

The Ph.D. Degree in Telecommunications and Networking

Graduate Telecommunications and Networking Program

University of Pittsburgh

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1. Purpose of the Degree

The Doctor of Philosophy (Ph.D.) degree in Telecommunications and Networking prepares students for independently engaging in advanced work in high-quality research and teaching. It provides research oriented graduate study and professional specialization in telecommunications and emphasizes both scholarly and applied research. To earn a Ph.D. degree, a student must demonstrate breadth of knowledge, give evidence of superior scholarship and mastery of a specialized field, and must demonstrate his/her ability to do significant and relevant research. In addition, the student must conceive, write and defend a Ph.D. dissertation representing a significant and original contribution to current academic research as demonstrated by a public dissertation defense and publication in established peer-reviewed academic conferences and/or journals. The major milestones en route to the Ph.D. degree are the preliminary examination, the comprehensive examination, the dissertation proposal, and the dissertation defense.

2. Overview of the Degree Requirements

A student pursuing a Ph.D. degree is first admitted to graduate study in Telecommunications and Networking. A minimum of 48 credits beyond a Masters degree are required. Exceptional students with a technical Bachelor's degree may be admitted on occasion and in such cases, a minimum of 72 credits beyond the baccalaureate degree is required. Included in these credits are graduate and seminar credits *beyond* the master's degree or its equivalent and at least 18 dissertation credits. *While these are minimum credit requirements, a Ph.D. student may be required to take more credits of coursework to satisfy the breadth and depth required to successfully complete their dissertation.* During the first or second term of study and in preparation for the preliminary examination, all Telecommunications and Networking Ph.D. students must attend a Ph.D. orientation session (a two-hour review of the requirements for the Ph.D. degree).

Every student must complete the preliminary examination within four semesters of his/her admission into the program unless an exception has been granted (e.g., part time status). The preliminary examination consists of two parts:

1) Completion of Five Core Courses with Minimum Grades: The five core courses are: TELECOM 2321: Wide Area Networks; TELCOM 2710: Foundations of Wireless Communications; TELECOM 2030: Mathematical Foundations for Telecommunications; TELCOM 2130: Queuing Theory; and IE 2001: Operations Research. The student can have at most one B+ in the five core courses. All other grades must be A- or higher. The average grade for the five courses must be at least A-.

2) An oral examination of the students' ability to solve an open-ended problem: This exam could have different types of questions like case study evaluations, problems with no single "right" answer, or a short published paper to be read and critiqued in an oral presentation of 20 minutes to the Telecommunications and Networking Program Committee (TNPC).

A student who successfully passes the preliminary examination is admitted to the Doctoral Program in Telecommunications and Networking. The student must now prepare for the comprehensive examination. Prior to the comprehensive examination a student must complete most of the course and seminar requirements. This includes the 6 credits of minor courses and 9 credits in doctoral level seminars in relevant topics. After completing most¹ of these requirements the student is eligible to apply to take the comprehensive examination.

For the comprehensive examination the student is required to write a "state-of-the-art" tutorial paper that provides a comprehensive literature survey, a critique and explanation of the topic considered in the paper. This paper must be submitted to the TNPC two weeks prior to the scheduled oral examination date. The oral part of the exam is directed primarily at the contents of the "State-of-the-art" paper, but questions in a larger context about the various relationships among the principal components of telecommunications may also be asked. In most cases the paper also provides the background from which the student's dissertation research begins. Students are encouraged to perform additional work on the "state-of-the-art" paper and submit it to a peer reviewed publication. In some cases, a student may wish to enlarge the "state-of-the-art" paper and submit it as a dissertation proposal. The comprehensive examination is a one-hour oral examination. Its primary function is to assess the student's ability to:

¹ "Most" here refers to the completion of every requirement. Occasionally, a student can apply to take the comprehensive exam if a minority of the course/seminar requirements is yet to be fulfilled with approval from their advisor.

