



IK2560 Mobile Networks and Services, 7.5 credits

Mobila nätverk och tjänster

Course syllabus for IK2560 valid from Autumn 22.

Intended learning outcomes

After passing the course, the student shall be able to

- Explain basic functions in mobile networks and make performance calculations
- Discuss the effect of the availability of affordable mobile services and the internet of things (IoT) in a global society
- Explain the architecture of existing mobile and wireless networks and compare a network architecture with another
- Describe the most important transmission methods, the network protocols and the applications in the cellphone networks of the current generation
- Explain, in at sense, environment and sustainability challenges for the IKT sector, included electromagnetic radiation, energy consumption, limited natural resources, environment harmful effects, economic effects (both infrastructure and equipment) and economic and social societal effect
- Show their knowledge of mobile networks and services both orally and in writing
- Follow the current literature i.e. survey papers, conference contribution and periodical articles in the area.

Course main content

- Basics of transmission methods, signal encoding, overview of wireless communication.
- Architecture for wireless LAN, PAN and BAN.
- Architecture of the cellphone networks of the current generation.
- Mobile applications, the things internet (IoT), and device-to-device communication (D2D).
- Sustainable development and tele-economy.

Eligibility

IK1203 Networks and Communications, or equivalent course.

Literature

C. Beard and W. Stallings. Wireless Communication Networks and Systems. Pearson Education, 2016.
Selected papers.

Examination

PRO1 - Project, 3.5 credits, grading scale: A, B, C, D, E, FX, F

TEN1 - Exam, 4.0 credits, grading scale: P, F

Make up exams may be given as oral examinations

Course Information

Teaching Methods of the Course

The course consists of lectures, tutorials, seminars, and a group project. The lectures present an overview of the material in the course and the tutorials give more time for questions and problem-solving. Some lectures also involve active problem-solving in smaller groups. Certain parts of the course must be studied on your own. Two seminars are dedicated to discussing scientific papers describing important aspects and results, while two seminars are dedicated to discussing the project's progress. The project work is designed to integrate the knowledge and skills gained and to foster the ability to follow the literature on the subject, formulate a relevant scientific problem, acquire new results, and analyze them to find an answer to the selected problem.

The project should address a problem agreed upon with the teachers (often connected to a published technical paper), requires roughly 50 hours of work by each student, and is examined through a written report and an oral presentation. Each group comprises 4 students, but the grading is individual.

Requirements for the written report:

- The length of the final report should be a maximum of 20 pages (at most 10,000 words) for the group (the style should be that of a conference paper).
- The problem and solution should focus on the system and services of wireless networks; that is, the topic of the course. It is important to make a literature survey and gather data (e.g., through interviews, measurements, or computer simulations), but the report must also include an analysis of the results and conclusions that connect it to the problem formulation.
- The contributions of each group member must be clear, either by dividing the report into one section per group member or by elaborating on the role of each group member in an appendix. It is important to divide the work tasks so that all group members are involved in both the data collection and the analysis. After finishing the written report, each group member must also submit a self-reflection report that might provide further details.
- The report should clearly describe: (1) what you have done; (2) who did what. If you have done some implementation and measurements, you should describe the methods and tools used, along with the test or implementation results, and your analysis. In the appendix, you can also mention tasks that were carried out that are not described in the final report (e.g., methods that you tried but didn't lead to useful results).

Requirements for the seminars and final oral presentation:

- Active attendance is required in all seminars, as a presenter and by taking part in discussions.
- At the final oral presentation, each group should present their results for at most 20 minutes. Note that this is the upper limit on time, not a lower limit, thus an individual doing a project might plan on around 10-15 minutes. The time should be divided roughly equally between the group members so that everyone actively presents something. The presentation is followed by a discussion with the teachers and fellow students.

Grading Criteria

The course consists of two requirements: a digital exam of 4 credits and a project of 3.5 credits. If the exam is passed, then the grade for the whole course is determined by the grade on the project.

The project is graded according to the following criteria. For project grades A to E, you must meet the learning outcomes

- To get an “A” your project report needs to be excellent.
- To get a “B” your project report needs to be very good.
- To get a “C” your project report needs to be good.
- To get a “D” you need to meet the learning objectives but you have demonstrated weaknesses.
- If your project has some errors (including incomplete references or failures to include relevant considerations of ethics and sustainability) the grade will be an “E”.

