



TEKNILLINEN KORKEAKOULU
TEKNISKA HÖGSKOLAN
HELSINKI UNIVERSITY OF TECHNOLOGY

Xiaolei Xie

identity number: 090183-171J

has been awarded by Helsinki University of Technology the degree

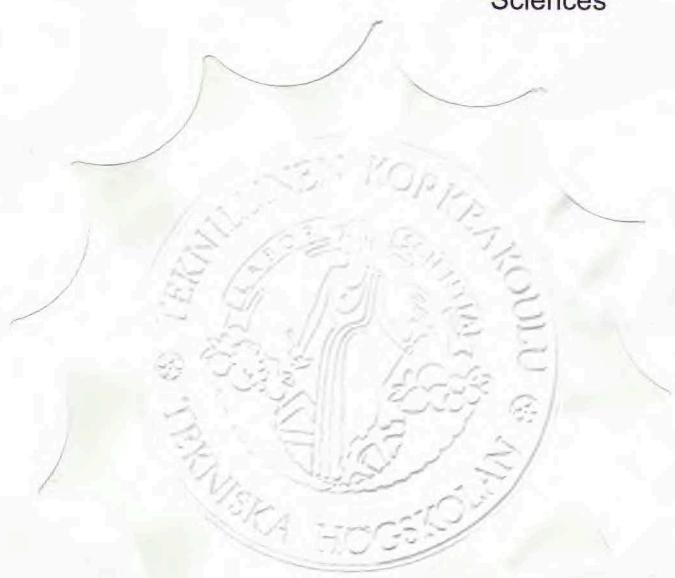
MASTER OF SCIENCE (TECHNOLOGY)

in accordance with the Degree Programme in Computer Science and Engineering

9 June 2008

Rector

Dean
Faculty of Information and Natural
Sciences





Xiaolei Xie

identity number: 090183-171J
student number: 66038R

has been awarded the degree

MASTER OF SCIENCE (TECHNOLOGY)

in the Degree Programme in Computer Science and Engineering

Major Subject grade very good

Mobile Computing - Services and Security

Master's Thesis grade excellent

An Authentication and Key Agreement Protocol for the UMTS Network

Master's Thesis Supervisor: Professor Sasu Tarkoma

The graduate has completed the Master's Programme in Mobile Computing - Services and Security included in the Degree Programme in Computer Science and Engineering.

This diploma includes two attachments: the transcript of completed courses lists the studies completed for the degree, and the Diploma Supplement for international use contains information on the university as well as on the studies completed for the degree certificate, their level and status in the education system.



Name: Xiaolei Xie
 Identity number: 090183-171J
 Student number: 66038R

Degree regulations: Degree Regulations for 2005
 Degree: Master of Science (Technology)
 Programme: Degree Programme in Computer Science and Engineering
 Unit: Master's Programme in Mobile Computing - Services and Security
 Major subject: Mobile Computing - Services and Security (T3010)

Accepted as an undergraduate student: 15.5.2006
 Accepted as a postgraduate student: -
 Terms present (autumn or spring): 6

This transcript of completed courses is a part of the degree certificate issued 9.6.2008 for the above mentioned degree.

COURSES COMPLETED

Code	Course	Credits	Gr	Date	Teacher
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Studies in Major

Mobile Computing - Services and Security

Advanced Studies in Network Services and Applications

T-109.4300	Network Services Business Models	3,0 cr	3	11.6.2007	Sakari Luukkainen
T-110.5100	Laboratory Works in Datacommunications Software	4,0 cr	hyv	9.1.2006	Seppo Äyräväinen
T-110.5116	Computer Networks II - Advanced Features P	4,0 cr	5	11.1.2008	Sasu Tarkoma
T-110.5120	Next Generation Wireless Networks P	4,0 cr	4	14.12.2005	Timo Kiravuo
T-110.6100	Special Assignment in Datacommunications Software P	5,0 cr	5	31.12.2006	Jukka Manner
	Autumn 2006				

