

Before we start - Background

- ◆ About the course
 - Terminology and concepts
 - Broad and deeper topics
 - Combines theory and practice

- ◆ Your professor
 - Principal Consultant at Riverbed Technology
 - Academic and professional experience
 - ◆ Telecommunication
 - ◆ Modeling and simulation
 - ◆ Network optimization
 - ◆ Statistical and analytical analysis of networks and applications

- ◆ Students
 - Prior learning or related experience in telecommunication and networking?

Course Introduction

- ◆ Instructor: Dragan Hrnjez
 - Email: dhrnjez@gmu.edu
 - Location: remote/off-site
- ◆ Office Hours
 - Dedicated virtual office hours via Zoom on Tuesdays between 6:30 PM to 7:10 PM (Please schedule office hour no later than 24 hours in advance). Alternate arrangements can be made. We will discuss these in our first meet up.
- ◆ Recommended Books:
 - There are no required books for this course. The following books are optional (used during previous semesters):
 - ◆ Carrier Grade Voice Over IP, Third Edition; McGraw-Hill Education; Richard Swale and Daniel Collins
 - ◆ Voice Over IP Fundamentals; Cisco Press; Davidson, Peters, Gracely, Bhatia, Kalidindi, Mukherjee; 2nd Edition; July 2006
 - ◆ IP Telephony: Deploying VoIP Protocols and IMS Infrastructure; John Wiley & Sons Ltd.; Oliver Hersent; 2011
 - ◆ *RTP: Audio and Video for the Internet; Addison Wesley; Colin Perkins; June 2003*
- ◆ Communication, content delivery and assignments:
 - Blackboard portal for asynchronous class-related activities
 - Website at <http://mason.gmu.edu/~dhrnjez> (user id: tcom631, pass: voiceIP)
 - Synchronous Zoom sessions
 - Additional materials will be distributed on an ongoing basis

Virtual Classroom Requirements

- ◆ To access the technologies used in this workshop, you will need Adobe Reader and Adobe Flash Player (latest version). If your computer doesn't already have this software and/or you are prompted for this download, you can go to the Adobe website and download this software
- ◆ You will need a web cam or an integrated laptop camera in case you want to present yourself to the class. I will have one and you will be able to see me
- ◆ You will also need a working headset with a microphone to listen to synchronous and synchronous sessions and to work on your lab requirements
- ◆ We will be utilizing Zoom for a synchronous meet-ups. To ensure that you're able to access the Zoom room, please make sure your device meets Zoom's system requirements

Assignments and Grading Policy

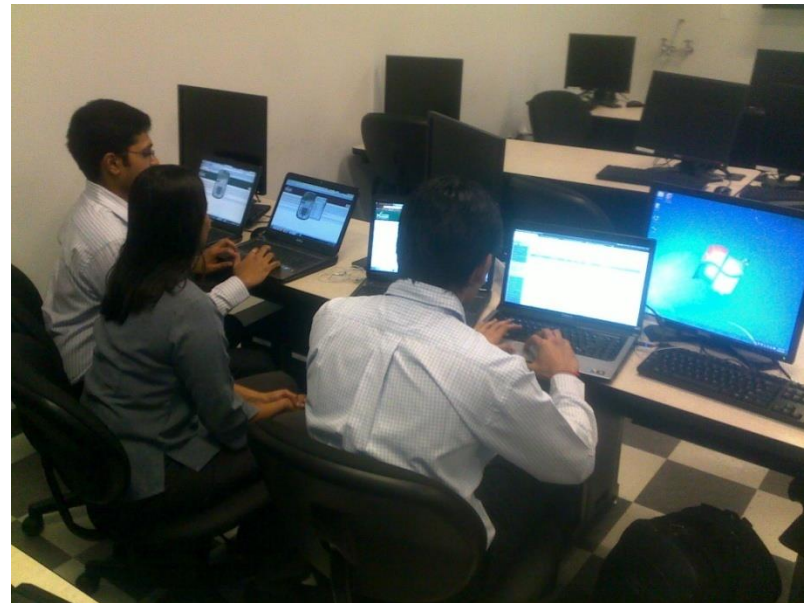
- ◆ Midterm
 - Option 1: in-class, closed-book/closed-notes, MC/TF questions, simple problems and essay questions
 - Option 2: remote and timed, MC/TF questions, simple problems
 - The decision will be made during next few weeks
- ◆ Labs (We will have 3 labs and the facilitation for these will be determined during the semester.)
 - We will discuss and explain lab activities in more details later
 - All three lab reports need to be turned in no later than Dec 11th 2018
- ◆ Homeworks
 - Several homework assignments throughout the semester
 - Due the following week after they are assigned
 - Return hard or softcopy in a single file with the student name visible in the file name
- ◆ Discussion boards
 - Throughout the semester we will have few discussion boards.
 - These are mandatory and they will be graded based on involvement and effort.
- ◆ Project
 - Assigned second week and is due last week of semester
 - This is a group project (3-4 students)
- ◆ Final Exam (take home – last week of the semester)
 - Comprehensive
 - MC/TF questions, more complex engineering problems and essay questions

