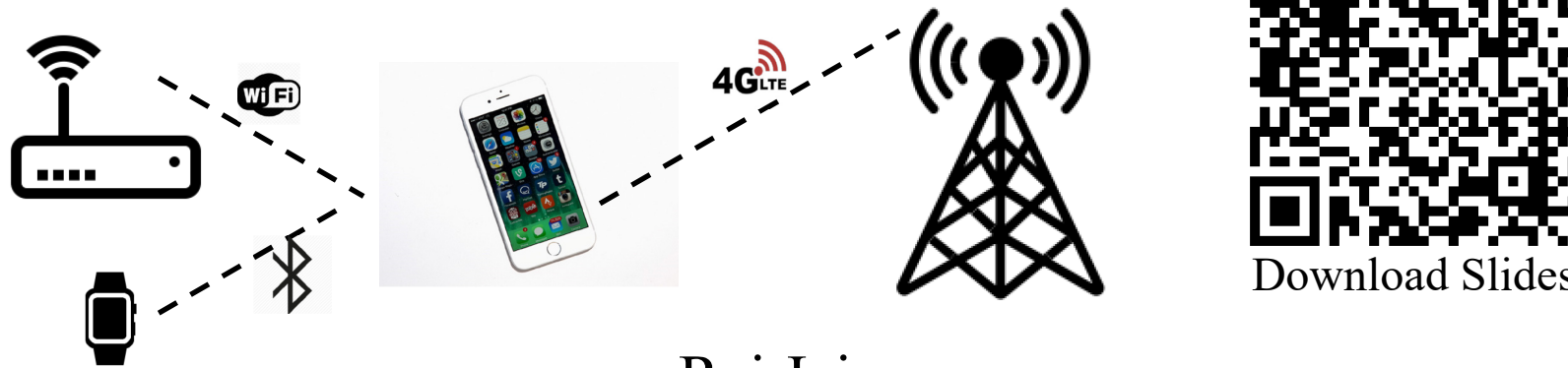


CSE 574S: Recent Advances in Wireless and Mobile Networking



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Audio/Video recordings of this class lecture are available at:

<http://www.cse.wustl.edu/~jain/cse574-22/>

Student Questions

- Are you going to upload these slides?

The slides are always posted with the video. You should download them before watching the video. The revised slides with Q&A are uploaded just before the Q&A session if there is time. You should download them before the class.

- ❖ New questions asked for the exam review session are preceded with this symbol.*



- ❑ Goal of this Course
- ❑ Grading
- ❑ Contents of the course
- ❑ Tentative Schedule
- ⇒ ❑ *Note: Please pay special attention to the recently changed text identified by an arrow symbol on the left margin. Ignore the recorded speech if different.*

Student Questions

- ❑ I have a problem with the exam time. In the video, you said that the first exam is on 10/1; however, on the slide, it is 9/28; which is the right one?

As indicated in the highlighted note on the left of this slide, all information on the slide takes precedence. So if the slide says 10/1, it is 10/1.

Networking = “Plumbing”

- ❑ Networking is the “plumbing” of computing
- ❑ Almost all areas of computing are network-based.
 - Distributed computing
 - Big Data
 - Cloud Computing
 - Internet of Things
 - Smart Cities



Networking is the backbone of computing

Student Questions

Networking is Fueling All Sectors of Economy

- ❑ Networking companies are among the most valued companies: Apple, AT&T, Samsung, Verizon, Microsoft, China Mobile, Alphabet, Comcast, NTT, IBM, Intel, Cisco, Amazon, Facebook, ...

⇒ All tech companies that are hiring currently are networking companies

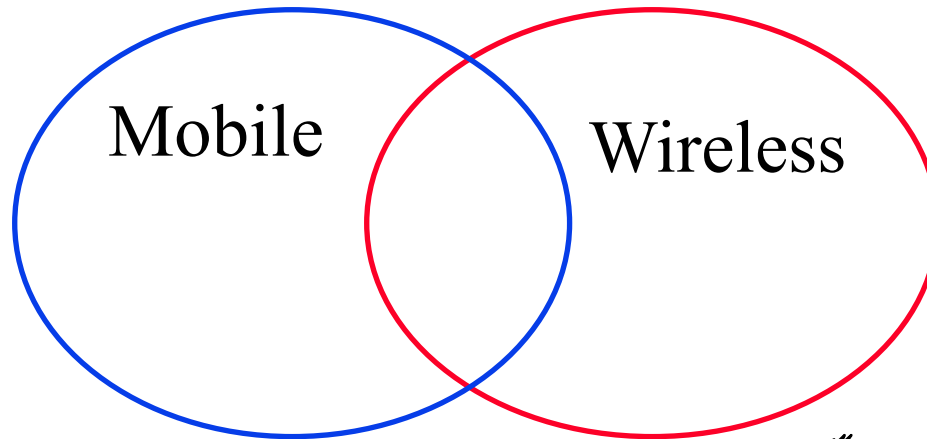
- ❑ Note: Apple became highly valued only after it switched from computing to communications (iPhone)