(1) Synthesize the theory, the research, and the important contributions which have shaped the field;

(2) Apply research methodologies to telecommunications topics;

(3) Show the inter-relationships among the structural components of the field and how research advances our understanding of these relationships.

After successfully completing the comprehensive examination, the student works with a faculty advisor to prepare a dissertation proposal and form a dissertation committee. The dissertation committee, selected by the student and dissertation advisor, and approved by the Program Chair and Dean, shall consist of at least five members, including the dissertation advisor, with the majority being from the Telecommunications and Networking Program graduate faculty. One of the members must hold a primary faculty appointment outside the School of Information Sciences. Upon the recommendation of the dissertation advisor, a member, or members, may be appointed from outside the University. The dissertation proposal must be approved by the student's dissertation committee. Successful completion of the comprehensive examination and approval of the dissertation proposal permit the student's academic advisor to recommend the student for doctoral candidacy. Normally a student will begin to register for dissertation credits after being admitted to doctoral candidacy. A minimum of 18 dissertation credits is required. To be eligible for the dissertation defense the student must complete the residency requirement) three terms of full-time study of which two terms must be consecutive). The final defense of the dissertation is a public session announced in University-wide media. The dissertation must be unanimously approved by the dissertation committee. All Ph.D. students are required to submit an article of publishable quality to a journal before the degree is awarded.

3. Admission Requirements

The following are requirements for admission to graduate study in Telecommunications and Networking for pursuing a Ph.D. degree:

(1) A master's degree from an accredited university, a recognized international program, or the equivalent. Students must submit official transcripts as evidence. Exceptional students with a technical Bachelor's degree may be admitted on occasion. Such students must still satisfy all other requirements that follow;

(2) Attainment in graduate work of minimum quality point average of 3.3 (on a scale with A having a value of 4 points per credit). A student's quality point average (QPA) will be calculated on the basis of equivalency from universities that use a different scale;

- (3) Submission of scores from the Graduate Record Examination (GRE). Sources on all three sections (verbal, quantitative, and analytical) of the GRE must be submitted;
- (4) At least three references from persons in the professional and academic communities. The TNPC may, on occasion, require additional references;
- (5) Submissions of an application fee determined by the School of Information Sciences;
- (6) As evidence of the ability to undertake doctoral work, an essay (not exceeding 1,000 words) indicating, as specifically as possible, the student's academic and professional goals in relation to the doctoral program and identifying potential areas and/or topics in which the student expects to pursue dissertation research;
- (7) Evidence of academic completion of:
 - Two different scientific computer programming languages
 - Coursework in probability and statistics
 - Differential and integral calculus

In addition, a candidate may elect to include the following optional material:

- (1) A complete curriculum vitae that provides an overview of education, work, publication, and other professional activities;
- (2) An example of published writing;
- (3) A description of any published or unpublished research, contributions to the professional or scholarly literature, and other professional or academic experience relevant to an assessment of his or her capacity to pursue doctoral study successfully.

The completed application and supporting documents should be submitted online at <https://app.applyyourself.com/?id=up-is>.

Applications from all individuals, regardless of citizenship, who have a degree from a non-U.S. institution, must be reviewed by the University Office of International Services (OIS) prior to their review by the TNPC.

International students must submit evidence of competence in the English language. The status of English in the country of origin may constitute such evidence. A minimum score of 600 on the old TOEFL (or its equivalent under the current TOEFL) or a minimum score of 86 on the Michigan Test is required for international students. In addition, University policy

requires that all international students be retested on English language abilities upon arrival at the University of Pittsburgh.

Credentials of prospective students are reviewed by the TNPC and voted upon by those members. Students whose complete credentials are not available for full admission may register as special students until the completed credentials are received, provided all other requirements have been satisfied. Students with deficiencies in either coursework or scholastic achievement may be admitted provisionally. Prerequisite courses should be completed within the first two terms. Only students whose transcript shows full graduate status may graduate.