Total credits: 20,0 cr

Average grade: 4,37

Grade: Very good

Advanced Studies in Technical Information Security

T-110.4206	Information Security Technology	3,0 cr	3	1.1.2006	Timo Kiravuo
T-110.5190	Seminar on Internetworking P	4,0 cr	3	30.5.2006	Antti Ylä-Jääskilä
	Mobile Communities				
T-110.5210	Cryptosystems	4,0 cr	5	11.1.2008	Sami Vaarala
T-110.6210	Individual Studies in Information Security P	5,0 cr	4	4.1.2006	Teemupekka Virtanen
	Achieve higher security with risk management				
T-79.5303	Safety critical systems	4,0 cr	5	11.5.2007	Ilkka Herttua, Teemu Tynjälä

Total credits: 20,0 cr

Average grade: 4,05

Grade: Very good

Total credits: 40,0 cr

Average grade: 4,19

Grade: Very good



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Identity number: 090183-171J
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Code	Course	Credits	Gr	Date	Teacher
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Basic Studies in Computer Science

Kie-98.7011	Finnish 1A	2,0 cr	3	20.10.2005	Seija Koski
Kie-98.7012	Finnish 1B	2,0 cr	2	9.12.2005	Seija Koski
T-106.5300	Embedded Systems	5,0 cr	3	22.5.2008	Heikki Saikonen
T-76.3601	Introduction to Software Engineering	5,0 cr	3	17.5.2006	Casper Lassenius
T-76.4115	Software Development Project I	6,0 cr	5	22.3.2007	Jari Vanhanen
Total credits:		20,0 cr			
Average grade:			3,50		
Grade:			Very good		

Methodological Principles (TIK)

T-61.5010	Information visualization P	5,0 cr	3	16.3.2007	Kai Puolamäki
T-79.5103	Computational complexity theory P	5,0 cr	4	16.1.2006	Tomi Janhunen
Total credits:		10,0 cr			
Average grade:			3,50		
Grade:			Very good		

Elective Studies (TIK)

Harj-0.1002	Training (higher university degree)	2,0 cr	hyv	19.3.2007	Antti Ylä-Jääski
Harj-0.1002	Training (higher university degree)	4,0 cr	hyv	11.10.2006	Antti Ylä-Jääski
Kie-98.1100	English Placement Test	3,0 cr	hyv	26.9.2005	Diane Pilkinton-Pihko
T-106.1003	Computer as a Tool	2,0 cr	5	12.10.2005	Aura Paloheimo
T-106.430	Operating Systems	3,0 ocr	4	31.8.2006	Vesa Hirvisalo
T-76.1143	Database Management	5,0 cr	3	16.5.2006	Juha Puustjärvi
Total credits:		20,5 cr			
Average grade:			3,73		
Grade:			Very good		

Master's Thesis (TIK)

T-110.D	Master's Thesis An Authentication and Key Agreement Protocol for the UMTS Network	30,0 cr	5	9.6.2008	Sasu Tarkoma
T-110.K	Maturity Test	0,0 cr	hyv	15.4.2008	Antti Ylä-Jääski
Total credits:		30,0 cr			
Average grade:			5,00		
Grade:			Excellent		

THE TOTAL SCOPE OF THE DEGREE

Total credits:	120,5 cr	
Average grade:		4,17

Name: Xiaolei Xie
Identity number: 090183-171J
Student number: 66038R

The scopes of studies are measured in old credits (ocr) or in credits (cr). One old credit indicates an input of approximately 40 hours of work of a student. In credit system the average number of hours demanded by one academic year of studies, 1600 hours, is equivalent to 60 credits.

Grading: pass (hyv), excellent (5), very good (4), good (3), very satisfactory (2) and satisfactory (1). The examination of an official language: good (ht) and satisfactory (tt). The grades for the study entities and the thesis in the pre-doctoral and doctoral degrees are pass (hyv) and pass with distinction (kh).