Grading*	
Midterm	12%
Labs	12%
Homeworks	12%
Discussion boards	6%
Project	34%
Final exam	24%

*Final grade determined by a weighted average

Grades	
A	90 or above
A-	87 to 89
B+	83 to 86
B	80 to 82
B-	77 to 79
C+	73 to 76
C	70 to 72
C-	67 to 69

Group Projects – use cases



Course Outline – Comprehensive VoIP

Topics	Book Readings
<p>Introduction to Voice and Voice Transmission Technologies: Voice characteristics, digitalization and encoding. Traditional circuit switched equipment and networks used in telephony. Signaling basics. Potential use-cases for VoIP deployments (benefits/challenges). Enterprise/Campus and Commercial Telephony. Typical VoIP Connection Strategies.</p>	<p>Carrier grade: Introduction</p> <p>Voice Over IP Fundamentals: Chapter 1, Chapter 2, Chapter 3 (not required)</p>
<p>Concept of Transporting Voice over Packet Switched Network: Internet Protocol (IP) introduction. Real time protocols: RTP, RTCP, RTSP, SCTP, UDP-Lite/Liter - packet formats, functionality and features. Real-time media synchronization.</p>	<p>Carrier Grade: Transporting Voice by Using IP</p> <p>Voice Over IP Fundamental: Chapter 6</p> <p>RTP: Audio and Video for the Internet</p>
<p>Voice over IP Decomposition: Human voice and coding techniques, compression. Factors that affect VoIP quality: delay, jitter, packet loss, echo. Performance and quality metrics for VoIP: MOS, R-Factor, PESQ. VoIP performance measurement and monitoring tools.</p>	<p>Carrier Grade: Speech-Coding Techniq.</p> <p>Voice Over IP Fundamentals Chapter 7</p> <p>RTP: Audio and Video for the Internet</p>
<p>Intro to VoIP signaling protocols: Overview. SIP signaling protocol: format and inter-workings.</p>	<p>Carrier Grade: The Session Initiation Protocol</p> <p>Voice Over IP Fundamentals: Chapter 11</p> <p>IP Telephony: Chapter 2</p>
<p>H.323 Signaling Protocol: Architecture, format and inter-workings.</p>	<p>Carrier Grade: H.323</p> <p>Voice Over IP Fundamentals: Chapter 12</p> <p>IP Telephony: Chapter 3</p>
<p>SS7 Signaling Protocol: Architecture, format and inter-workings (H.323, SIP and ISUP (SS7) signaling protocols).</p>	<p>Carrier Grade: VoIP and SS7</p> <p>Voice Over IP Fundamentals: Chapter 4</p>

Course Outline – Comprehensive VoIP

Topics	Book Readings
<p>The Softswitch Architecture: Interoperability of different signaling protocols (H.323, SIP, SS7) using Softswitches, Applications of Softswitches in a carrier grade VoIP environment. (SS7 signaling over IP-based networks). VoIP – PSTN migration and integration strategies.</p>	<p>Carrier Grade: Distributed Gateways and the Softswitch Architecture</p> <p>Voice Over IP Fundamentals: Chapter 14</p> <p>IP Telephony: Chapter 4</p>
<p>Voice over IP Network Planning and Design: Traffic analysis and forecasting (advanced), numbering and dial plans, number routing, vendor selection criteria for LAN and WAN deployments. E.911, CALEA.</p>	<p>Lecture notes and supplemental reading</p>
<p>VoIP Quality and QoS: A thorough explanation of QoS components, protocols and trade-offs. RSVP, Diffserv, MPLS and 801.2q protocols are covered in details in terms packet format, features and functions and their pros and cons. format, features and functions and their pros and cons.</p>	<p>Carrier Grade: quality of Service</p> <p>Voice Over IP Fundamentals: Chapter 8</p>
<p>VoIP Security: Requirements, technologies and NAT/Firewall considerations. VoIP encryption analysis.</p>	<p>Carrier Grade: Interconnecting VoIP Networks</p> <p>Voice Over IP Fundamentals: Chapter 10</p> <p>IP Telephony: Chapter 6</p>
<p>NextGen VoIP: VoIP Mobility. VoIP Equipment: Adapters, soft phones, WiFi phones, mobile phones. Collaboration and presence. Billing and Mediation. VoiceXML. IP Multimedia Subsystem (IMS).</p>	<p>Pats in Voice Over IP Fundamentals: Chapter 15 Chapter 16</p>