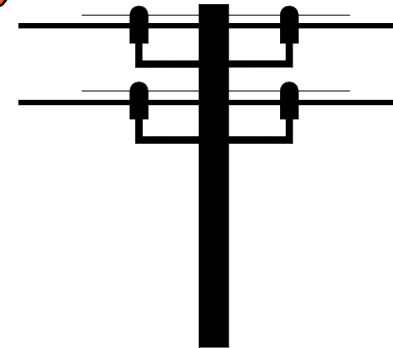
Networking = Economic Indicator

Student Questions

Mobile vs Wireless



- ❑ Mobile vs. Stationary
- ❑ Wireless vs Wired
- ❑ Wireless \Rightarrow Media sharing issues
- ❑ Mobile \Rightarrow Routing, addressing issues



Student Questions

- ❑ When we say mobile, are we referring to the device's portability? My thinking was that mobile communications are one of the wireless systems.
Mobile = Location frequently changes, e.g., mobile home.

Wireless Networking

Impact of Wireless on Networking:

1. Not tied to walls/infrastructure
⇒ Ad-hoc networking
2. Error-prone ⇒ Traffic Management
3. Frequent Disconnections
⇒ Resource Management
Quality of Service for multimedia
4. Battery operated
⇒ Media access and networking while sleep
⇒ Time synchronization
5. Broadcast ⇒ Security

Student Questions

- ❑ What is the Quality of Service? The term makes sense but is it specifically defined?

Yes. QoS is defined as Throughput (packets/sec), Delay (transmit delay, propagation delay, processing delay), and Loss Rate (errors and congestion). This was discussed in the first module of CSE 473.

- ❑ Could you provide more detail on frequent disconnections tied to resource management?

Disconnections are due to TCP timeouts after a certain number of retransmissions. The packets may be lost due to buffer overflow (congestion) or errors (bad signal). In wireless networks, the bad signal is much more frequent than in wired networks.

Mobile Networking

Impact of Mobility on Networking:

- Location
- Addressing
- Handoff

Student Questions

- Does area code has more significance than where a phone was registered?

Will be discussed during the 1G/2G/3G module. The area code of your phone number is where your information is kept and needs to be accessed before connecting every call.

- My iPhone has a charging port that can transmit data. Could a drive not be plugged into that?

Ask Apple! Not a wireless topic. There are accessories to allow drive connections to iPhone.

Why Wireless Networking?

1. Wireless (Wi-Fi) is ubiquitous (Intel Centrino)
2. Most of the access (end user connectivity) is wireless
 - Smart phones, Tablets, and many laptops (Ultra books) have no wired Ethernet connections
3. Most of telecommunication carriers' revenue is in wireless
4. New Developments:
 - 5G: 1 Gbps Metropolitan Area Networks
 - Vehicular Networking (802.11p)



Student Questions

- Does 5G bring as many benefits as compared to 4G? Why didn't we see so in our daily life? If not, why it's necessary?

5G is ten times faster than 4G. It is just coming to the USA.

- You mention 6G here, but 5G+ has only been released in certain metropolitan areas. Could you talk more about this?

A new G comes in every ten years. Researchers work ten years ahead. So we are thinking about 2030 when 6G will be standard. The schedules for various G's will be discussed during the 4G/5G discussion.

Mobile Internet

- ❑ June 29, 2007: Apple announced iPhone
⇒ Birth of Mobile Internet, Mobile Apps
 - Almost all services are mobile apps: Google, Facebook, Bank of America, ...
- ❑ 2014 **mobile** data traffic was 2.5×10^{18} B/month.
30× the size of the entire global Internet in 2000 (75 PB/month).
- ❑ Between 2016-21:
 - PC traffic will be only 1/4th compared to 1/2 in 2016.
 - **Smart phone** traffic will be 1/3rd compared to 1/8th in 2016
 - **Mobile traffic** will grow twice as fast as fixed IP traffic
- ❑ Issues: Errors, Disconnection, Limited bandwidth, Limited distance



Student Questions

- ❑ How can we distinguish between mobile traffic and fixed IP traffic? MAC address?
At the point of connection, we know if it is coming via an Access Point or an Ethernet switch.