Average grades are calculated by weighting the course grades according to their credits which are graded: excellent (5), very good (4), good (3), very satisfactory (2) and satisfactory (1). If a course is assessed as pass, it is not included in the average. Decimals are truncated without rounding up.

Espoo, 10 June 2008

Karoliina Kekko

Karoliina Kekko



Helsinki University of Technology
IL / Karoliina Kekko
Otakaari 1, P.O.Box 1000, FI-02015 TKK, Finland
+358 9 4511
<http://www.tkk.fi/>

The degree has been completed according to the Government Decree on University Degrees (794/2004) given out on 19 August 2004, and the Helsinki University of Technology Degree Regulations approved on 13 December 2004.

The minimum scope of the degree is 120 credits and, on average, it takes two years of full-time study to complete the degree.

The modules are graded excellent, very good, good, very satisfactory and satisfactory or pass.

This degree certificate has been issued in two original copies, one in English and the other in Finnish.



DIPLOMA SUPPLEMENT

This Diploma Supplement follows the model developed by the European Commission, Council of Europe and UNESCO/CEPES. The purpose of this supplement is to provide sufficient independent data to improve the international 'transparency' and fair academic and professional recognition of qualifications (diplomas, degrees, certificates, etc.). It is designed to provide a description of the nature, level, context, content and status of the studies that were pursued and successfully completed by the individual named on the original qualification to which this supplement is appended. It should be free of any value-judgements, equivalence statements or suggestions about recognition. Information should be provided in all eight sections. Where information is not provided, a reason should be given.

1 INFORMATION IDENTIFYING THE HOLDER OF THE QUALIFICATION

1.1 Family name(s):	Xie
1.2 Given name(s):	Xiaolei
1.3 Date of birth (day/month/year):	09/01/1983
1.4 Student identification number or code:	66038R

2 INFORMATION IDENTIFYING THE QUALIFICATION

2.1 Name of qualification and title conferred (in original language):	Diplomi-insinööri [Master of Science (Technology)]
2.2 Main field(s) of study for the qualification:	Degree Programme in Computer Science and Engineering
2.3 Name and status of awarding institution (in original language):	Teknillinen korkeakoulu (Helsinki University of Technology), state recognised university, Decree on Higher Education Degree Structure 464/1998 (including amendments)
2.4 Name and status of institution (if different from 2.3) administering studies:	Not applicable
2.5 Language(s) of instruction/examination:	English

3 INFORMATION ON THE LEVEL OF THE QUALIFICATION

3.1 Level of qualification:	See 8. Second-cycle university degree, Master's level
3.2 Official length of programme:	The degree consists of at least 120 credits, two years of full-time study (in addition to a first-cycle degree of at least three years).
3.3 Access requirements:	See 8. The admission requirement for the second-cycle university degree (Master of Science) is a relevant first-cycle degree. There is numerus clausus, i.e. restricted entry, to all fields of study.

4 INFORMATION ON THE CONTENTS AND RESULTS GAINED

4.1 Mode of study:	Full-time
4.2 Programme requirements:	See 8. According to the Degree Regulations dated 13 December 2004, studies leading to a Master of Science degree shall include studies of methodological principles (10 cr), major and minor studies (60 cr), elective studies (at least 20 cr) as well as a Master's thesis (30 cr).
4.3 Programme details:	See transcript of academic records.
4.4 Grading scheme and, if available, grade distribution guidance:	See transcript of academic records. Grade distribution guidance: not applicable
4.5 Overall classification of the qualification:	-

5 INFORMATION ON THE FUNCTION OF THE QUALIFICATION

5.1 Access to further study:	Eligible for doctoral studies
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5.2 Professional status:

The degree of diplomi-insinööri is generally accepted as a requirement for a professional career.

