

King Fahd University of Petroleum & Minerals
College of Computer Sciences and Engineering
Computer Engineering Department

CSE 555 - Protocol Engineering (3-0-3)
Section 01 - SM: 6:30-7:45 PM, Room: 22-132
Spring 2004 (Term 032)

Syllabus

Course Objective:

Introduction to formal techniques in the design and verification of protocols.

Catalog Description:

Protocols and languages. Protocol structure. Structured protocol design. Fundamentals of Protocol Engineering. Specification and modeling. State Machines and Reachability Analysis. Formulation of desirable properties of protocols. Formal Logic and Deduction. Verification techniques. Formal description languages (SDL, ESTELLE, LOTOS). Protocol synthesis. Protocol Design. Validation and conformance testing. Computer aided design tools for protocol engineering (Simulation, test generation, and validation tools).

Prerequisite: (COE 540 and (ICS 252 or Equivalent)) or Consent of Instructor.

Instructor: Dr. Mohammed Houssaini Sqalli, Assistant Professor, COE

Office: 22-149 **Phone:** 1725 **Email:** sqalli@ccse.kfupm.edu.sa

Office hours: UMT 11:20AM-12:30PM, SM 8:00-8:30PM, and by appointment.

Course URL: <http://www.ccse.kfupm.edu.sa/~sqalli/032/cse555>

Textbook:

- “*Design and Validation of Computer Protocols*” by Gerard J. Holzmann, Prentice-Hall, 1991. (<http://spinroot.com/spin/Doc/Book91.html>)

Reference Books:

- “*Principles of Protocol Engineering and Conformance Testing*” by Behcet Sarikaya, Ellis Horwood, 1993.
- “*Communication Protocol Specification and Verification*” by Richard Lai and Ajin Jirachiefpattana, Kluwer Academic Publishers, 1998.
- “The Spin Model Checker: Primer and Reference Manual” by Gerard J. Holzmann, Addison-Wesley, September 2003.

Grading Policy:

Assignments/Quizzes	20%
Term project	25%
Midterm	20%
Final Exam	30%
Attendance and participation	5%

Exam dates

Monday, April 5, 2004, in class
Scheduled by the registrar

Attendance: attendance is required by all students. Official excuse for an authorized absence must be presented to the instructor no later than one week following the absence. More than 6 unexcused absences lead to a “DN” grade.

Course Topics:

- 1. Introduction to Protocol Engineering (Ch. 1) (2 Weeks)**
 - Motivation
 - Computer networks
 - Protocols as languages
 - Examples of some of the well-known protocols
 - Overview of structured protocol design and testing techniques

- 2. Protocol Structure (Ch. 2-4) (2 Weeks)**
 - Elements of a protocol
 - Service and environment
 - Vocabulary and format
 - Procedure rules
 - Structured protocol design
 - Error control techniques
 - Flow control techniques
 - Case study of protocol engineering

- 3. Validation Models (Ch. 5) (1 Week)**
 - Processes, channels, and variables
 - Communicating sequential processes (CSP)
 - Control flow
 - Modeling timeouts

- 4. Correctness Requirements (Ch. 6) (2 Week)**
 - Correctness criteria
 - Reasoning about behavior
 - Assertions and system invariants
 - Deadlocks and bad cycles
 - Temporal claims
 - Case studies

- 5. Protocol Design (Ch. 7) (2 Weeks)**
 - Service specification
 - Assumptions about the channel
 - Protocol vocabulary and message format
 - Procedure rules
 - Design of layers

- 6. Formal Description Techniques (FDTs) (Ch. 8) (2 Weeks)**
 - Informal and formal descriptions
 - Finite state machines (FSMs)
 - Execution of machines
 - Minimization of machines
 - Combining machines
 - Extended FSMs
 - Petri nets

- Description languages: ESTELLE; SDL; and LOTOS
- Case studies

7. Conformance Testing (Ch. 9) (1 Week)

- The conformance testing problem
- Functional and structural testing
- Deriving unique I/O sequences
- Transition tours

8. Protocol Synthesis and Validation (Ch. 10-11) (2 Week)

- Protocol derivation
- Incremental Design
- Place Synchronization
- Manual proof method
- Automated validation methods
- Detecting nonprogress and acceptance cycles
- Checking temporal claims

9. Term papers presentations (1 Week)