Ref: Cisco, "Cisco Visual Networking Index: Forecast and Methodology, 2016-2021," June 6, 2017,

<https://www.cisco.com/c/dam/en/us/solutions/collateral/service-provider/visual-networking-index-vni/complete-white-paper-c11-481360.pdf>

Internet of Things



Smart Watch



Smart TV



Smart Car



Smart Health



Smart Home



Smart Kegs



Smart Space



Smart Industries

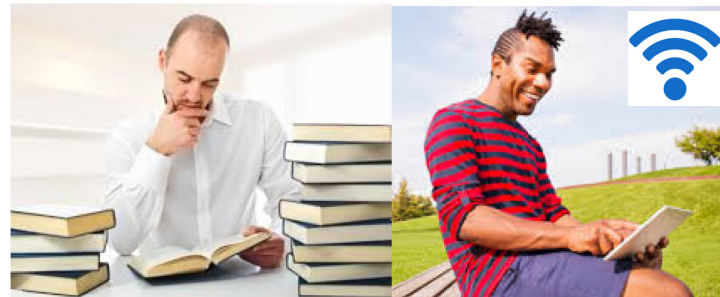


Smart Cities

Student Questions

What's Smart?

- ❑ Old: Smart = Can think \Rightarrow Computation
= Can Recall \Rightarrow Storage
- ❑ Now: Smart = Can find quickly, Can Delegate
 \Rightarrow Communicate = Networking
- ❑ Smart Grid, Smart Meters, Smart Cars, Smart homes, Smart Cities, Smart Factories, Smart Smoke Detectors, ...



Not-Smart Smart

Student Questions

Goal of This Course

- ❑ Comprehensive course on wireless and mobile networking
- ❑ Broad coverage of current key areas
- ❑ Topics of interest to industry
- ❑ Intro to physical layer “Wireless Communication.”
- ❑ Emphasis on lower layers: Layers 2, 3
- ❑ Emphasize both present (Industry standards and products) and near future (Research)
- ❑ Graduate course: (Advanced Topics)
⇒ Less reliance on one textbook

Student Questions

What Will You Learn?

1. How is wireless different from wired communication?
2. How does Wi-Fi work?
 1. How is the speed of Wi-Fi increasing from 10 Mbps to 10 Gbps?
 2. What is the difference between a/b/g/n/ac/ad/...
3. How is Bluetooth different from Wi-Fi?
4. How is ZigBee different from Wi-Fi?
5. What are the protocols that are used in IoT?
6. Why do we need new protocols for IoT?
7. What is the fundamental difference between 1G/2G/3G/4G/5G
8. What new features came in with 4G?
9. What new techniques enabled 5G?
10. What about 6G? When and how?

Student Questions

- I was wondering if we are discussing the MATTER protocol when we talk about ZigBee.

No.

- Are any new topics in the field that will make this class different from the 2018 videos?

Yes, that is why the schedule is "tentative" (other than the exam dates). I am compiling a list of new developments to be included.

- Will the physical mechanism of the wireless network be covered in the lecture?

Physics is discussed in more detail in ESE courses on "Wireless Communications." We will devote one module to that. CSE focuses more on higher layers.

Tentative Schedule

#	Date	Topic
1	8/29/22	Course Overview
2	8/31/22	Wireless Trends+Wireless Coding and Modulation (Part 1)
3	9/5/22	Wireless Coding and Modulation (Part 2)
4	9/7/22	Wireless Signal Propagation
5	9/12/22	IEEE 802.11 Wireless LANs. Part I:Basics
6	9/14/22	Wireless LANs Part II: 802.11a/b/g/n/ac (Part 1)
7	9/19/22	Wireless LANs Part II: 802.11a/b/g/n/ac (Part 2)
8	9/26/22	Exam 1 Review
9	9/28/22	Mid-Term Exam 1

Student Questions

To double confirm, are the dates of the exams fixed?

YES

Tentative Schedule (Cont)

#	Date	Topic
10	9/30/22	60 GHz Millimeter Wave Gigabit Wireless Networks
11	10/3/22	Vehicular Wireless Networks + Wireless in White Spaces
12	10/5/22	IoT+Bluetooth and Bluetooth Smart (Part 1)
	10/10/22	<i>Fall Break</i>
13	10/12/22	Bluetooth and Bluetooth Smart (Part 2)
14	10/17/22	IEEE 802.15.4 WPAN
15	10/19/22	Low Power WAN Protocols for IoT
16	10/24/22	Introduction to 6LowPAN and RPL
17	10/26/22	Exam 2 Review
18	10/31/22	Mid-Term Exam 2

Student Questions

- I was wondering if we will discuss the differences between classic Bluetooth and Bluetooth LE.