Under the Finnish legislation, a person who has taken the degree of diplomi-insinööri [Master of Science (Technology)] is qualified for posts or positions in the public sector for which the qualification requirement is a second-cycle university degree. In some cases, the qualification requirement also includes the completion of major or minor studies in certain specified fields of study.

The degree falls under the Directive 2005/36/EC of the European Parliament and of the Council on the recognition of professional qualifications.

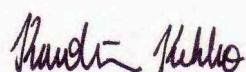
6 ADDITIONAL INFORMATION**6.1 Additional information:****6.2 Further information sources:**

Teknillinen korkeakoulu
Helsinki University of Technology
PL 1000
FI-02015 TKK
Finland
<http://www.tkk.fi/>
<http://www.minedu.fi/>, Ministry of Education
<http://www.oph.fi/info/recognition/>, The Finnish National Board of Education

7 CERTIFICATION OF THE SUPPLEMENT

7.1 Date: 09/06/2008

7.2 Signature:



Karoliina Kekko
Registrar

7.3 Capacity:

7.4 Official stamp or seal:

**8 INFORMATION ON THE NATIONAL HIGHER EDUCATION SYSTEM**

See the enclosed attachment.

DIPLOMA SUPPLEMENT

8

INFORMATION ON THE NATIONAL HIGHER EDUCATION SYSTEM

The Finnish education system consists of basic education, general and vocational upper secondary education, higher education and adult education. The basic education consists of a 9-year compulsory school for all children from 7 to 16 years of age.

Post-compulsory education is given by general upper secondary schools and vocational institutions. The general upper secondary school provides a 3-year general education curriculum, at the end of which the pupil takes the national Matriculation examination (ylioppilastutkinto/studentexamen). Vocational institutions provide 3-year programmes, which lead to upper secondary vocational qualifications (ammatillinen perustutkinto/yrkesinriktad grundexamen).

General eligibility for higher education is given by the Matriculation examination and the upper secondary vocational qualification. These qualifications require at least 12 years of schooling. Equivalent foreign qualifications also give general eligibility for higher education.

The Finnish higher education system comprises 20 universities (yliopisto/universitet) and 29 polytechnics (ammattikorkeakoulu, AMK/yrkeshögskola, YH). Ten of the universities are multi-faculty universities and ten are specialised institutions. All universities engage in both education and research and have the right to award doctorates. The polytechnics are multi-field institutions of professional higher education. Polytechnics engage in applied research and development. The polytechnics use the terms polytechnic or university of applied sciences when referring to themselves. This higher education system description uses the term polytechnic.

Higher education studies are measured in credits (opintopiste/studiepoäng). Study courses are quantified according to the work load required. One year of studies is equivalent to 1600 hours of student work on the average and is defined as 60 credits. The credit system complies with the European Credit Transfer and Accumulation System (ECTS).

8.1. University degrees

The Government Decree on University Degrees (794/2004) defines the objectives, extent and overall structure of degrees. The universities decide on the detailed contents and structure of the degrees they award. They also decide on their curricula and forms of instruction.

8.1.1. First-cycle university degree

The first-cycle university degree consists of at least 180 credits (3 years of full-time study). The degree is called kandidaatti/kandidat in all fields of study except Law (oikeusnotraari/rättsnotarie) and Pharmacy (farmaseutti/farmaceut). The determined English translation for all these degrees is Bachelor's degree, the most common degrees being the Bachelor of Arts or Bachelor of Science.

Studies leading to the degree provide the student with: (1) knowledge of the fundamentals of the major and minor subjects or corresponding study entities or studies included in the degree programme and the prerequisites for following developments in the field; (2) knowledge and skills needed for scientific thinking and the use of scientific methods or knowledge and skills needed for artistic work; (3) knowledge and skills needed for studies leading to a higher university degree and for continuous learning; (4) a capacity for applying the acquired knowledge and skills to work; and (5) adequate language and communication skills.

Studies leading to the degree may include: basic and intermediate studies; language and communication studies; interdisciplinary programmes; other studies and work practice for professional development. The degree includes a Bachelor's thesis (6 – 10 credits).

