

Identification	Subject	CMS 595 Internet Architecture 8 ECTS
	Department	Computer Science
	Program	Graduate
	Term	Spring, 2024
	Instructor	Hafiz Muhammad Azeem Akram
	E-mail:	a.akram@khazar.org
	Classroom/hours	Neftchilar Campus, 414 old Wednesday, 18:40-21:00
Prerequisites	English proficiency	
Language	English	
Compulsory/Elective	Required	
Recommended Textbooks	<ol style="list-style-type: none"> 1. Eiji Oki. “Advanced Internet Protocols, Services, and Applications”, Wiley, ISBN: 9780470499030 2. Larry L. Peterson and Bruce S. Davie. Computer Networks: A Systems Approach, 6th Edition”, Pearson; ISBN:9780128182000 3. James F. Kurose. “Computer Networking”, 8th Edition, Pearson; ISBN: 9780135928615 	
Course Description	<p>Welcome to the Internet Architecture course!</p> <p>Through a combination of theoretical study and hands-on practical exercises, students will develop the skills necessary to optimize performance metrics, emphasizing efficiency, scalability, and flexibility in Internet-based systems. By the end of the course, students will have a deep understanding of Internet architecture principles, protocols, and technologies, along with the practical skills needed to address performance challenges and implement scalable and flexible Internet-based systems. This course will prepare participants for careers in network engineering (R&D), system administration, web development, and other related fields where a strong foundation in Internet architecture and networking is essential.</p>	
Course objectives	<ol style="list-style-type: none"> 1. To develop a comprehensive grasp of internet architecture principles, protocols, and technologies. 2. To acquire practical skills to address and optimize performance metrics, emphasizing efficiency, scalability, and flexibility. 3. To explore advanced topics in networking, including error detection, routing algorithms, data link layer mechanisms, and wireless communication. 	
Learning outcomes	<ol style="list-style-type: none"> 1. Demonstrate a thorough understanding of fundamental principles, protocols, and technologies within the Internet architecture. 2. Apply practical skills to address and optimize performance metrics, including efficiency, scalability, and flexibility in network design. 3. Improve problem-solving skills, and preparing for challenges and opportunities in the dynamic field of internet architecture. 	

Teaching methods	Lecture		x
	Group discussion		x
	Experiential exercise		x
	Simulation Lab		x
	Course paper		x
Evaluation	Methods	Date/deadlines	Percentage (%)
	Midterm Exam		30
	Final Exam		30
	Quizzes		15
	Research Project		15
	Class Participation		10
	Total		100
Policy	<p>Preparation for class The lecture material will focus on the major points introduced in the text. Reading the assigned chapters and having some familiarity with them before class will greatly assist your understanding of the lecture. After the lecture, you should study your notes and work relevant problems.</p> <ul style="list-style-type: none"> Withdrawal (pass/fail) This course strictly follows grading policy of the School of Engineering and Applied Science. Thus, a student is normally expected to achieve a mark of at least 60% to pass. In case of failure, he/she will be required to repeat the course the following term or year. Cheating/plagiarism Cheating or other plagiarism during the Quizzes, Mid-term and Final Examinations will lead to paper cancellation. In this case, the student will automatically get zero (0), without any considerations. Professional behavior guidelines The students shall behave in the way to create favorable academic and professional environment during the class hours. Unauthorized discussions and unethical behavior are strictly prohibited. Ethics Students should not arrive in late to class. All cell phones must be turned off and stowed away before entering class. Use of any electronic devices is not allowed in the classroom and violators will be punished accordingly. Quizzes At the end of every topic, a brief quiz of five minutes duration will be conducted. The final grades for the quiz will be determined by taking the average at the end of the semester. Project Students are expected to complete the course project independently and present their work. The grade assessments will be based on the quality of the project and the presentation. Class Participation Class attendance 50%, Class activity 50%. Failure to attend 180 minutes of class will result in a loss of one attendance point. 		

WK	Date/Day (tentative)	Topics	Recommended Readings
1	14/02/2024	<ul style="list-style-type: none"> • Applications • Requirements • Network Architecture • Implementing Network Software • Performance 	Lecture Slides Research Paper
2	21/02/2024	<ul style="list-style-type: none"> • Efficiency, scalability, and flexibility of IP network • Key factors influencing transmission delay and strategies for minimizing • Techniques for managing and minimizing queuing delay 	Lecture Slides Research Paper
3	28/02/2024	<ul style="list-style-type: none"> • Real-world implications and scenarios affecting end-to-end delay • Exploration of End-to-End Throughput • Interactions between protocol layers and their role in network communication 	Lecture Slides Research Paper
4	06/03/2024	<ul style="list-style-type: none"> • Identification and analysis of factors influencing delays in HTTP transactions • Examination of the structure and components of HTTP GET requests • Analysis of server communication and the information exchange process • Examine the caching mechanisms in web browsers 	Lecture Slides Research Paper
5	13/03/2024	<ul style="list-style-type: none"> • Analysis of SMTP's architecture and message transmission process • Comparison of client-server and peer-to-peer (P2P) file distribution models • Case studies and real-world examples showcasing the strengths and weaknesses of each model • Case studies and discussions on optimizing internet architecture for better performance and user experience 	Lecture Slides Research Paper
6	20/03/2024		No Working Day
7	27/03/2024	<ul style="list-style-type: none"> • Analysis of how TCP handles segment loss and retransmission • Discussion on the importance of RTT estimation in TCP • Understanding the principles of error detection and correction 	Lecture Slides Research Paper
8	03/04/2024	Midterm Exam	
9	10/04/2024		No Working Day

10	17/04/2024	<ul style="list-style-type: none"> • Analysis of TCP Congestion Window Evolution • Exploration of TCP retransmission strategies in the context of reliable data transmission Mux and Demux 	Lecture Slides Research Paper
11	24/04/2024	<ul style="list-style-type: none"> • IPv4 • IPv6 • IPv6 Tunneling and Encapsulation 	Lecture Slides Research Paper
12	01/05/2024	<ul style="list-style-type: none"> • Understanding the principles of link state routing • Dijkstra's Algorithm features and optimizations • Bellman-Ford Algorithm • Comparative analysis with Link State Algorithms • Overview of hybrid routing protocols combining link state and distance vector concepts • Challenges and considerations for routing in large-scale networks • Scalability issues and solutions 	Lecture Slides Research Paper
13	08/05/2024	<ul style="list-style-type: none"> • Overview of error detection and correction in communication systems • Two-Dimensional Parity for error detection • Understanding Cyclic Redundancy Check (CRC) as an error detection method • Mathematical principles behind CRC • Analysis of efficiency and limitations of Random-Access Protocols 	Lecture Slides Research Paper
14	15/05/2024	<ul style="list-style-type: none"> • Understanding spread spectrum techniques and basic CDMA operation • Multiple access interference and its mitigation • CDMA system optimization and capacity planning • Address resolution and mapping techniques • Advanced features and optimizations in Learning Switches 	Lecture Slides Research Paper
15	22/05/2024	<ul style="list-style-type: none"> • Introduction to 4G wireless communication standards • 5G and beyond • Discussion on the impact of emerging technologies on network architecture 	Lecture Slides Research Paper
		Final Exam	

Note: This syllabus is a guide for the course and any modifications to it will be announced in advance.