4. Matriculation

A student is said to have matriculated upon admission and enrollment into the program.

4.1 Academic Advising and Plan of Studies

An advisor will be assigned to the student upon entering the program but students are free to select a different advisor for subsequent advising and registration as their interest become more focused. The Ph.D. student should seek a faculty program advisor who is knowledgeable in the student's major area of study. The advisor must be a member of the graduate faculty and the TPNC who is able to spend the time and effort necessary for the advising role, will be available for examinations, and with whom a productive and comfortable working relationship can be established. The advisor selected by the student for the period prior to the dissertation stage of the program is the program advisor. The program advisor and the dissertation advisor may be the same person, but the student has the option to select a different advisor of the dissertation. A list of graduate faculty and their respective research interests is available from the administrative assistant of the TNPC.

4.2 Program Advisor

Upon agreement of the faculty member to act as the student's advisor, the signed agreement is placed in the student's folder. Any subsequent change of program advisor should be submitted in writing to the Chair of the TNPC and placed on record in the student's folder.

Doctoral students are ultimately responsible for their own direction and progress through the program and are encouraged to seek advice from any member of the SIS faculty or other University faculty in this endeavor. The program advisor however, is the one primarily responsible for providing guidance, insight, advice, information, explanation of University and School policies, and general assistance in the pursuit of the Ph.D. degree. The program advisor will also approve those actions requiring a faculty signature. All coursework and dissertation credits must be approved by an advisor.

The program advisor assists the student in (1) developing a plan for the program of studies and (2) arranging for the preliminary and the comprehensive examinations.

4.3 Plan of Studies

A candidate for the Ph.D. should have broad knowledge of the field of Telecommunications as well as a specialization in the area of major interest. Every candidate should have, in addition, a strong background in research methodologies.

A plan of study should be designed by the advisor and student as early as possible after admission. A copy of the plan of study must be on file in the student's folder and should be consulted during each registration.

In the doctoral program, at least 9 credits must be doctoral level courses and seminars. Some courses at the master's degree levels are also appropriate for doctoral study. Courses at the undergraduate level do not meet the minimum requirements for doctoral study although they may be taken to supplement a particular program of study.

5. Degree Requirements

5.1 Credit Requirements

The Telecommunications and Networking Ph.D. program requires a minimum of 48 credits beyond a Masters degree. Exceptional students with a technical Bachelor's degree may be admitted on occasion and in such cases, a minimum of 72 credits beyond the baccalaureate

degree is required. These credits must include 6 credits of minor courses, 9 credits of doctoral level seminars in relevant topics and at least 18 credits of dissertation research and writing; however, regardless of the number of credits taken, no more than 18 credits for dissertation research and writing may be applied toward graduation. The grade for these credits will appear as an “S” on the student’s transcript. While these are minimum credit requirements, every Ph.D. student may be required to take more credits of coursework to satisfy the breadth and depth required to successfully complete their dissertations. Graduation depends upon meeting the minimum credits requirements and all other requirements.

Graduate degrees are conferred only on those students who have completed all courses required for the degree with at least a 3.3 QPA. Grades of C or lower are unacceptable for the graduation credit.

All students who are candidates for doctoral degrees are governed by the regulations of the University Council on Graduate Study, which establishes minimum standards for graduate work throughout the University as well as by those regulations established by the SIS faculty.

5.2 Minor

In consultation with the advisor, each student must complete at least two courses in a minor discipline. The goal of the minor is to enable the student to have a background in an area useful toward the dissertation research, but not in Telecommunications and Networking. Students with a Masters degree in a related field may apply their master’s courses toward fulfilling the minor requirement. This is not equivalent to transfer of credits. Elementary courses and courses that are tightly linked to Telecommunications and Networking are not acceptable for this requirement.

5.3 Doctoral Seminar

The doctoral seminar requirement can be fulfilled by three doctoral seminars (9 credits) in Telecommunications and Networking or alternative seminars in Information Science,

Electrical Engineering or Computer Science. At least one doctoral seminar must be in Telecommunications and Networking.

