COMP 3331/COMP 9331 2021 T2 Week 1 Lecture 1

# Overview of the course

## Teaching Staff

* Lecturer-in-Charge: Salil Kanhere,
* Course Admin: Ayda Valinezhad Orang

## How to get help

* Use cs3331@cse.unsw.edu.au and DO NOT email LiC/admin on personal email address.
* Use Ed forum to ask questions regarding the course, labs, tutorials, assignments and exams, <https://edstem.org/join/8egWkk>

## Learning Recourses

* <https://webcms3.cse.unsw.edu.au/COMP3331/21T2/> Lecture Notes.
* Computer Networking: A Top-Down Approach, Jim Kurose, Keith Ross, Addison-Wesley (Pearson), 6th or 7th Edition.
* Homework, quiz, and additional reading material (on WebCMS)

## Learning Objectives

* To gain in-depth introduction to a wide range of topics in the field of computer networks, including the Internet.
* To obtain hands-on understanding of networking protocols.
* To gain skills in network programming, designing and implementing network protocols, evaluating network performance and problem solving.
* To build necessary foundational knowledge required in more advanced networking courses.

## Course Schedule

* [Introduction to Computer Networks](https://webcms3.cse.unsw.edu.au/COMP3331/21T2/resources/60218) (Week 1)
* [Application Layer Part 1 (Principles, HTTP, E-mail)](https://webcms3.cse.unsw.edu.au/COMP3331/21T2/resources/60196) (Week 2)
* [Application Layer - DNS/P2P/CDN/Socket Programming](https://webcms3.cse.unsw.edu.au/COMP3331/21T2/resources/60246) (Week 3)
* [Transport Layer part 1](https://webcms3.cse.unsw.edu.au/COMP3331/21T2/resources/60202) (Week 4)
* [Transport Layer part 2](https://webcms3.cse.unsw.edu.au/COMP3331/21T2/resources/60202) (Week 5)
* [Network Data Plane](https://webcms3.cse.unsw.edu.au/COMP3331/21T2/resources/60191) (Week 7)
* [Network Control Plane](https://webcms3.cse.unsw.edu.au/COMP3331/21T2/resources/60199) (Week 8)
* [Link Layer](https://webcms3.cse.unsw.edu.au/COMP3331/21T2/resources/60212) (Week 9)
* [Wireless\_Links\_Networks](https://webcms3.cse.unsw.edu.au/COMP3331/21T2/resources/60209) and [Network Security](https://webcms3.cse.unsw.edu.au/COMP3331/21T2/resources/60208) (Week 10)
* [Course Recap + Overview of Final Exam](https://webcms3.cse.unsw.edu.au/COMP3331/21T2/resources/60210) (Week 10)

## Course Delivery

### Lectures and Lecture Recordings

We will use Zoom Meetings. Below are the links for two weekly lectures. You can either use the Zoom app on your computer or mobile device or a web browser to connect.

[Monday 13:00 - 15:00](https://unsw.zoom.us/j/88672615742?pwd=R0RlSGM5TTJJaVFzWDBuTjdHVVp5Zz09)

[Tuesday 16:00 - 18:00](https://unsw.zoom.us/j/87561281408?pwd=VTJOQnMzOGMrOEcxTlJ2TG5TT0ovZz09)

There are two ways to access the video recordings. We will aim to upload the videos within 1-2 hours after the live lecture concludes.

[Echo360 Playlist](https://echo360.org.au/section/7df10949-e718-4803-a9f5-1377e4d6c09d/home)(Zoom Chat is added as a PDF document alongside the videos)

[YouTube Playlist](https://www.youtube.com/playlist?list=PLPsY-Ly5lDUiUxwdALbNCKHfhJlknBVql)

### Lab and Lab Recordings

**All labs will be held online using Teams/Zoom – meeting. Live Tutorial links and recording links are on WEBCMS lab page.** We will have 2-hour lab sessions starting Week 2 (Weeks 2-5, 7-10)

* 6 Lab Exercises – 5/6 best performing labs will be used for assessment.
* 2 Problem-based learning sessions (Tutorials in Week 5 & 10). This serves the purpose of exam preparation. Students can ask questions during tutorials.

## **Important Information**

Please test everything on CSE machines via VLAB or VNC before submitting. We have some programming exercises for this course and students have the choice to use C, Java, or Python for these tasks. However, please follow the instruction and always test your code on CSE machines because tutors will use the CSE environment to run tests.

**Some useful links for using VNC:**

* Recommended client: TigerVNC (<https://tigervnc.org>)
* Details: [https://taggi.cse.unsw.edu.au/FAQ/VLAB\_- \_The\_technical\_details/](https://taggi.cse.unsw.edu.au/FAQ/VLAB_-%20_The_technical_details/)
* UNSW VPN: <https://www.myit.unsw.edu.au/services/students/remote-accessvpn>
* China Students Access Network: <https://www.myit.unsw.edu.au/services/students/china-studentsaccess-network>
* You will need to know basic command line Linux commands: http://www.unixguide.net/linux/linuxshortcuts.shtml

## Plagiarism

### What is plagiarism?

Presenting the (thoughts or) work of another as your own. Plagiarism will be checked for and penalized. To avoid plagiarism, labs, assignments, exams must be entirely your own work. You cannot work on assignment as a pair (or group).

