

## 课程详述

### COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	<b>课程名称 Course Title</b>	计算机网络 <b>Computer Networks</b>
2.	<b>授课院系 Originating Department</b>	计算机科学与工程系 Department of Computer Science and Engineering
3.	<b>课程编号 Course Code</b>	CS305
4.	<b>课程学分 Credit Value</b>	3
5.	<b>课程类别 Course Type</b>	专业核心课 Major Core Courses
6.	<b>授课学期 Semester</b>	秋季 Fall
7.	<b>授课语言 Teaching Language</b>	中英双语 English & Chinese
8.	<b>授课教师、所属学系、联系方式 (如属团队授课, 请列明其他授课教师) Instructor(s), Affiliation &amp; Contact (For team teaching, please list all instructors)</b>	张进, 助理教授, 计算机科学与工程系, zhangj4@sustc.edu.cn Jin Zhang, Assistant Professor, Department of Computer Science and Engineering, zhangj4@sustech.edu.cn
9.	<b>实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact</b>	王薇, 教学实验员, 计算机科学与工程系, wangw6@sustech.edu.cn Wei Wang, Assistant Teaching Technician, Department of Computer Science and Engineering, wangw6@sustech.edu.cn
10.	<b>选课人数限额(可不填) Maximum Enrolment (Optional)</b>	

11. 授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 Tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other (Please specify)	总学时 Total
	32		32		64
学时数 Credit Hours					
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	CS102A 计算机程序设计基础 A Introduction to Computer Programming A				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite					
14. 其它要求修读本课程的学系 Cross-listing Dept.	通信工程				

### 教学大纲及教学日历 SYLLABUS

#### 15. 教学目标 Course Objectives

课程以互联网为载体，介绍现代计算机网络的基本概念和原理，重点介绍协议、架构和实现问题。课程首先介绍如何基于已有的网络协议和架构来实现网络应用程序（如电子邮件、FTP）。接下来按照自顶向下的方式介绍网络协议的架构及各层协议：应用程序、传输、网络、数据链路和物理层，以及层次化背后的原理及具体应用。课程的高级主题中探讨了包括软件定义的网络、无线网络在内的多方面前沿技术。

Using the Internet as a vehicle, this course introduces the underlying concepts and principles of modern computer networks, with emphasis on protocols, architectures, and implementation issues. Students will first learn how to implement network applications (e.g., e-mail, ftp) using the existing network protocols and architectures. Students then study how/why these protocols and architectures work by using the layered organization of the Internet in a top-down fashion: Application, Transport, Network, Data Link and Physical layers. The course will also cover advance topics including software-defined networking, wireless networking.

#### 16. 预达学习成果 Learning Outcomes

成功完成本课程后，学生将获得以下技能：

1. 熟悉层次化的网络通信架构（OSI 和 TCP/IP）。
2. 了解客户端/服务器模型和有代表性的应用层协议。
3. 学习 sockets 编程以及如何实现客户机/服务器程序。
4. 了解可靠数据传输的概念以及 TCP 如何实现可靠性传输。
5. 了解拥塞控制的原则和公平高效的权衡考虑因素。
6. 学习路由算法和 IP 协议的语义和语法。
7. 了解错误检测的基本知识，包括奇偶校验、校验和以及 CRC 方式。

As a result of successfully completing this course, students will:

1. Become familiar with layered communication architectures (OSI and TCP/IP).
2. Understand the client/server model and key application layer protocols.
3. Learn sockets programming and how to implement client/server programs.
4. Understand the concepts of reliable data transfer and how TCP implements these concepts.

5. Know the principles of congestion control and trade-offs in fairness and efficiency.
6. Learn the principles of routing and the semantics and syntax of IP.
7. Understand the basics of error detection including parity, checksums, and CRC.

