

CS3C03/SE4C03 Networks and Security

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February 14, 2015

1 Precondition

Students are expected to have basic knowledge in Operating Systems.

2 What the students should know and be able to do

1. Students should know and understand
 - (a) Nodal delay
 - (b) The 5 layer network stack
 - (c) Main example from each layer: HTTP, TCP, IP, Ethernet, fiber-optic
 - (d) Wireless and mobile networks
 - (e) Public key cryptography, hashing functions
 - (f) Basics of network security (Kerberos, etc.)
2. Students should be able to
 - (a) Use and understand Wireshark outputs
 - (b) Basic network management and troubleshooting
 - (c) Network security audit
 - (d) Utilize a public key ring
 - (e) Work with Apache, PHP, HTML

3 Mapping to Attributes with their Indicators

A01 Knowledge

Competence in specialized engineering knowledge 2a–2e

A02 Analysis

Ability to identify the essential characteristics of a technical problem, including scope 1b–2e

Ability to identify reasonable assumptions (including identification of uncertainties and imprecise information) that could or should be made before a solution path is proposed 1a,1e,1f,2b–2e

Ability to identify a range of suitable engineering fundamentals (including techniques) that would be potentially useful for analyzing a technical problem 1b,1e–??

Ability to decompose and organize a problem into manageable subproblems 1c,1e,2a

Ability to obtain substantiated conclusions as a result of a problem solution, including recognizing the limitations of the solution 1e,1f,2e

A03 Investigation

Uses appropriate techniques to collect data 1f,2b

Assess the accuracy and precision of results and recognize limitations of the approach 2e

A04 Design

Recognizes and follows an engineering design process 2a

Recognizes and follows engineering design principles 1b

Obtains experience with open-ended problems 1f,2c

Properly documents and communicates processes and outcomes 2c,2e

Table 1: Rubric: (4) Competence in Specialized Engineering Knowledge

Topic	Below	Marginal	Meets	Exceeds
Nodal Delay 1a Based on Q1 in final exam	cannot explain the meaning of nodal delay	can explain most parts	can explain all aspect of nodal delay	can perform analysis of nodal delay, including active queue management
The 5 layer network stack 1b Based on Q2 in final exam	cannot subdivide into 5 standard layers	can subdivide the layers but does understand interfaces	can subdivide into layers, understands sockets, ports, headers	can subdivide into layers, and do socket programming and other interface programming
TCP/IP 2a Based on Q3 & Q4 in final exam	Vague understanding of the protocols	Understands TCP & IP packet formats and basic functionality	Able to articulate a good understanding of flow, congestion, reliable data transfer and routing	Can implement the basic functionality of TCP/IP
Security 1e, 1f, 2c-2e Based on Programming assignment 2	Does not understand basic assumptions of security/cryptography	Some understanding of cryptography and security, but no technical ability	Able to implement basic cryptographic routines, and some understanding of Protocols	Able to analyze and implement security protocols such as WEP
WWW 1c, ??, 2e Based on Q6 in the final exam	Casual knowledge of WWW	Some knowledge of web browsers and HTTP	Understanding of issues such as pipelining, stateless aspects of HTTP; WWW as network overlay	Can design a rudimentary search engine

Table 2: Rubric: **What students should be able to do**
Student work used: 2 programming assignments (10% each); 2 wireshark labs (5% each)

Topic	Below	Marginal	Meets	Exceeds
Work with Nodal Delay 1a Based on First Wire-shark lab	cannot assess delay in retrieving large file with http	has a basic intuition	can assess delay in terms of bytes transferred	can perform analysis of delay, including basic stats
Work with the 5 layer network stack 1b Programming assignment 1 & 2	Not able to clearly delineate layer duties; program does not compile	Program compiles, but conceptually not clean	Program compiles, and layers implemented	Program compiles, sockets clearly defined, layers very clear
Implement communication with TCP/IP 2a Based on Programming assignments 1 % 2, and first wire-shark lab	Unable to work with basic protocol features	Some programming and scripting related to TCP & IP packet formats and basic functionality	A working program without robustness	A working program with robustness — i.e., works under diverse network conditions
Implement communication with security 1e, 1f, 2c-2e Based Programming assignment 2	Does not understand basic assumptions of security/cryptography	Implements basic cryptographic protocol	Working program with security in place	Program with public key exchange, and RC4 implementation for encrypting flow
Measuring performance 1e, 1f, 2c-2e Timing network performance; Wireshark lab 2	Cannot time delays	Some timing but without understanding of flow, congestion, nodal delays	Timing with good grasp of flow and congestion	Timing and conceptual understanding of tradeoff between efficiency and security