### Serious Consequences

* Plagiarism may result in suspension from UNSW.
* Scholarship students may lose scholarship.
* International students may lose visa.
* Supplying your work to any another person may result in loss of all your marks for the lab/assignment.

## Assessment

|  |  |
| --- | --- |
| Labs | 20%. |
| Assignment | 20%, Assignment released in Week 4, due in Week 10. |
| Mid-term test | 20%, Monday, 12th July 2021, 13:00 – 15:00 (Week 7), access from Moodle. |
| Final Exam | 40%, Open-book Exam. |

**Hurdle – must score at least 40% to pass the course.**

## Introduction to Computer Networks

## 1.1 What is the Internet?

* An interconnection of different computer networks.
* An infrastructure that provides services to networked applications.

“Nuts and bolts” view

All these devices are called **hosts** or **end systems**. End systems are connected by a network of **communication links** and **packet switches**.

Diagram

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Figure End System Interaction

Internet is the “network of networks”, we have interconnected ISP (Internet Service Provider) to provide communication using protocols managing control sending, receiving of messages. In this course we mainly talk about RFC Request for comments as the Internet standards.

“Service” view

We can also describe the Internet as an infrastructure that provides services to applications. In addition to traditional applications such as e-mail and Web surfing, Internet applications include mobile smartphone and tablet applications, including Internet messaging, mapping with real-time road-traffic information, music streaming from the cloud, movie and television streaming, online social networks, video conferencing, multi-person games, and location-based recommendation systems. The applications are said to be distributed applications, since they involve multiple end systems that exchange data with each other. **Importantly, Internet applications run on end systems, they do not run in the packet switches in the network core.**

Protocol

**Protocols define format, order of messages sent and received among network entities, and actions taken on msg transmission, receipt**. A network protocol is similar to a human protocol, except that the entities exchanging messages and taking actions are hardware or software components of some device (for example, computer, smartphone, tablet, router, or other network-capable device). Some examples of protocols are TCP, IP, HTTP, Skype, 802.11.

Diagram

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Figure Human Protocol vs Computer Protocol

## 1.2 Network edge

End System (Hosts)

Recall from the previous section ([Figure 1](#_1.1_What_is)) that in computer networking jargon, the computers and other devices connected to the Internet are often referred to as **end systems**. They are referred to as end systems because they sit at the edge of the Internet. End systems are also referred to as **hosts**because they run application programs such as a Web browser program, a Web server program, an e-mail client program, or an e-mail server program.

Access Network

Access network, physical media refer to wired, wireless communication links that physically connects an end system to the first router (also known asthe “edge router”: A router that connects the edge components to the 'core' routers.) on a path from the end system to any other distant end system. [Figure 1](#_1.1_What_is) showsseveral types of access networks (home, enterprise, and wide-area mobile wireless) inwhich they are used.

\* There are 15 slides in the lecture notes giving examples of access network, however, they are for information only, students only need to be familiar with the terminology and concepts.

## 1.3 Network core (The most important part of this lecture)

There are two fundamental approaches to moving data through a network of links and switches:

* circuit switching: used in the legacy telephone networks.
* packet switching: used in the Internet.

### 1.3.1 Circuit Switching

In circuit-switched networks, the resources needed along a path (buffers, link transmission rate) to provide for communication between the end systems are reserved for the duration of the communication session between the end systems. That is, end -end resources allocated to, reserved for “connection” between source & destination. Circuit switching provide guaranteed performance, bandwidth is dedicated to each user and no sharing between the bandwidths.

Diagram

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Figure Timing in Circuit switching

Above diagram illustrates the circuit establishment phase, data transfer phase, and circuit teardown phase. This is what we refer as the Timing Diagram. We will use a lot of timing diagram in the later part of the course.

**Issues with Circuit Switching**

1. Inefficient: The Internet communication tends to be very bursty, if we reserve bandwidth for a user and the user is not using it, we are wasting a lot of resources. For example, imaging there are 10 users in the bandwidth, but only one person is using the Internet, circuit switching still needs to reserve the bandwidth for the 9 users who are not using the bandwidth. Dedicated circuit cannot be used or shared in periods of silence.

2. Fixed data rate: Computers communicate at very diverse rates. Circuit switching has fixed data rate, which is not very useful when users use different applications at diverse rates. For example, viewing a video vs. using telnet or web browsing.

3. Connection state maintenance: Circuit switching requires per communication state to be maintained that is a considerable overhead. **Circuit switching is not scalable.**

### 1.3.2 Packet Switching

* **Data is sent as chunks of formatted bits (Packets)**. In the graph below, the photo is divided into several parts to be sent.
* **Packets consist of a header and payload**. Payload is the data being carried, header holds instructions to the network for how to handle packet, for example, TTL and Checksum to protect header.

Graphical user interface

Description automatically generated with medium confidence

* **Switches forward packets based on their headers**. Store-and-forward transmission means that the packet switch must receive the entire packet before it can begin to transmit the first bit of the packet onto the outbound link.

Diagram

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* **Each packet travels independently**. Between source and destination, each packet travels through communication links and packet switches (for which there are two predominant types, routers and link-layer switches). Please note that even for the same file, packet may travel through different paths.
* **No link resources are reserved in advance (compare this to circuit switching). Instead, packet switching leverages statistical multiplexing**.

This is the end of lecture 1 week 1, **statistical multiplexing** will be covered in lecture 2.