

# Response to query from Anders Sjögren on 2014.08.25 IK1550 and IK1552 Internetworking

Professor Gerald Q. Maguire Jr.

## From the KOPPS description for IK1550 and IK1552\*

### Lärandemål

This course will give both practical and general knowledge on the protocols that are the basis of the Internet. After this course you should have a good knowledge about Internet protocols and internetworking architecture. You should have a general knowledge aiding you in reading research and standardization documents in the area.

### Learning Outcomes

Following this course a student should be able to:

1. Understand the principles on which internetworking is based - which define the Internet (both what it is and why it has proven to be so successful)
2. Understand TCP/IP protocol stack, layering, encapsulation and multiplexing
3. Understand multiplexing, demultiplexing, upward and downward multiplexing
4. Encapsulation as used for Mobile IP, Virtual Private Networks (VPNs), IP security, ... and other tunnelling protocols
5. Understand how information is encoded in headers and how the choice of this encoding and field size may effect the use and evolution of a protocol
6. Understand how data is encoded in the body of a packet and how this may effect internetworking - especially in the presence of firewall and network address translators.
7. Understand IP Addressing, subnetting and address resolution - including the interaction of protocols across layers
8. Understand a number of higher layer protocols including the security risks and performance limitations of each
9. Understand the basic details of routing and routing protocols (RIP, BGP, OSPF) - with an emphasis on their limitations and behaviors
10. Understand autoconfiguration and naming (BOOTP, DHCP, DNS, DDNS, DNSsec, ENUM, ... ) - with an emphasis on risks, limitations, scaling, and evolution
11. Understand the nature and pressures on the design and operations of internets - particularly on scaling, performance, delay bounds, due to new Internet applications (VoIP, streaming, games, peer-to-peer, etc.
12. Understand the advantages and disadvantages of IPv6 (in comparison to IPv4)
13. Read the current literature at the level of conference papers in this area.

While you may not be able to understand all of the papers in journals, magazines, and conferences in this area - you should be able to read 90% or more of them and have good comprehension. In this area it is especially important that develop a habit of reading the journals, trade papers, etc. In addition, you should also be aware of both standardization activities, new products/services, and public policy in the area.

14. Demonstrate knowledge of this area in writing.

By writing a paper suitable for submission to a trade paper or national conference in the area.

---

\* Note that the numbers of the learning outcomes have been added here to facilitate the analysis later in the document.

## Kunskaps-och färdighetsprogression mot uppfyllnad av nationell examensordning

### Examsensmål #1

1.1.1 – very strong coupling in lectures and lecture notes to current literature in both research literature and standards, extensive references to relevant publications spanning range from popular literature to current research

1.1.5 – I try to emphasize in the lectures for the course that Wikipedia is not a primary source and that each student has to learn to evaluate the level of belief that they have in a source – this is also why we examine some of the fundamental source documents (the Internet RFCs) that define a specific protocol.

1.1.6 is implicit in their reading and collecting information for their paper

1.2.1 Is coupled to both the combined lectures and recitations and to the written report.

1.3.2 A change that could be made for the future is to add 1.3.2 by adding an explicit exercise in class (near the end of the term) where students would review other students' draft papers and we would have a discussion about these reviews and what can be done to improve the choice of references (towards more primary references), choice and application of analytical or experimental methods, and how to better communicate to the intended reader(s). This could also be connected to 10.1.6.

1.3.3 This is done via learning object (LO) #14 above

2.3.3 The lectures notes about growth grades and network value relate the number of users to network value – using several different models for how this valuation can be done and cites a research paper on a comparison of the traditional Metcalf's law to modern IP networks.

LO#2, 3, 4 – emphasize the fundamentals of multiplexing and how this is related to encoding (see LO# 5, 6, 7) and stochastic processes are used to emphasize why many important protocols avoid periodic timers – as this gives rise to complex fractal behavior.

2.3.4 LO#8,9,10, 11, and 12 examine the scaling, security, and performance of protocols in several areas – noting how the development of protocols occurs and how this evolution is related and limited to fundamental aspects of internetworking as described in LO#1..#7.

5.1.2 The combined lectures and recitations emphasize the use of Wireshark to capture traffic and how one can use the output to measure and examine the performance and behavior of protocols. Examples programs are given to illustrate how the student's can write their own traffic generators and major academic and industrial traffic generators are noted.

5.2.2 LO#9..12 are related to the models from LO#1, 2, 3, 5, and 6 to understand limitations in LO8 .. 12

5.3.2 Via LO#14

5.3.3 is addressed via LO#8..12 and the models noted in 5.2.2

6.1.1 LO#1,6, 11, and 12 examine the architectural principles of internetwork and their impact of economics and society.

8.3.2 via LO#13 and 14

10.1.6 I have attempted to address this by having students write additions to Swedish language version of Wikipedia articles concerning an individually selected page related to the topic of the course. This is not currently in the list of graded activities for the students, but I have used it as an informal input to "plus" the student's grade for their paper (i. e., when the student's paper is on the border between letter grades I use their effort with respect to the Wikipedia page to decide whether to round up or down [or more precisely to truncate or round up]). I have mixed experience with students doing such a contribution to the Swedish Wikipedia. In some cases there have been strong reactions by a Wikipedia "editor" removing all of the student's contributions and some student (especially non-native Swedish speakers) find this exercise quite difficult.

10.2.1 via LO#11 – as these are some of the places where Internets have their largest interaction surface with society.