

Telematics I

Chapter 0 Preamble

- ❑ Who are we?
- ❑ The topic of „Telematics I“
- ❑ Research and teaching at „Fachgebiet Telematik/Rechnernetze“
- ❑ Formalities (resources, exams)

<http://www.tu-ilmenau.de/fakia/telematik1.html>



Who are we?

- ❑ Fachgebiet „Telematik/Rechnernetze“
 - ❑ Prof. Dr.-Ing. Günter Schäfer
g.schaefer@ieee.org oder guenter.schaefer@tu-ilmenau.de
 - ❑ M.Sc. Simon Buttgerit
 - ❑ Web page:
 - <http://www.tu-ilmenau.de/telematik>
- ❑ Teaching (Summer Term):
 - ❑ VL Advanced Networking Technologies
 - ❑ VL Programmierparadigmen
 - ❑ VL Schutz von Kommunikationsinfrastrukturen
 - ❑ VL Telematik 1
 - ❑ Projektseminar Simulation von Internet-Protokollfunktionen
 - ❑ Hauptseminar Telematik



- ❑ In general: architectures and protocols of communication systems
 - ❑ Structure, design, performance evaluation, implementation, ...
 - ❑ For all types of communication: computer networks, voice communication, data & multimedia content, technical communication (control devices)
 - ❑ Special focus on security issues

- ❑ More specifically:
 - ❑ Security requirements of communication services
 - Authenticity, integrity, confidentiality of peer entities and exchanged data
 - ❑ Security aspects of protocol mechanisms
 - What side “security relevant” side-effects are introduced by specific mechanisms?
 - ❑ How to protect communication infrastructures
 - Main issue: How to ensure availability of systems and offered services?



- ❑ Have you ever wondered what *really* happens when
 - ❑ Typing <http://www.tu-ilmenau.de> into a Web browser?
 - ❑ Making a phone call?
- ❑ How does data get from one device to another?
 - ❑ What happens “behind the scene” and “on the wire”?
- ❑ Communication systems enable this transport of data
 - ❑ What are the necessary ingredients for such systems? Typical components?
 - ❑ Are there any basic mechanisms to put such components together? To organize their working together?
 - ❑ How can we cope with size, complexity, failures, user demands, ... in such systems?



- ❑ This lecture is about basic architecture and protocol mechanisms
 - ❑ Attempts to give an overview of important components
 - ❑ For both data communication and voice / “telecommunication”
- ❑ It is not about specific technical solutions
- ❑ It is not about mobile and wireless communication
 - ❑ Covered in follow-up lectures
 - ❑ Requires “Telematics I” as pre-requisite
- ❑ It is not about distributed systems
 - ❑ Rather, builds the foundation for them to work
- ❑ It only gives a rough introduction to network security
 - ❑ There is also a specific lecture on this topic during the winter term



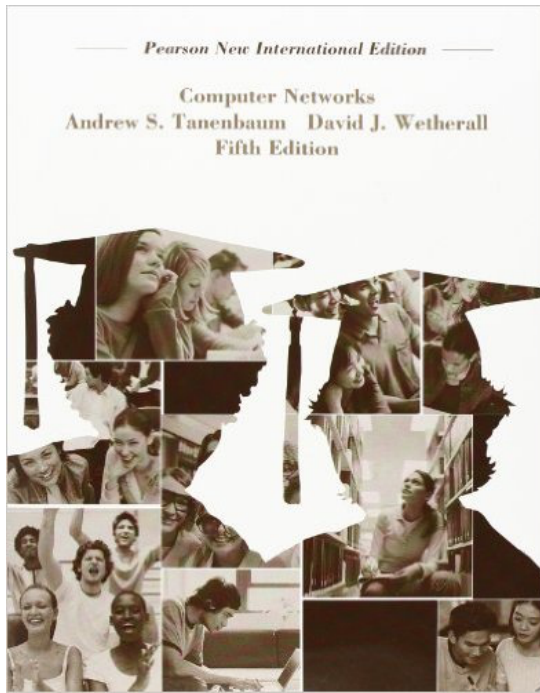
- ❑ Slides are/will be available on the web site
- ❑ There will be no script
 - ❑ Secondary literature is recommended
- ❑ To give due credit where credit is due:
 - ❑ Large parts of the course slides are taken from a set of slides prepared / compiled by Prof. Holger Karl from University of Paderborn
 - ❑ Some of the material on these slides (text, pictures, graphs, pictograms, etc.) is used from lectures given by Profs. Krüger, Juling, Zitterbart, Schiller, Carle at the Universities of Karlsruhe, Braunschweig, Kiel, FU Berlin
 - ❑ Other parts are based on material available via the Internet, company presentations, and similar sources
 - In particular, Tanenbaum’s, Peterson/Davie’s and Kurose/Ross’ books’ online material
 - ❑ Many thanks to everybody who contributed here and has graciously agreed to make their material available



