Programme syllabus

Master’s Programme, Network Services and Systems, 120 credits

Programme objectives

The field of communication has radically changed our lives and societies. We now take communication services that only have become widely available during the last ten years for granted: for instance, the Web and its search engines; Internet and mobile telephony or peer-to-peer file sharing and social networks. Such services affect our daily lives, they free us in the choice of how and where we work, relax, play and socialize.

The design of communication networks and services is therefore central for future developments of our societies. The Network Services and Systems master program provides the competence needed to work in this dynamic, challenging and highly interesting field

of engineering, addressing emerging networking paradigms for Internet of Things, cloud computing and cyberphysical systems. The programme covers the foundations of Internetworking, wireless networks, network security and management of large distributed systems. Students can then follow the Design and Technology track to gain in-depth knowledge of emerging network technologies, networked services, mathematical modeling or network security, or the Enterprise track, focusing on the design of industrial IT systems. The skill-set includes working with network hardware, analytic and simulation tools for evaluating the performance of the systems, as well as a sharpened proficiency in programming.

Knowledge and understanding

For the Master’s Degree, the student should be able to know and understand:

- The scientific fundamentals and practical applications of computer communication for both wired and wireless networks
- Protocol models and their realization, considering wireless networks and internet protocols, network security and network management
- Deep understanding in areas emerging networking technologies, network security, large distributed systems, IT system management
- Mathematical modeling, simulation methodology and systems experimentation for functional and performance evaluation
- Scientific methodology and its application on the field of the program.

Skills and abilities

For the Master’s Degree, the student should be able to:

- mathematically analyze network functions and protocols,
- specify, design and construct parts of communication systems and to implement them in software
- present technical systems and results from studies both orally and in writing, as well as to hold demonstrations of systems
• work independently and in group, to plan and lead work, critically evaluate the quality of own work and to be able to continuously improve it
• read and understand research results within the field and to apply the results.

Ability to make judgements and adopt a standpoint

For the Master’s Degree, the student should be able to:

• apply a scientific approach to his or her own technical work
• be conscious of the possibilities and limitations of technology, its role in society and how it is being used nationally and internationally
• be aware of ethical issues concerning research and development.

Extent and content of the programme

The program is at the second level and comprises two years of full time study, 120 higher education credits, corresponding to 120 ECTS credits. The program includes compulsory courses in the area of network systems and services, and two tracks, Design and Technology, and Enterprise, preparing for research and development or entrepreneurship in the area. The language of instruction throughout the program is English.

Eligibility and selection

Basic admission requirements Basic eligibility to be accepted to the master’s program requires a completed Bachelor's degree, corresponding to a Swedish Bachelor's degree (180 higher education credits), or equivalent academic qualifications from an internationally recognised university. Students should have in addition, good knowledge in English, both in oral and in written forms. Applicants must provide proof of their proficiency in English. For all program at KTH where English is the language of instruction, the specific eligibility requirement is English B/6 or equivalent.

Specific admission requirements Specific eligibility to the programme requires:

The previous Degree should include:

• at least 60 higher education credits of course work in electrical engineering, computer engineering or computer science
• basic courses in mathematics, including calculus, linear algebra and mathematical statistics
• courses passed with distinction in programming (preferably C or Java).

It is recommended that applicants have experience in solving problems using computational software, particularly MATLAB, and passed courses covering operating systems and signals and systems.

The specific eligibility requirements can be assessed as not-fulfilled if:

1. the average grade is less than 75% of the highest grade
2. the degree awarding institution is not considered to meet acceptable quality standards by the authorities of the country in which the institution is located
3. the degree does not qualify for admission to equivalent Master level in the country where the degree is awarded.

The selection process is based on the following selection criteria: University, previous studies (for instance GPA, grades in specific subjects and English), motivation for the studies (for instance letter of motivation, references, thesis proposal and relevant work experience). The evaluation scale is 1-75.
Implementation of the education

Structure of the education

The program extends over two academic years. Each academic year spans 40 weeks and it is divided into four seven-weeks long study periods. Each study period is concluded by an examination period of between two and five days. For each period there is an extra examination time for make-up exams ca. 8 weeks after the original exam.

Courses

The programme is course-based. Lists of courses are included in appendix 1.

The education in the program consists of a course block and a master’s thesis project for 120 ECTS. The courses are studied during the first six study periods and include 42.5 ECTS credits of obligatory courses, 22.5 ECTS credits of conditionally elective courses, depending on the chosen track. The courses selected from the tracks have to lead to deep knowledge in one of the selected areas of network systems, network services, network security, analytic modeling, or IT system management. Finally, courses can be freely selected from all KTH courses. The program is concluded by the thesis project that comprises 30 ECTS credits, a full semester of work.

Grading system

Courses in the first and the second cycle are graded on a scale from A to F. A-E are passing grades, A is the highest grade. The grades pass (P) and fail (F) are used for courses under certain circumstances.

Conditions for participation in the programme

Each student is responsible for registering for the term at the beginning of each term. This is done via the ”personal menu” on KTH’s website. There is a limited time window for doing this. Term registration indicates that the student is active and opens the system so that results may also be reported.