10/5

Tentative Schedule (Cont)

#	Date	Topic
19	11/2/22	Cellular Networks: 1G/2G/3G
20	11/7/22	LTE
21	11/9/22	4G/LTE-Advanced (4G)
22	11/11/22	LTE Advanced Pro (4.5G)
23	11/16/22	5G (Part 1)
24	11/18/22	5G (Part 2)
	11/23/22	<i>Thanksgiving Break</i>
	11/25/22	<i>Thanksgiving Break</i>
25	11/30/22	TBD
26	12/2/22	Exam 3 Review
27	12/7/22	Exam 3

Student Questions

❑ Exam 3 is on 12/7. Do we have another lecture or exam after 12/7? I saw WebSTAC said the Final is on 12/21.

There are no lectures or exams after 12/7. There is no "Final."

Prerequisite: CSE473S

- ❑ Protocol Layers: ISO/OSI reference model
- ❑ TCP/IP protocol stack
- ❑ LAN Addressing: Unicast vs. multicast, Local vs. Global
- ❑ Extended LANs: Hubs vs. Bridges vs. Routers vs. Switches
- ❑ IPv4 and IPv6 Address: Public vs. Private Addresses
- ❑ Subnets
- ❑ Address Resolution Protocol (ARP)
- ❑ TCP connection setup, Checksum (pseudo-header), Slow start
- ❑ TCP vs. UDP

Student Questions

- ❑ I have not taken 473S. However, I have many experiences learning networking, so I hope it is okay for me to take this course!

It is your decision. Review CSE473 class notes and see if you are missing a lot. If so, take that first.

- ❑ What's the best way to review the CSE473 content? I know about networking, but I haven't taken any networking courses.

All my courses and class discussions are available online.

<http://www.cse.wustl.edu/~jain/cse473-22/index.html>

However, it may be too late to review these now. You are strongly advised to wait till the next offering of this course.

Text Book

- ❑ No one book covers the the breadth of the material in this course
- ❑ There will be a reading list with each lecture.
The list may include some books, websites, and Wikipedia links
- ❑ Mostly, books available as “Safari Books” will be used.
- ❑ WUSTL has a subscription to Safari Books
⇒ All WUSTL students and faculty have free online access.

Student Questions

Projects

- ❑ Hands-on project or a survey paper related to the topics of the course
- ❑ Most survey topics will be assigned.
You can suggest hands-on projects for approval.
- ❑ Average 6 Hrs./week/person on project + 9 Hrs./week/person on class
- ❑ Recent Developments: Last 2 to 4 years
⇒ Not in books
- ❑ Will be published on my website,
Better ones may be submitted to magazines or journals.

Student Questions

- ❑ For Project, what does "9 Hours/week/person in the class" means? Do we spend time during class doing projects?
You do a project in your own time. However, plan to spend 6 hrs/week extra during the project.
- ❑ Is there a programming project in this course?
Yes. If you want to do a hands-on project, you can write a paragraph about what you want to do. It could be a software or hardware-oriented project. If accepted, you can do that. We even allow two people to join in a hands-on project.

Examples of Projects

- ❑ Implementation of a Mobile Aerial Wireless Network
- ❑ A Survey of Bio-Inspired Wireless Communication
- ❑ Cloud RAN: Basics, Advances and Challenges
- ❑ A Survey of Distributed Radio Systems
- ❑ Energy Efficient Wireless Communication Survey
- ❑ Long Range Low Power (LRLP) Wireless Network
- ❑ LTE-A for Device to Device and Machine-to-Machine Comm
- ❑ M2M Communication Scheduling using LTE/LTE-A
- ❑ Emerging MIMO Technologies
- ❑ Network Coding for Wireless Applications: A review
- ❑ A Survey of Self-Organizing Networks

Student Questions

- ❑ So it's possible or not that someone may have the same topic as others who may be in the class or already have had a paper on the website?

I supply a list of topics. Everyone indicates three preferences. I select one of those 3. There is no overlap. I give them more options if someone cannot be assigned their preferred topic.

- ❑ When should we expect the survey paper assignment? And will we go over more of what that entails?

The list will be supplied on 10/5. I will have several lectures about writing.