8.1.2. The second-cycle university degree

The second-cycle university degree consists of at least 120 credits (2 years of full-time study). The extent of studies required for a programme leading to the second cycle university degree which is geared towards foreign students is a minimum of 90 credits. The degree is usually called maisteri/magister. Other second-cycle degree titles are diplomi-insinööri/diplomingenjör (Technology), proviisori/provisor (Pharmacy) and arkkitehti/arkitekt (Architecture). The determined English translation for all these degrees is Master's degree, the most common degrees being the Master of Arts or Master of Science. The second-cycle university degree title in the fields of Medicine, Veterinary Medicine and

DIPLOMA SUPPLEMENT

Dentistry is lisensiaatti/licentiat, the English title being Licentiate. The admission requirement for the second-cycle university degree is a first-cycle degree.

In the fields of Medicine and Dentistry the university may arrange the education leading to the second-cycle university degree without including a first-cycle university degree in the education. In Medicine the degree consists of 360 credits (6 years of full-time study) and in Dentistry the degree consists of 300 credits (5 years of full-time study).

Studies leading to the second-cycle university degree provide the student with: (1) good overall knowledge of the major subject or a corresponding entity and conversance with the fundamentals of the minor subject or good knowledge of the advanced studies included in the degree programme; (2) knowledge and skills needed to apply scientific knowledge and scientific methods or knowledge and skills needed for independent and demanding artistic work; (3) knowledge and skills needed for independently operating as an expert and developer of the field; (4) knowledge and skills needed for scientific or artistic postgraduate education; and (5) good language and communication skills.

The studies leading to the second-cycle university degree may include: basic and intermediate studies and advanced studies; language and communication studies; interdisciplinary study programmes; other studies; and internship improving expertise. The degree includes a Master's thesis (20 – 40 credits).

8.2. Doctoral degrees

Students can apply for doctoral studies after the completion of a relevant second-cycle degree. The aim of doctoral studies is to provide student with an in-depth knowledge of their field of research and capabilities to produce novel scientific knowledge independently.

A pre-doctoral degree of lisensiaatti/licentiat (Licentiate) may be taken before the Doctor's degree and in general it takes 2 years of full-time study to complete.

The Doctor's degree takes approximately 4 years to complete after the second-cycle degree or 2 further years following the pre-doctoral degree. A student who has been admitted to complete the Doctor's degree must complete a given amount of studies, show independent and critical thinking in the field of research and write a Doctor's dissertation and defend it in public.

8.3. Polytechnic degrees

The government decree on polytechnics (352/2003 including amendments) defines the objectives, extent and overall structure of polytechnic degrees. The Ministry of Education confirms the degree programmes of polytechnics, and within the framework of these regulations, the polytechnics decide on the content and structure of their degrees in more detail. The polytechnics also decide on their annual curricula and forms of instruction.

8.3.1. First-cycle polytechnic degrees

The first-cycle polytechnic degree consists of 180, 210 or 240 credits (3 to 4 years of full-time study) depending on the study field. For specific reasons, the Ministry of Education may confirm the scope of the degree to exceed 240 credits. The first-cycle polytechnic degree is called ammattikorkeakoulututkinto/yrkeshögskolexamen. The determined English translation for the degree is Bachelor's degree. The degree titles indicate the field of study, e.g. Bachelor of Engineering or Bachelor of Health Care.

Studies leading to the degree provide the student with (1) broad overall knowledge and skills with relevant theoretical background for working as expert of the field; (2) knowledge and skills needed for following and advancing developments in the field; (3) knowledge and skills needed for continuous learning; (4) adequate language and communication skills; and (5) knowledge and skills required in the field internationally.

The first-cycle polytechnic degree comprises basic and professional studies, elective studies, a practical training period and a Bachelor's thesis or a final project.