Signing up for courses is done via https://www.universityadmissions.se . The system there for choosing courses is open from 1-15 November and 1-15 May, unless other information is posted.

For promotion to study year two, the student must have received at least 45 higher education credits from the first year. In order to receive the degree, the student must fulfil the criteria for at least one of the specializations.

Recognition of previous academic studies

Under certain circumstances, and in agreement with the programme director, credits for previous studies can be received according to the local policy of KTH, see http://intra.kth.se/regelverk/utbildning-forskning/grundutbildning/prestationer/policy-for-tillgodoraknande-av-hogskoleutbildning-inklusive-bedomning-av-reell-kompetens-1.27200?l=en_UK

Studies abroad

Exchange studies for course work abroad is available according to the exchange programs implemented at KTH. The Degree project (Master’s Thesis project) can be performed abroad providing the student has an advisor at KTH and one at the receiving institution and that the work follows the KTH regulations for a Thesis project. Studies abroad require an agreement from the program director.

Degree project

The thesis project comprises 30 higher education credits of work. A major part of the course work, a minimum of 60 higher education credits, including the compulsory courses, must have been completed before the project may commence. The project must provide an in-depth study within the field of the courses studied in the programme, and the topic has to be accepted by the program director and the examiner before the start of the work.
The thesis is graded on a scale from A to F. A-E are passing grades, A is the highest grade. The evaluation criteria, which are common to all of KTH, are the technical and scientific contents, the work process and the presentation of the project. Reference: http://intra.kth.se/en/regelverk/utbildning-forskning/grundutbildning/examensarbete/overgripande-regler-och-riktlinjer-for-examensarbete-30-hogskolepoang-for-masterexamen-120-hogskolepoang-samt-betygssattning-av-examensarbete-1.27212

Degree

Students who have successfully completed a two-year Master's programme (120 ECTS) will be awarded a "Teknologie masterexamen", translated into English as "Degree of Master of Science (two years)". For the degree, the following is required:

- At least 90 higher education credits, including the obligatory courses and track courses according to the track requirements.
- Degree Project for 30 higher education credits.


Appendix 1 - Course list
Appendix 2 - Programme syllabus descriptions
Appendix 1: Course list

Master's Programme, Network Services and Systems, 120 credits (TNSSM), Programme syllabus for studies starting in autumn 2015

General courses

Year 1

Mandatory courses (33.0 credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>AK2036</td>
<td>Theory and Methodology of Science with Applications (Natural and Technological Science)</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2120</td>
<td>Internetworking</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2220</td>
<td>The Sustainable Networked Systems Engineer</td>
<td>3.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2500</td>
<td>Networked Systems Security</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2950</td>
<td>Wireless Networks</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

Conditionally elective courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD2385</td>
<td>Software Engineering</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EH2770</td>
<td>IT Management with Enterprise Architecture I</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2200</td>
<td>Queuing Theory and Teletraffic Systems</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2520</td>
<td>Building Networked Systems Security</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EQ2870</td>
<td>Machine to machine communication</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>IK2213</td>
<td>Network Services and Internet-based Applications</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>
Recommended courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD2310</td>
<td>Java Programming for Python Programmers</td>
<td>1.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>DD2448</td>
<td>Foundations of Cryptography</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2800</td>
<td>Individual Project in Networked Systems</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EQ2330</td>
<td>Image and Video Processing</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>MJ2670</td>
<td>Risk Management</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

Supplementary information

Course list: Information is based upon the curriculum for academic year 2014/2015. Changes may occur.

Degree Requirements for the two year program:

Select one track and at least 22.5 ECTS conditionally elective courses within the track.

Complement up to 120cr with elective courses.

All conditionally elective courses are also recommended electives.

Year 2

Mandatory courses (40.5 credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>EP2220</td>
<td>The Sustainable Networked Systems Engineer</td>
<td>3.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2300</td>
<td>Management of Networks and Networked Systems</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP242X</td>
<td>Degree Project in Communication Networks, Second Cycle</td>
<td>30.0</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

Conditionally elective courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>EH2781</td>
<td>IT Management with Enterprise Architecture II, Case Studies</td>
<td>15.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EL2745</td>
<td>Principles of Wireless Sensor Networks</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2400</td>
<td>Network Algorithms</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2510</td>
<td>Advanced Networked Systems Security</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>
## Recommended courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>EH2030</td>
<td>Business Development and Quality Management</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EH2720</td>
<td>Management of Projects</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2520</td>
<td>Building Networked Systems Security</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EP2800</td>
<td>Individual Project in Networked Systems</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EQ2460</td>
<td>Seminars in Wireless Systems</td>
<td>3.0</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

## Supplementary information

Course list: Information is based upon the curriculum for academic year 2014/2015. Changes may occur.

Degree requirements

- 40.5 hp compulsory course
- 22.5-30 hp conditionally elective course
- 22.5-30 hp elective course
- 30 hp master thesis

### Year 3
Appendix 2: Specialisations

Master's Programme, Network Services and Systems, 120 credits (TNSSM), Programme syllabus for studies starting in autumn 2015

This programme has no specialisations.