6. Residence and Registration Requirements.

Full-time study on campus is considered most beneficial to students, but it is recognized that students may have off-campus responsibilities as well. The Ph.D. degree therefore can be completed by a combination of full-time and part-time study. Three terms of full-time study are required, two of which must be consecutive and must be taken after successful completion of the preliminary examination. Full-time study is defined as 9 or more graduate credits per term. All students, whether on campus or away, must maintain active status by registering according to the requirements stated in the next section of this document.

Doctoral students in residence must register for at least 3 credits in each term until they have achieved candidacy.

To maintain active status, all doctoral students not in residence must be registered for a minimum of 3 credits in each 12-month period (3 credits in one term or 1 credit in each of three terms) from the time of admission to candidacy until receipt of degree.

A student who fails to register for at least one of three consecutive terms will be automatically placed on inactive status and will be required to apply for readmission in order to continue graduate study. Upon readmission, the student is required to adjust the program of studies to meet current Ph.D. degree program, School, and University requirements.

In keeping with University policy, all graduate students must be enrolled for a minimum of 1 credit in the term in which the student graduates.

Doctoral students who have completed all credit requirements for the Ph.D. degree, including minimum dissertation credit requirements, and are working full time on their dissertations, should register for "Full-time Dissertation Study," with a fixed registration of \$500 per term for both Pennsylvania residents and non-residents. Enrollment in this course

fulfills the University requirements for registration in the term of graduation and for 3 credits in the year of graduation.

6.1 Probation and Termination

All students pursuing the doctoral degree are required to maintain a cumulative QPA of at least 3.3 after admission to graduate study and for all coursework applicable to the degree. Students are automatically placed on academic probation when their cumulative QPA falls below 3.3. The TNPC may choose to terminate students on probation for two consecutive terms. A cumulative QPA of 3.3 or better is required for admission to doctoral study and for the award of the doctoral degree.

6.2 Transfer of Credits

Upon the petition to the TNPC and with the consent of the program advisor, transfer of credits may be granted with the requirement that the students take at least 30 post master's credits of courses and seminars at the University of Pittsburgh. This credit for graduate coursework completed at another institution may be granted if the credit has not been applied to a previous degree, has been earned within the 6-year statute of limitations, and is relevant to the student's doctoral studies in the Department of Information Science. Advanced standing is granted at the time of admission or during the first term of coursework, if approved. Petitions for transfer of credits must be received at the time of application or during the first term of attendance. Transcripts verifying the graduate courses must accompany the petition along with sufficient documentation to permit the faculty to evaluate their relevance to the doctoral program.

Transfer credits must be earned at an accredited institution granting degrees at doctoral level. No credit will be granted toward doctoral degrees for work completed in extension courses or in off-campus centers of another institution unless those credits are approved for graduate degrees at that institution. Transfer credits will not be accepted for courses in which a grade lower than a "B", or its equivalent, has been received. Transfer credits are entered on the

student's transcripts as block credits; grades (and quality points) are not recorded for credits by transfer.

7. Preliminary Examination

The preliminary examination, according to Regulations Governing Graduate Study at the University of Pittsburgh, is held:

. . . to assess the breadth of the student's knowledge of the discipline, the student's achievement during the first year of graduate study, and the potential to apply research methods independently. . . . The evaluation is used to identify those students who may be expected to complete a doctoral program successfully and also to reveal areas of weakness in the student's preparation.

The TNPC has clarified further that the overall objectives of the preliminary examination are:

- (1) To test the Ph.D. students for breadth of knowledge;
- (2) To evaluate their skills, and their ability to apply them;
- (3) To evaluate their ability to do research, and;
- (4) Provide a set of integrative experiences that differentiate telecommunications and networking from other fields (e.g. EE, CS, and IS).