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8.3.2. The second-cycle polytechnic degrees

The second-cycle polytechnic degree consists of 60 or 90 credits (1 or 1.5 years of full-time study). The degree is called ylempi ammattikorkeakoulututkinto/högre yrkeshögskolexamen. The determined English translation for the second-cycle polytechnic degree is Master's degree. The degree titles indicate the field of study, e.g. Master of Culture and Art or Master of Business Administration. Eligibility for second-cycle polytechnic degrees is given by a relevant first-cycle degree with at least 3 years of relevant work or artistic experience.

Studies leading to the degree provide the student with (1) broad and advanced knowledge and skills for developing the professional field as well as the theoretical skills for working in demanding expert and leadership positions in the field; (2) profound understanding of the field, its relation to work life and society at large as well as the knowledge and skills needed for following and analysing both theoretical and professional developments in the field; (3) capacity for life-long learning and continuous development of one's own expertise (4) good language and communication skills required in work life; and (5) knowledge and skills needed to function and communicate in the field internationally.

The second-cycle polytechnic degree comprises advanced professional studies, elective studies and a final thesis or a final project.

HELSINKI UNIVERSITY OF TECHNOLOGY (TEKNILLINEN KORKEAKOULU)

TKK Degree Regulations dated 13 December 2004

1. Type of establishment

The mission of Helsinki University of Technology is to promote free research, to provide higher education based on research in technology and architecture, to promote scientific and artistic education also otherwise, and to educate students to serve their country and humanity.

Helsinki University of Technology awards the following degrees in technology and architecture.

First-cycle university degrees:	Bachelor of Science in Technology [B.Sc. (Tech.)] Bachelor of Science in Architecture [B.Sc. (Archit.)]
Second-cycle university degrees:	Master of Science in Technology [M.Sc. (Tech.)] Master of Science in Architecture [M.Sc. (Archit.)] Master of Science in Landscape Architecture [M.Sc. (Landscape Archit.)]
Pre-doctoral degrees:	Licentiate of Science in Technology [Lic.Sc. (Tech.)] Licentiate of Science in Architecture [Lic.Sc. (Archit.)]
Doctoral degrees:	Doctor of Science in Technology [D.Sc.(Tech.)] Doctor of Science in Architecture [D.Sc.(Archit.)] Doctor of Philosophy [Ph.D]

The main language of instruction at Helsinki University of Technology is Finnish. Some programmes are also offered in English or in Swedish.

2. Grading scheme

The grades used are excellent (5), very good (4), good (3), very satisfactory (2) and satisfactory (1). The courses can also be assessed: pass/fail. The grades used for the Bachelor's thesis are 'pass' and 'pass with distinction'.

The Bachelor's degree is given the overall grade 'with honours' (erinomaisesti) if the weighted average grade is at least 4 and the grade of the Bachelor's thesis is pass with distinction. The Master's degree is given the overall grade 'with distinction' (oivallisesti) if the weighted average grade and the grade of the Master's thesis are at least 4. Average grades are calculated by weighting the course grades according to their credits. If a course is assessed as pass, it is not included in the average. According to the statistics of 2001-2005, about 11 % of the Master of Science degree graduates received the overall grade 'with distinction'.

The grades for the study entities and the thesis in the pre-doctoral and doctoral degrees are 'pass' and 'pass with distinction'.

3. Credits

Higher education studies are measured in credits (cr, opintopiste/studiepoäng). One year of studies is equivalent to 1600 hours of student work on the average and is defined as 60 credits.

N.B. In connection with the reform of the Finnish university degrees which took effect in autumn 2005, Helsinki University of Technology adopted the European credit system. ECTS credits (cr, opintopiste/studiepoäng) have replaced the previous credits (ocr, opintoviikko/studievecka).

In order to compare the credits:

- one credit (cr, opintopiste) = one ECTS credit
- one previous credit (ocr, opintoviikko) = 1,5 credits (cr, opintopiste) = 1,5 ECTS credits