Examples of Projects

- ❑ Voice over LTE: Status and Migration Trends
- ❑ A Survey of Software-Defined Wireless Networks
- ❑ Virtualization in Wireless Networks
- ❑ Energy Efficiency in Wireless Networking Protocols
- ❑ Wireless Power Transfer – Concepts and Applications
- ❑ Survey of Low Altitude Unmanned Aerial Vehicles
- ❑ Security and Privacy Issues in the Internet of Things
- ❑ Wireless Networks for Disaster Relief
- ❑ Survey of Wireless Based Indoor Localization Technologies
- ❑ Recent Advances in Broadband Wireless Access Networks
- ❑ Recent Advances in Cognitive Radios
- ❑ Constrained Application Protocol for Internet of Things

Student Questions

- ❑ Can you please assign the project topics early to allow us more time to work on them?

The topics list will be published on October 5th. Everyone needs maturity in networking before selecting one of the choices. Everyone selects at the same time.

Project Requirements

- ❑ Recent Developments: Last 3 to 5 years
 - ▷ Generally not in books
- ❑ Comprehensive Survey:
Technical Papers, Industry Standards, Products
- ❑ Will be published on my website,
Better ones may be submitted to magazines or journals
- ❑ No copyright violations:
 - ⇒ You need to re-draw all figures
 - ⇒ You need to summarize all ideas in your ***own*** words
 - ⇒ Cannot copy any part of text or figure unmodified
 - ⇒ Short quotes ok
 - ⇒ Any unmodified figures need permissionsAny infringement will result in forfeiture of grades even after graduation.

Student Questions

Grading

- Exams (Best 2 of 3 Exams) 60%
- Video Reviews 10%
- Homework/Class Quizzes 10%
- Project 15%
- Class Participation 5%
- Pass/Fail:** 60 points

Student Questions

- Do homeworks include programming and/or Research?

Labs do have some programming.

Some students may do projects that require programming.

- Could you go over all of what class participation includes?

In Slide 1-40, we will go over that today.

Project Schedule and Point Weights

Day	Date	Due	Points
Wednesday	9/7/2022	Search	0.5
Monday	10/3/2022	HTML Sample	0.5
Monday	10/10/2022	Topic	
Monday	10/17/2022	References	1
Monday	10/24/2022	Outline	1
Monday	11/7/2022	Draft Paper	4
Monday	11/14/2022	Reviews	1
Monday	11/21/2022	HTML	2
		Final Paper	5
		Total	15

Student Questions

- I'm supposed to be going on a few business trips for work during October and November, where I will not be able to attend class or two during my trips. Will I miss out on quizzes and class participation points because of these trips? Unfortunately, these trips are unavoidable for me, and I understand that missing class is a big deal. I am sorry for that. *You will miss many points. You are **strongly** advised to drop this course.*

Exams

- ❑ Exams consist of numerical, fill-in-the-blank, and multiple-choice (true-false) questions.
- ❑ There is negative grading on incorrect multiple-choice questions. Grade: +1 for correct. $-1/(n-1)$ for incorrect.
⇒ For True-False: +1 for Correct, -1 for Incorrect
This ensures that random marking will produce an average of zero.
- ❑ Everyone, including the graduating students, is graded the same way.
- ⇒ ❑ *Everyone's grade is scaled up so that the highest score becomes 100% for that exam. This eliminates the effect of the difficulty level of different exams and makes them comparable and combinable.*

Student Questions

- ❑ For the exam, It said, "everyone should take the first two exams." But on slide 23, you said that if we get 30 in the first exam, we do not have to take the second one. Do I misunderstand something?

Exams are worth 60 points. Each exam gives 30 points. You must take at least two exams to get 60 points. You can take any two of the three exams. However, it is best to take the first two to know if you need to take the third. The third exam is close to finals for other courses, so most students do better in the first two.

Exams (Cont)

- ❑ All exams are a closed book.
One 8.5" X11" cheat sheet with your notes on both sides is allowed.
- ❑ No smartphones allowed. Only a simple TI-30 or equivalent calculator allowed for calculations.
- ❑ Exam dates are fixed, and there are no substitute exams
 - ▷ Plan your travel accordingly.
- ❑ Best two of the three exams are used.
- ❑ *Everyone should take the first two exams. The third is optional. The exams will be in person in the classroom.*
- ❑ ~~Respondus will be used to monitor the exam.~~
- ❑ ~~You will need a webcam separate from the one on your laptop for Respondus. Also, get a good headset with a microphone.~~

Student Questions

- ❑ Is the 3rd exam cumulative?
The exams are not cumulative. Each exam covers material covered after the previous exam. So all exams are equally easy/challenging.
- ❖ Is the calculator mandatory?
No, it is not mandatory. You can do the mental computation.
- ❖ What topics will be covered in the Exam? What is not included?
Modules 1-6 are covered in Exam 1. All topics discussed are included. Answers may be in slides or reading lists. Topics not included in the slides are not included.
- ❖ Will the exams use acronyms?
YES

Exams (Cont)