This examination and preparation for it should enable the student to review all areas of Telecommunications and Networking relevant to his/her research, present all the material "in the front" of the student's brain at the same time, and improve the ability to see relationships among various parts and to see gaps or cracks that exist between these areas in Telecommunications and Networking.

A research paper/master's thesis is not required for completing the preliminary exam. However, individual faculty members, before accepting a student as an advisee, may require the student to write a master's thesis² to evaluate his/her interest and ability in research.

7.1 Eligibility

To be admitted to the preliminary examination a student must:

- (1) Have completed a master's degree in a closely related field (e.g. telecommunications, information science, computer science, engineering, mathematics). Exceptional students admitted after a Bachelor's degree must have completed all pre-requisite coursework;
- (2) Be admitted to full graduate status (i.e., all provisional admission requirements must be completed);
- (3) Have attended the Ph.D. orientation session;
- (4) Be registered in the term in which the preliminary examination is taken;
- (5) Apply in writing and with the advice and consent of a faculty advisor to the administrative assistant of the TNPC by the announced deadline.

Students (whether full-time or part-time) are encouraged to take the preliminary examination, with the advice of the faculty advisor, as early as possible.

7.2 Registration Requirements

² The purpose of the master's thesis is to motivate the student to "try on" research on a small scale. If the student finds that research is not what they thought it would be, it would be early enough to pursue other career alternatives. It provides an opportunity for the faculty to assess qualitative features such as "research mindset" and "research potential". It also motivates the student to build working relationships with one or more of the telecommunications faculty in a way that might not have been available prior to the project. The thesis typically takes from 4 to 8 months (typically one or two terms – one as independent study [if necessary]) and the other as the thesis itself) to complete. For non-MST Ph.D. students, this may take a bit longer because of the time needed to establish relationships with the faculty members as well as to pick up the relevant background.

Students must be registered in the term in which their preliminary examination is completed.

7.3 Process

The preliminary examination is a single examination that every student must complete within four semesters of his/her admission into the program unless an allowable exception (detailed below) exists.

7.3.1 Content and Format

The preliminary examination consists of two parts:

(1) Completion of Five Core Courses with Minimum Grades: The five core courses are TELECOM 2321: Wide Area Networks; TELECOM 2710: Foundations of Wireless Communications; TELECOM 2130: Queuing Theory; TELECOM 2030: Mathematical Foundations for Telecommunications; and IE 2001: Operations Research. The student can have at most one B+ in the five core courses. All other grades must be A- or higher. The average grade for the five core courses must be at least A-. If the student fails to achieve the required grades, the core courses **cannot be taken again and the Ph.D. candidacy will be terminated.** There will be no appeals or petitions. Students are REQUIRED to complete the five core courses in not more than 4 semesters from the start (including summer). Exceptions will be made for part-time Ph.D. students in consultation with their advisors or if a course is not offered during the four semesters.

(2) Oral Exam: The oral exam will be offered once a year in the Spring Semester. The student's ability to solve an open-ended question will be tested here. This exam consists of different types of questions such as case study evaluations, problems with no single "right" answer, or a short published paper to be read and critiqued. The exam will be handed to the students two days prior to the oral examination. The students will have two days to prepare and will answer the questions in an oral presentation lasting 20 minutes before all the faculty members (see timing). A student has to pass the oral exam

at the earliest opportunity (within the first four semesters) and should not wait till completion of the four core courses to attempt the oral exam. A student will have successfully completed the preliminary exam after passing the oral exam and completion of the core course as required.

7.3.2 Grading

The oral component is graded out of 20 points and a student must obtain at least 16 points to pass this component. Two tries are allowed for the oral component.

7.3.3 Timing

A student has to pass the oral exam at the earliest opportunity (within the first four semesters) and should not wait till completion of the four core courses to attempt the oral exam. A student will have successfully completed the preliminary exam after passing the oral exam and completion of the core courses as required. The student must notify the Telecommunications and Networking Ph.D. Czar that he/she intends to take the oral exam at the beginning of the Spring Semester of interest. The date and time of the oral exam will be communicated to the student by the Telecommunications and Networking Ph.D. Czar.

