



University of Indonesia  
Faculty of Computer Science

# COMPUTER NETWORKS IKI 20240 I

## General Information

Course Title	<b>Computer Networks</b>
Course Code	<b>IKI 20240 I</b>
Course Load	<b>3 hours credit (3 SKS)</b>
Course Level	<b>Undergraduate</b>
Course Coordinator	<b>Johny Moningka</b>
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Prerequisite	<b>Introduction to Computer Organization</b>

## Course Description

The course is an introduction to the principles of the Internet based computer networks. It emphasizes on the top down approach of the Internet model, starting from the application layer on the top. It works its way down toward the transport, network, data link, and physical layers.

## Course Objectives

### Terminal Course Objectives

It is expected that upon successful completion of the course, students will be able to:

1. Compare and contrast the services provided by each layer of an Internet based computer networks, i.e. the application, transport, network, data link, and physical layers.
2. Construct an Internet based computer networks from the five layers with a top-down approach.

### Supporting Course Objectives

After successfully completing this course, the students should be able to:

1. Differentiate an Internet based computer networks from other models of computer networks.

2. Apply the protocol concept in a computer networks, as well as in daily life.
3. Analyze the communication between the client and server.
4. Compare and contrast between a connectionless and connection-oriented service.
5. Compare and contrast between circuit and packet switching.
6. Compare and contrast various network access and physical media.
7. Calculate various delay and loss in computer networks.
8. Compare and contrast various layered architectures and service models.
9. Analyze popular network applications, such as the web, file transfer, e-mail, directory services, and Point-to-Point (P2P) file sharing.
10. Analyze various services provided by the transport layer.
11. Analyze the message exchange over the Internet with a network analyzer, such as the Ethereal.
12. Analyze various services provided by the network layer.
13. Analyze various services provided by the transport layer.
14. Design, implement, and test a simple network application, using socket programming.

## References and Learning Resources

### Recommended Resources

- [1] Kurose, J.F., K.W. Ross, *Computer Networking, A Top-Down Approach Featuring the Internet, 3<sup>rd</sup> ed.* Addison-Wesley; Boston, 2005.
- [2] Cisco – *IP Addressing and Subnetting for New Users*, 2005
- [3] <http://www.ethereal.com/docs/user-guide/>
- [4] *C Network Programming Guide*
- [5] *Java Network Programming Guide*

### Learning Management System

Additional course resources, such as course slides, network simulators, network analyzers, discussion forums, and exercises are available on the faculty learning management system, i.e. SCellE (<https://scele.cs.ui.ac.id>).

### Assignments

Week	Individual Assignment
2	Delay & Loss Calculation
10	Subnetting & CIDR Design
11	Open Shortest Path and Border Gateway Protocol

## Week Group Assignment

- |       |   |
|-------|---|
| 3 & 4 | Jigsaw Collaborative Learning on application protocols (web, mail, file transfer, directory service, peer-to-peer file sharing) |
| 8     | Problem Based Learning on network analysis using network analyzer software, e.g. Ethereal                                       |
| 15    | Problem Based Learning on simple socket programming   |

## Example of Assignments

### Transmission vs Propagation Delay

Access the network simulator on

[http://media.pearsoncmg.com/aw/aw\\_kurose\\_network\\_2/applets/transmission/delay.html](http://media.pearsoncmg.com/aw/aw_kurose_network_2/applets/transmission/delay.html)

Please discuss:

1. What is the definition of transmission delay?
2. What is the definition of propagation delay?
3. Make an experiment with the network simulator, when the head of the packet has arrived at the receiver, but the transmission of the tail of the packet has not finished.
  - a. Write the formula to calculate the total delay.
  - b. Calculate the delay
  - c. Compare your calculation with the time elapse shown by the simulator
  - d. Write the analysis of the comparison.

## Evaluation

The assessment forms and weighting scheme of this course are as follows:

Assessment	Frequency	Weight
Individual Assignments	3	15%
Group Assignments	3	15%
Midterm Examination	1	35%
Final Examination	1	35%
<b>Total</b>		<b>100 %</b>

## Class Policies

- **Attendance**  
Students are expected to attend class or visit SCELE regularly. There are 75% minimum attendance requirements, and attendance sheets will be passed out and will be considered into students' class participation grade. In the case of absence, students are responsible to stay current on information regarding materials covered in class and any changes in schedule.
- **Late Assignments**  
Late assignment submission will be penalized by deducting 5 (five) points from the total grade for each day after the assignment due date. If the students have a justified reason for not turning the assignment on time (e.g., due to extenuating circumstances), the students should inform the coordinator prior to the due date to maintain flexibility and fairness amongst the students. All late assignments are to be turned in to the secretary.