Each group member is evaluated individually and must contribute to both data collection and analysis.

Exam

For the date and time, see: <http://www.kth.se/student/schema>

Teacher, Course Responsible, and Examiner

Emil Björnson	08-790 42 23	emilbjo@kth.se	Examiner, teacher
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Slimane Ben Slimane	08-790 93 53	slimane@kth.se	Teacher
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Marina Petrova	08-790 42 44	petrovam@kth.se	Teacher
Eren Berk Kama		ebkama@kth.se	Teaching assistant

Course Information on the Web

Current information URL: <https://www.kth.se/student/kurser/kurs/IK2560?l=en>

Detailed course information is available in Canvas.

Detailed Course Planning

The course consists of 11 lectures (L), 6 tutorials (T), and 4 seminars (S) of two hours each (except the first lecture which is three hours). Every teaching hour is 45 minutes. The teaching activities will be given in lecture halls and classrooms in Electrum unless anything else is announced during the course.

Activity	Description	Readings	Teacher
L1	Transmission fundamentals I	Beard C. and W. Stallings: Chapter 1, Sections 2.1-2.3, Appendix 2A + Offprint: Appendix B	Vitaly Petrov
L2	Transmission fundamentals II	Beard C. and W. Stallings: Chapter 2.3-2.5, Appendix 2A	Vitaly Petrov
T1	Transmission fundamentals I	Problems: 2.1, 2.2, 2.4, 2.5, 2.6, 2.7, 2.15, 2.16, 2.17, Offprint	Eren Berk Kama
L3	The wireless channel	Beard C. and W. Stallings: Chapter 6	Vitaly Petrov
T2	Transmission fundamentals II	Problems: 2.9, 2.10, 2.11, 2.12, 2.13, Offprint	Eren Berk Kama
T3	The wireless channel	Problems: 6.1, 6.3, 6.6, 6.7, 6.8, 6.9, 6.13, 6.14, Offprint	Eren Berk Kama
L4	Signal encoding techniques	Beard C. and W. Stallings: Chapter 7	Ben Slimane
L5	OFDM and spread Spectrum	Beard C. and W. Stallings: Chapter 8, 9	Ben Slimane
T4	Signal encoding techniques	Problems 7.5, 7.6, 7.8, 7.13, 7.16, 7.18, 7.19	Eren Berk Kama
L6	Coding and error control	Beard C. and W. Stallings: Chapter 10	Ben Slimane
T5	OFDM and spread spectrum	Problems 8.1, 8.3, 8.4, 8.5, 8.6, 9.1, 9.3, 9.4	Eren Berk Kama
L7	Wireless networks	Beard C. and W. Stallings: Chapter 11.1-3, 13.1	Ki Won Sung
T6	Coding and error control	Problems 10.2, 10.3, 10.6, 10.9, 10.11, 10.20, 10.21	Eren Berk Kama
L8	Infrastructure economics, Network dimensioning and deployment strategies	Beard C. and W. Stallings: Chapter 15 + papers	Jan Markendahl
L9	Cellular networks	Beard C. and W. Stallings: Chapter 14	Ki Won Sung
L10	Infrastructure economics, Network dimensioning and deployment strategies	Beard C. and W. Stallings: Chapter 15 + papers	Jan Markendahl
S1	Seminar 1	Selected papers on mobile ecosystem, network capacity, WiFi, LWPAN, backscattering, and energy efficiency	Multiple teachers
L11	Bluetooth and IEEE 802.15	Beard C. and W. Stallings: Chapter 12	Ki Won Sung
S3	Seminar 2	Papers on 5G cellular networks, machine learning for communications, and visionary papers towards 6G	Multiple teachers
	Mid-course Exam		
S2	Seminar 3	Project proposal	All teachers
S4	Seminar 4	Presentation on project progress	All teachers
	Project presentations		All teachers
	Final Exam		

Tutorials (T1,...,T6) and Seminars (S1,...,S4) will provide formative feedback, while the written examination, project report, and project presentation will involve summative feedback. The project report and project presentation are evaluated together for the project grade.