed in class.
- It is engaging

B—Good Work

A "B" is given to work of high quality that reflects a command of the material and a strong presentation but lacks sustained intellectual engagement with the material.

A "B" project shares most characteristics of an "A" project, but

- It may have some minor weaknesses in its implementation, either technical or creative.
- It may have some minor lapses in implementing the one or two required elements.

C—Adequate Work

Work receiving a "C" is of good overall quality but exhibits deficiencies in the student's command of the material or problems with presentation or implementation.

A "C" project is generally competent; it is the average performance. Compared to a "B" paper:

- It may have serious shortcomings in its implementation or organization.
- It fails to meet two to three requirements outlined in the assignment.
- The functionality of one or more elements has been compromised.

D or F—Unsuccessful Work

The grade of "D" indicates significant problems with the student's work, such as a shallow understanding of the material.

- It is messy in its implementation
- It displays major organizational problems
- It fails to fulfill three or more of the requirements outlined in the assignment
- It is irrelevant to the assignment
- It includes confusing transitions or lacks transitions altogether

An "F" is given when a student fails to demonstrate an adequate understanding of the material, fails to address the exact topic of a question or assignment, or fails to follow the directions in an assignment, or fails to hand in an assignment.

Pluses (e.g., B+) indicate that the assignment is especially strong on some, but not all, of the criteria for that letter grade. Minuses (e.g., C-) indicate that the paper is missing some, but not all, of the criteria for that letter grade.