- ❑ All exams are a closed book.
One 8.5" X11" cheat sheet with your notes on both sides is allowed.
- ❑ No smartphones allowed. Only a simple TI-30 or equivalent calculator allowed for calculations.
- ❑ Exam dates are fixed, and there are no substitute exams
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- ❑ *Everyone should take the first two exams. The third is optional. The exams will be in person in the classroom.*
- ❑ ~~Respondus will be used to monitor the exam.~~
- ❑ ~~You will need a webcam separate from the one on your laptop for Respondus. Also, get a good headset with a microphone.~~

Student Questions

- ❖ Can we use both sides of a piece of paper? Handwritten/printed?
Yes, both sides, handwritten or printed.
- ❖ Can I bring a basic calculator?
Basic=TI-30 or equivalent
- ❖ How much time do we have to finish the exam?
50 minutes
- ❖ Is this location confirmed Green Hall / L0120 ?
Yes

Homework Submission

- ❑ All homework is due the following Monday, just before the beginning of the class, unless specified otherwise. This gives you the weekend to work on the homework.
- ❑ Late submissions will **always** have a penalty.
- ❑ *The penalty is 10% per day ⇒ You have a maximum of 9 days to submit late homework with a penalty.*
- ❑ All homework should be submitted on *canvas*
- ❑ The class handout number identifies all homework.
- ❑ All homework should be in a separate file.
- ❑ Homework has Due Date/time and Until Date/time. Please try to do the homework before the due date. Submissions will be allowed up to the “until date/time” *with* a penalty. Canvas will not accept submissions after the “until date/time.”

Student Questions

- ❑ So we have one blank page, and we should not write our names anywhere in the document.
Correct?

No. All submissions are online and private. There is no need for a blank page or name. The video was about hardcopy submissions, which are no longer required.

- ❑ Will there be homework due on Labor Day? Or will it be due on Tuesday?

Whenever Monday is a holiday, the homeworks will be due just before the next class, Wednesday. Homework 1 assigned today is due on 9/7 at 1 PM.

Homework Grading

- ❑ Grading basis: Method + Correct answer
- ❑ Show how you got your answer
 - Show intermediate calculations.
 - Show equations or formulas used.
 - If you use a spreadsheet, a statistical package, or write a program, print it out and turn it in with the homework.
 - For Excel, set the print area and scale the page accordingly to fit a page. (See Page Setup)
- ⇒ ❑ **Questions:** There may be questions during the class to check if you have understood the material. *These count towards class participation.*

Student Questions

- ❑ Will class quizzes be given on Canvas?

I have updated this slide to say that answering questions in class counts toward class participation. There are no surprise quizzes.

Questions

- ⇒ During the class, I may ask some questions to ensure that you have understood the topics.

Student Questions

Academic Integrity

- ❑ Academic integrity is expected in homework, quizzes, and exams.
- ❑ All solutions submitted are expected to be yours and not copied from others or solution manuals, or from the Internet
- ❑ School requires us to report all integrity violations to the department

Student Questions

Class Discussions

- ❑ We will use Piazza for class discussion.
- ❑ Find our class page at:
- ❑ <https://piazza.com/wustl/fall2022/cse574s>

Student Questions

Office Hours

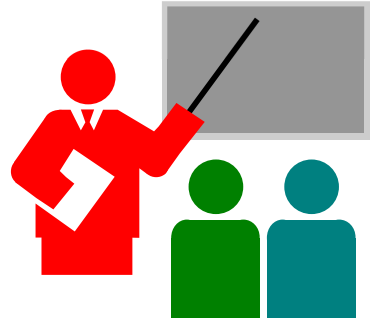
- ❑ Office Hours: On Zoom, by appointment
- ❑ **Teaching Assistant:** Zebo Yang Zebo at wustl.edu
 - Office Hours on Zoom: Friday 1:30-2:30 PM
Sunday 1:30-2:30 PM
- ❑ Please write **CSE574** in the subject field of all emails related to this course.
- ❑ Use the words “**Homework xx**” in the subject field on emails related to homework xx. Remember to indicate the homework number.
- ❑ *Resolve your grading issue with the TA first before approaching the instructor.*

Student Questions

- ❖ Is it possible to have an extra TA session the day before the exam?

Yes.

Summary



- ❑ We are living in the Internet age. Most activities, including work and play, require the Internet.
- ❑ Networking companies are among the most valued companies in the world.
- ❑ Wireless networking is taking over the edge, fueled by smartphones and smart devices (IoT).
- ❑ Goals of this course:
 - To prepare you for the current job market in networking
 - To teach you how to keep up with the latest in wireless and mobile networking

Student Questions

- ❖ Do we need to remember all numbers and percentages in the reading list?
No. Mostly concepts from the reading list. In general, only trends not exact values.