17. 课程内容及教学日历（如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）

**Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)**

第一周：计算机网络导论

[Lab 1]. 练习网络错误常见异常的检测方法

第二周：因特网及因特网协议介绍

基于包交换技术的网络的性能指标：延迟、丢包率、吞吐量  
服务模型，网络协议的相关概念

[Lab 2]. 学习使用 WireShark 软件用于网络协议的学习及分析

第三周：应用层协议：应用层协议的基本原理，HTTP 以及 WWW 服务

[Lab 3]. 通过实验进一步理解 HTTP 协议的细节

第四周：应用层协议：DNS 及 Email

[Lab 4]. 通过实验进一步理解 DNS 协议的细节，实现基于 HTTP 协议的应用

第五周：应用层协议：P2P,流媒体应用以及 socket 编程

[Lab 5]. 练习 P2P, 以及 socket 编程实现细节

第六周：传输层协议：传输层的服务及原则，复用与解复用，UDP 协议

[Lab 6.] 通过实验进一步理解 CDN 与 DASH 协议的实现

第七周：传输层协议：可靠性传输与 TCP

[Lab 7]. 通过实验进一步理解 TCP 与 UDP 协议的实现细节

第八周：传输层协议：TCP 的流控与拥塞控制

[Lab 8]. 通过实验进一步理解 TCP 中的滑动窗口机制

第九周：网络层协议：数据层面的相关操作

[Lab 9]. python 练习

第十周：网络层协议：IP 协议，网络层的转发实现，SDN

[Lab 10] raw socket 编程练习

第十一周： 网络层协议：控制层

路由算法介绍：链路状态,距离向量, OSPF, BGP

[Lab 11]. 基于 IP, ICMP, DHCP 的实验练习

第十二周：网络层协议：控制层

SDN 的控制层, ICMP, SNMP 协议

[Lab 12]. 基于路由器 MSR810 的网络搭建及路由实验

第十三周： 链路层,

错误检测及纠正, MPLS 协议介绍, 多路接入协议, 局域网技术介绍

[Lab 13] 基于交换机 S5110 的网络搭建及链路交换实验

第十四周：链路层, 局域网技术

[Lab 14] 基于无线路由器的配置使用

第十五周：无线局域网

[Lab 15]. 使用网络模拟器来完成网络搭建及配置

第十六周：总结与复习

[Lab 16]. 复习及答疑

Week 1. Course overview

[Lab 1]. Practice on common methods of network monitoring and diagnosis

Week 2. What is the Internet, what is a protocol? (textbook: Chapter 1)

delay, loss, throughput in packet-switched networks, protocol layers, service models

[Lab 2]. Practice on Wireshark to analysis protocol

Week 3. Application layer 1 (textbook: Chapter 2.1-2.3)

principles of application-layer protocols, World Wide Web, HTTP

[Lab 3]. Practice on HTTP

Week 4. Application layer 2 (textbook: Chapter 2.4-2.5): DNS, Email

[Lab 4]. Practice on HTTP and DNS

Week5. Application layer 3: P2P, Video streaming, socket programming

[Lab 5]. Practice on P2P, socket programming

Week 6. Transport layer 1 (textbook: Chapter 3.1-3.3):

transport-layer services and principles, multiplexing and demultiplexing applications, UDP

[Lab 6]. Practice on CDN and DASH

Week 7. Transport layer 2 (textbook: Chapter 3.4-3.5):  
reliable of data transfer, TCP

[Lab 7]. Practice on TCP and UDP

Week 8. Transport layer 3 (textbook: Chapter 3.6-3.7):  
Flow control, congestion control

[Lab 8]. Practice on TCP sliding window

Week 9. Network layer-data plane 1 (textbook: Chapter 4.1-4.2)

[Lab 9]. Practise on python

Week 10. Network layer-data plane 2 (textbook: Chapter 4.3-4.4)  
Internet Protocol, generalized forwarding, SDN

[Lab 10]. Practise on raw socket

Week 11. Network layer-control plane 1 (textbook: Chapter 5.1-5.4)  
Link-State, Distance-Vector, OSPF, BGP

[Lab 11]. Practise on IP, ICMP and DHCP

Week 12. Network layer-control plane 2 (textbook: Chapter 5.5-5.7)  
SDN control plane, ICMP, SNMP

[Lab 12]. Practise on router MSR810

Week 13. Link layer, LANs 1

error detection, correction, network as a link layer: MPLS, multiple access protocols

[Lab 13]. Practise on switch S5110

Week 14. Link layer, LANs 2 (textbook: Chapter 6.4-6.7)

[Lab 14]. Practice the wireless LAN router

Week 15. Wireless and mobile network (textbook: Chapter 7.1-7.3)

[Lab 15]. Practice on packet tracer to create a network

Week 16. Summary & Review

[Lab 16]. Review, Q&A.

18. 教材及其它参考资料 Textbook and Supplementary Readings

Computer Networking: A Top-Down Approach James Kurose and Keith Ross, Pearson (6th Ed.)

课程评估 ASSESSMENT

19. 评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance				
课堂表现 Class Performance				
小测验 Quiz				
课程项目 Projects		30%		项目代码, 答辩 Project and presentation
平时作业 Assignments		10%		作业 assignments
期中考试 Mid-Term Test		30%		闭卷考试 Unseen exam
期末考试 Final Exam		30%		闭卷考试 Unseen exam
期末报告 Final Presentation				
其它 (可根据需要 改写以上评估方式) Others (The above may be modified as necessary)				

20. 记分方式 GRADING SYSTEM

A. 十三级等级制 Letter Grading  
 B. 二级记分制 (通过/不通过) Pass/Fail Grading

课程审批 REVIEW AND APPROVAL

21. 本课程设置已经过以下责任人/委员会审议通过  
 This Course has been approved by the following person or committee of authority