□ Basic textbook:

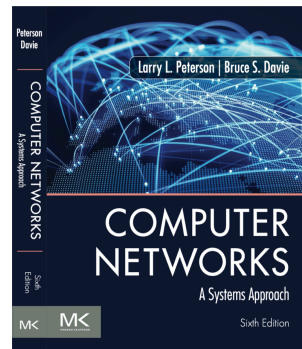
A. Tanenbaum, *Computer Networks*, 5th edition, Prentice-Hall

- Classic textbook, excellent tutorial style, if occasionally a bit lengthy
- Better do not use a translation
- Good command of English is necessary anyway
- <https://csc-knu.github.io/sys-prog/books/Andrew%20S.%20Tanenbaum%20-%20Computer%20Networks.pdf>



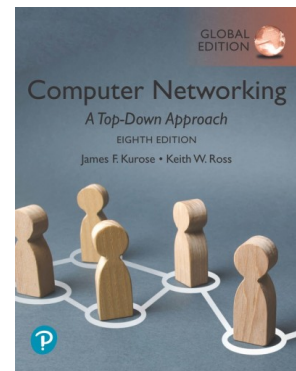
□ L. L. Peterson & B. S. Davie, *Computer Networks – A Systems Approach*, 2012, 6th edition, Elsevier

- Rather technical approach, quickly gets down to „how to build it“ questions
- Maybe a bit quick on the beginner, though
- <https://book.systemsapproach.org/index.html>



□ J. F. Kurose & K. W. Ross, *Computer Networking: A Top-Down Approach*, 2021, 8th edition, Pearson

- Motivates why communication systems are built in a certain fashion by starting out from the applications that they should support
- https://gaia.cs.umass.edu/kurose_ross/index.php



- ❑ There will be a written exam
 - ❑ Date, place, details to be announced
 - ❑ No additional material (books, slides, etc.) allowed during exam
 - ❑ You will have to register in advance for this exam

- ❑ Both lecture and exercise material are relevant for the exam



A Short Advertisement Before We Begin... :o)

- ❑ There is an additional course – entitled „Simulative Evaluation of Protocol Functions” (project seminar, 4 SWS) – which is designed to give you a “hands-on” experience with network protocol functions and simulation studies:
 - ❑ Introduces a simulation environment and lets you add protocol functionality
 - ❑ Studied protocol functions: forwarding, routing, (interface queues), connection setup, error-, flow- and congestion control
 - ❑ Requires good programming skills
 - ❑ Knowledge of C++ is an asset (but not a pre-requisite)
 - ❑ Allows you to obtain in-depth knowledge of topics covered in Telematics I and the techniques and art of simulation studies – because afterwards “you did it!” :o)

- ❑ For introduction and inscription email to:

michael-jan.stoyke@tu-ilmeneau.de



Example: Evaluation of TCP Congestion Control

The screenshot displays the OMNeT++ simulation environment for a network model. The main window shows a network topology with two routers, 'LeftRouter' and 'RightRouter', connected to multiple nodes (LeftNode[0-4] and RightNode[0-4]). A message 'eACK-1 (A=426) 1003' is shown being sent from LeftNode[0] to LeftRouter.

The event log on the left lists various events such as 'eACK-1 (A=428) 1003', 'eDATA 31 (A=1) 2004', and 'eACK-1 (A=430) 1003'. The console output shows detailed messages and events, including 'Message eBTR 30 (B=1) 2004, 3->1005,2 dropped in queue TransportNetwork,RightRouter,interfaceQueue[0]'.

On the right, the 'Graphs' window contains several plots:

- Chart 2:** A line graph showing 'congWindowVector' (blue line) and 'ssthreshVector' (red line) over time. The x-axis ranges from 29 to 30.5, and the y-axis ranges from 0 to 20. The congestion window fluctuates significantly, while the ssthresh remains relatively stable around 5.
- Transitions:** A state transition diagram showing 'transport' and 'PeerToPeerApp3' components.
- Histograms:** Two histograms showing the distribution of values for 'TransportNetwork.RightRouter.in' and 'TransportNetwork.RightNode[4]'. The first histogram has N=35557 and #cells=21. The second histogram has N=16205 and #cells=21.