7.4 Admission to Doctoral Study

With the successful completion of the preliminary examination, the student is fully admitted to doctoral study in Telecommunications and Networking. The Director of the TNPC will notify the student in writing of admission to doctoral study.

After admission, the student must complete the remaining coursework including doctoral level seminars, the probability, research design, and information science course requirements, and the residency requirement.

8. Comprehensive Examination

The student must satisfactorily pass a comprehensive examination designed to assess mastery of the general field of telecommunications, acquisition of both depth and breadth in the

area of specialization within the field, and the ability to use the research methods of the discipline. The purpose of the comprehensive examination is to assess the student's ability to understand a sub-area of telecommunications and networking in depth. In order to do research, a student must be able to read, understand, present, and criticize research papers in the field. It is also important that the student be able to explain it in depth to someone who is unfamiliar with that area. Thus, this examination centers on the development of a tutorial as well as a lecture in which the student must explain the subject to the satisfaction of the entire Telecommunications and Networking faculty. From a learning perspective, this provides the student with an experience of structuring and explaining a technical topic in detail. It is expected that a student has completed the minimum 36 credits of coursework before taking the comprehensive exam.

8.1 Eligibility

(1) Completed most of the graduate course and seminar work for completion of a Ph.D.

These credits include:

- 6 credits in graduate level courses in a minor area approved with the consent of the faculty advisor
- 9 credits in doctoral level seminars

(2) Completed a "state-of-the-art" paper to be submitted to graduate faculty two weeks prior to examination date;

(3) Apply to the Director of the Telecommunications and Networking program for permission to take the comprehensive examination.

8.2 Registration Requirements

Students must be registered in the term in which their comprehensive examination is taken.

8.3 Content and Format

The comprehensive examination has a written component and an oral component. In preparation for the one-hour oral examination, the examinee must prepare a written “state-of-the-art” paper that must be submitted to the TNPC two weeks prior to the scheduled exam date. The “state-of-the-art” paper is a critical essay that explores the literature of the selected topic; the student identifies, synthesizes, and evaluates the relevant literature on the topic (See Appendix B.)

The comprehensive examination will be conducted by at least four members of the TNPC faculty. The exam will be directed at the “state-of-the-art” paper and the various relationships among the components of telecommunications. Goals of the comprehensive examination committee are to assess the student’s understanding of the topic of the “State-of-the-art” paper, the theoretical framework that supports it; the quality of the student’s research skills necessary to understand, integrated, and extend knowledge gained through scholarly inquiry; and the relationships of the topic to telecommunications. The results of the exam are conveyed to the student, by the examination committee, usually within an hour after completion of the exam.

A student who fails the comprehensive examination is no longer eligible to continue in the Ph.D. program.

8.4 Process

The procedure to schedule and take the comprehensive examination is as follows:

- (1) The student will select a topic of interest in his research area in consultation with his advisor. When the advisor is satisfied that the student understands the subject matter in sufficient depth, the student prepares a tutorial paper;
- (2) The student will prepare a comprehensive literature survey of the research on this topic and prepare a tutorial document that is referenced and complete in itself. This document must not exceed 20 pages in length, with a font size of 12 pt, and margins of 1 inch on the left and right. Also, the document must be prepared so that the faculty can

easily read it. A researcher in Telecommunications and Networking who is not familiar with the research topic should be able to understand and appreciate the issues in this topic by reading the document;

(3) The work should be completely done by the student except for informal suggestions from the advisor. The advisor may provide only grammatical feedback; it is up to the student to decide what content is necessary, and how to organize it, because this is a crucial part of the tutorial. Occasionally the advisor may suggest inclusion of certain topics;