- Academic Dishonesty and Incomplete Mark  
Each student should be familiar with the guidelines set in the “Code of Student Ethics” for issues pertaining to academic dishonesty. No incompletes mark (I) will be assigned. There will be no makeup assignments unless prior notice is given and supporting document of emergency is given.

## Lesson Plan

Topic	Assignment	Reference
<b>Week 1</b>		
Computer Networks and Internet <ul style="list-style-type: none"> <li>Internet</li> <li>Client server</li> <li>Connectionless &amp; connection-oriented service</li> <li>Circuit switching &amp; packet switching</li> </ul>		[1] 1.1 – 1.3
<b>Week 2</b>		
Computer Networks and Internet <ul style="list-style-type: none"> <li>Network access</li> <li>Physical media</li> <li>Delay &amp; lost</li> <li>Layered architecture &amp; service model</li> <li>History of computer networks &amp; Internet</li> </ul>	Individual Assignment	[1] 1.4 – 1.8
<b>Week 3</b>		
Application Layer <ul style="list-style-type: none"> <li>Principles of network application</li> <li>Web &amp; Hyper Text Transfer Protocol (HTTP)</li> <li>File Transfer Protocol (FTP)</li> <li>E-mail</li> </ul>	Group Assignment	[1] 2.1 – 2.4
<b>Week 4</b>		
Application Layer <ul style="list-style-type: none"> <li>Domain Name Service (DNS)</li> <li>Point to Point (P2P) file sharing</li> <li>Socket programming with Transmission Control Protocol (TCP)</li> <li>Socket programming with Used Datagram Protocol (UDP)</li> <li>Simple web server</li> </ul>	Group Assignment	[1] 2.5 – 2.9
<b>Week 5</b>		
Transport Layer <ul style="list-style-type: none"> <li>Transport layer services</li> <li>Multiplexing and de-multiplexing</li> <li>Connectionless transport: UDP</li> <li>Reliable data transfer</li> </ul>		[1] 3.1 – 3.4
<b>Week 6</b>		
Transport Layer <ul style="list-style-type: none"> <li>Connection oriented transport: TCP</li> <li>Congestion control</li> <li>TCP congestion control</li> </ul>		[1] 3.5 – 3.7
<b>Week 7</b>		
Midterm Examination		
<b>Week 8</b>		
Network Ethereal <ul style="list-style-type: none"> <li>Network analyzer concepts</li> <li>Ethereal, an example of network analyzer</li> </ul>	Group Assignment	[3]

Topic	Assignment	Reference
<ul style="list-style-type: none"> <li>▪ Protocol identification, as an output on Ethereal interfaces</li> <li>▪ Simulation and analysis of several application layers, with Ethereal</li> </ul>		
<b>Week 9</b>		
Network Layer <ul style="list-style-type: none"> <li>▪ Network layer services</li> <li>▪ Virtual switch &amp; datagram networks</li> <li>▪ Router</li> </ul>		[1] 4.1 – 4.3, [2]
<b>Week 10</b>		
Network Layer <ul style="list-style-type: none"> <li>▪ Internet Protocol (IP)</li> <li>▪ Routing algorithm</li> </ul>	Individual Assignment	[1] 4.4 – 4.5, [2]
<b>Week 11</b>		
Network Layer <ul style="list-style-type: none"> <li>▪ Routing on the Internet</li> <li>▪ Broadcast &amp; multicast routing</li> </ul>	Individual Assignment	[1] 4.6 – 4.7, [2]
<b>Week 12</b>		
Data Link and Physical Layer <ul style="list-style-type: none"> <li>▪ Data link layer services</li> <li>▪ Error-detection &amp; error-correction techniques</li> <li>▪ Multiple access protocols</li> </ul>		[1] 5.1 – 5.3
<b>Week 13</b>		
Data Link and Physical Layer <ul style="list-style-type: none"> <li>▪ Data link layer addressing</li> <li>▪ Ethernet</li> <li>▪ Interconnections: hubs &amp; switches</li> </ul>		[1] 5.4 – 5.6
<b>Week 14</b>		
Data Link and Physical Layer <ul style="list-style-type: none"> <li>▪ Point-to-Point Protocol (PPP)</li> <li>▪ Link virtualization</li> </ul>		[1] 5.7 – 5.8
<b>Week 15</b>		
Socket Programming <ul style="list-style-type: none"> <li>▪ TCP socket concepts and techniques programming with Java or C</li> <li>▪ Design a client of a network protocol on application layer, with TCP socket</li> <li>▪ Implement and test the design</li> </ul>	Group Assignment	[4], [5]
<b>Week 16</b>		
Final Examination		