Google Search Modifiers

- ❑ filetype:pdf, doc, ppt, pptx
- ❑ site:wustl.com
- ❑ intitle:trend
- ❑ inurl:trend
- ❑ allintitle:Networking Trends
- ❑ Allinurl:
- ❑ “ “ \Rightarrow Exact Phrase
- ❑ OR
- ❑ AND
- ❑ + \Rightarrow Must include
- ❑ - \Rightarrow Not include
- ❑ ~X \Rightarrow X or similar
- ❑ * \Rightarrow Wildcard

Student Questions

Project Homework 1

- ❑ Search web pages, books, and journal articles from IEEE Xplore, ACM Digital Library, **MOBIUS**, **Safari books**, **ILLIAD** at Olin Library for one of the following topics:
 1. Wireless Networking Trends
 2. Mobile Networking Trends
 3. Internet of Things
- ❑ On the web, try the following search points:
 - <http://library.wustl.edu/findart.html>
 - <http://library.wustl.edu/fulltext/>
 - <http://scholar.google.com>
 - <http://books.google.com>
 - <http://dl.acm.org/>
 - <http://ieeexplore.ieee.org/Xplore/home.jsp>

Student Questions

- ❑ Could you clarify how we gain access to Safari books?

<https://one.wustl.edu/task/all/safaribooks>

- ❑ When is project homework 1 start and due?

All homework is due on the Monday following the class discussion or Wednesday if Monday is a holiday. Project homework 1 is due on Wednesday, Sep 7, 2022.

- ❑ When will this Project Homework 1 assignment be available on Canvas?

It should be available today.

Project Homework 1 (Cont)

- Ignore all entries dated 2017 or before. Also ignore all entries that do not indicate the topic or similar words in the title. List others in the following format (5 each):
 - Author, “Title,” publisher, year, ISBN. (for five books)
 - “Title,” URL [One line description] (for five webpages)
 - Author, “Title,” source (for five technical/magazine articles)
- For the books, including whether the book is available at WUSTL, MOBIUS, Safari, or ILLiad
- Serially number the references and submit them electronically to canvas.
- Make a list of other interesting search points and share them in class.

Student Questions

Common Mistakes in Project Homework #1

- ❑ Not indicating where the book can be found in WUSTL
- ❑ Listing books/Magazines/journals that have little to do with the topic – may show up in search engines because of a minor mention of the topic or words
- ❑ Web Pages – No one line descriptions
- ❑ Incomplete bibliographic data for journal articles. Need volume, issue, year, pages.
- ❑ Missing journals. Need names of journals dealing with the topic chosen.

Student Questions

Quiz 0: Prerequisites

True or False?

T F

1. Datalink refers to the 2nd layer in the ISO/OSI reference model
2. HTTP is an example of an application layer protocol
3. Finding a path from one node to another in a large network is a transport layer function.
4. CRC is used for error detection
5. MAC address of a node changes as it changes its location.
6. For long delay paths, on-off flow control is better than window flow control.
7. Ethernet uses a CSMA/CD access method.
8. All Ethernet packets are acknowledged.
9. The packets sent in a connection-oriented network are called datagrams.
10. Spanning tree algorithm finds a loop-free path in a network.

Marks = Correct Answers ____ - Incorrect Answers ____ = _____

Student Questions

Answers to this quiz will be provided in the class for you to check your answers privately. Next 4 slides will also be covered in the class.

Remote Classes

- ❑ **All** classes of this course throughout this semester will be remote using Zoom.
- ❑ The class is **flipped**: you review the material in the video before the class and submit your questions on a form.
- ❑ Class time will be used to answer those and any additional questions.
- ❑ *Everyone should have their camera on. Your facial expression during class discussion indicates your level of understanding and attentiveness as in a physical class.*
- ❑ All questions during the class will be via “Zoom chat” *or microphone* and broadcast/visible/audible to all students.

Student Questions

Class Participation

- *The following activities count towards your class participation:*
 - *Answering instructor questions in the class*
 - *Answering other students' questions on Piazza*
 - *Being present and attentive in the class*
- Keep track of your participation. You may be asked at the end.*
- Asking questions on Piazza does not count*
- Zoom reports include the time you join and leave and how much “attention” you paid to the session. Multiple monitors and unnecessary keyboard and mouse activities on other applications are counted as a lack of attention.
- Students should join with their full name and email. That way, I can associate your participation.

Student Questions

Video Review Task

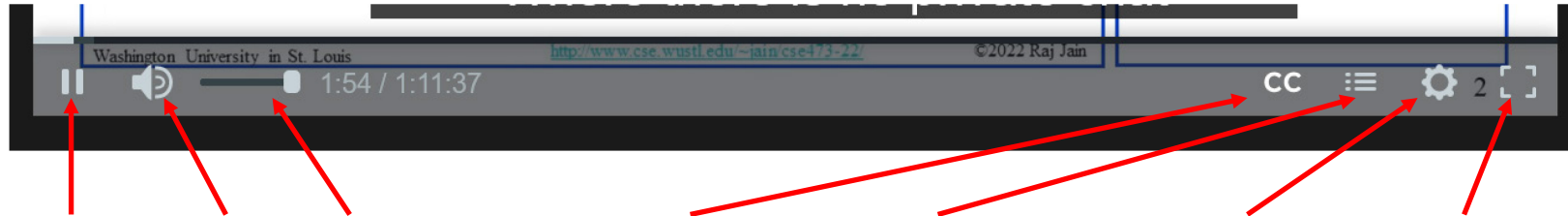
- *Video Review question form closes at midnight before the class so the questions can be incorporated into the class presentation. This is the deadline (Due Date). The allowable deadline (Until Date) is ten days after with a 10% penalty/day.*
- During each video review, please answer the quiz questions on Canvas. These questions are simple and have 10-grade points.*
- Also, remember to write your questions about each slide on the Google form. Submission of the form is required.*
- If you do not have any questions on a slide, you should leave it blank.*
- *Everyone should ask at least one question.*

Student Questions

- Are the quizzes embedded in the videos graded for correctness?
Yes. Each quiz adds 2 points iff the Google form has also been submitted.*

Video Play Menu

- ❑ *When you mouse over the bottom of the play area, several controls show up, as shown below.*



Start/Stop Mute Volume Closed Captions Table of Contents Settings Full Screen

- ❑ *These features are available only on recordings played directly from the course website or Canvas. Not available on YouTube.*
- ❑ *Press CC to enable and disable the display of “Closed Captions.” with transcription of the speech.*
- ❑ *Table of contents lists each slide’s title. This allows you to jump to the particular slide in the video.*

Student Questions

Acronyms

- ❑ BAN Body Area Networks
- ❑ CSMA/CD Carrier Sense Multiple Access with Collision Detection
- ❑ IEEE Institution of Electrical and Electronic Engineers
- ❑ ILLIAD Inter-Library Loan
- ❑ IMT International Mobile Telecommunication
- ❑ IPv4 Internet Protocol Version 4
- ❑ IPv6 Internet Protocol Version 6
- ❑ ISO International Standards Organization
- ❑ LAN Local Area Network
- ❑ LRLP Long Range Low Power
- ❑ LTE Long-Term Evolution
- ❑ MAC Media Access Control
- ❑ OSI Open System Interconnection
- ❑ OSPF Open Shortest Path First

Student Questions

Acronyms (Cont)

- ❑ RFID Radio Frequency Identification
- ❑ TCP Transmission Control Protocol
- ❑ TV Television
- ❑ UMB Ultra-Mobile Broadband
- ❑ URL Uniform Resource Locator
- ❑ UWB Ultra-Wideband
- ❑ VoIP Voice over IP
- ❑ Wi-Fi Wireless Fidelity
- ❑ WUSTL Washington University in Saint Louis
- ❑ WWW World-Wide Web

Student Questions

Scan This to Download These Slides



Raj Jain

<http://rajjain.com>

http://www.cse.wustl.edu/~jain/cse574-22/j_01int.htm

Student Questions

- ❖ Will we have all of our HW returned before the exam so we can use it as a review of the material as well?

Yes.

Related Modules



CSE567M: Computer Systems Analysis (Spring 2013),
https://www.youtube.com/playlist?list=PLjGG94etKypJEKjNAa1n_1X0bWWNyZcof

CSE473S: Introduction to Computer Networks (Fall 2011),
https://www.youtube.com/playlist?list=PLjGG94etKypJWOSPMh8Azcg5e_10TiDw



CSE 570: Recent Advances in Networking (Spring 2013)
<https://www.youtube.com/playlist?list=PLjGG94etKypLHyBN8mOgwJLHD2FFIMGq5>

CSE571S: Network Security (Fall 2011),
<https://www.youtube.com/playlist?list=PLjGG94etKypKvzfVtutHcPFJXumyyg93u>



Video Podcasts of Prof. Raj Jain's Lectures,
<https://www.youtube.com/channel/UCN4-5wzNP9-ruOzQMs-8NUw>

Student Questions