(4) The student finds a date for the presentation where at least four of the Telecommunications and Networking faculty can attend. At least two weeks prior to the examination date, the student must deliver a final copy of the tutorial document to all faculty members;

(5) It is strongly recommended that the student provide some preliminary research results on an advancement in the topic or at least reproduce the most relevant work conducted by researchers in the topic;

(6) The student has to publicly present the material from this document orally on the day of the examination to the faculty in a presentation lasting 45 minutes. The presentation will be tutorial in nature with additional results if any. The faculty may question the student to assess his or her understanding of the topic in question as well as in any general topic in the area. The faculty may ask questions for clarification and to test the students grasp on the subjects as well as closely related subjects and methodologies.

The response of the TNPC may take on several forms, including:

- Unconditional pass
- Conditional pass, with conditions such as
 - Additional recommended or required coursework

- Specific modification to the tutorial paper
- Re-attempt the oral presentation
- Fail

All Telecommunications and Networking students are encouraged to attend comprehensive exams to see what is expected and learn from the tutorial presentation.

8.5 Time and Timing

The Comprehensive examination should be taken after the student has completed almost all coursework, seminars, etc. and after the student has successfully completed the Preliminary examination. In any case, every student **must** complete the comprehensive exam within 18 months of completing the preliminary exam.

9. Dissertation

9.1. Dissertation Advisor

Students must gain the agreement of a member of the Telecommunications and Networking faculty, who is also a member of the graduate faculty, to chair the dissertation committee that will advise the student on the area of research and the design of the study. The advisor's agreement is recorded in the student's file. Any request to change the dissertation advisor must be submitted in writing to the chair of the TNPC. Approval for the change and the selection of another dissertation advisor is filed in the student's folder.

The students' dissertation advisor:

- (1) Assists in choosing the dissertation committee and in confirming the eligibility of all members selected;
- (2) Arranges with the TNPC support staff to schedule the dissertation proposal presentation;
- (3) Reviews progress toward completion of the research;

- (4) Arranges with support staff to schedule the dissertation defense;
- (5) Chairs the dissertation defense;
- (6) Secures appropriate signatures from dissertation committee members and assures that all required paperwork is submitted in accordance with the TNPC, SIS, and University procedures.

9.2 Dissertation Proposal

After successfully completing the comprehensive examination, the student, in consultation with the dissertation advisor, must prepare a dissertation proposal and select a dissertation committee. The dissertation proposal must be approved by the dissertation advisor and the dissertation committee.

The dissertation proposal represents a contract between the student and the Ph.D. committee. The student should specify in as much detail as possible the problem they wish to solve and the method they intend to use to solve it. Acceptance of the proposal includes, to the extent possible, concrete research goals. When the student achieves the goals, the Ph.D. research is to be considered finished. Modification of the goals can only be made collectively and should be written and signed by the student and each committee member. The student should make regular progress reports to the entire committee. According to University policy:

Meetings of the doctoral candidate and his/her dissertation committee must occur at least annually from the time the student gains Admission to Doctoral Candidacy. During these meetings, the committee should assess the student's progress toward degree and discuss objectives for the following year and a timetable for completing degree requirements.

Students demonstrate their ability to complete a sound project of original research by presenting and defending the dissertation proposal to their dissertation committee. The dissertation committee must unanimously approve the dissertation topic and research plan before the student may be admitted to candidacy for the doctoral degree. Approval of the

proposal does not imply either the acceptance of a dissertation prepared in accord with the proposal or the restriction of the dissertation to this original proposal.

Originality may be reflected in a number of ways. For example, a candidate may pose an important new problem or formulate an existing problem in a novel and useful way. A candidate may investigate previously ignored material or develop new techniques for investigating issues. Extensions of previous investigations are acceptable provided they incorporate important new elements in the design or execution of the research.

Normally, a satisfactory dissertation will form the basis for one or more publishable articles. The dissertation committee may offer an opinion on the publishable content of the proposed research.

9.2.1 Time and Timing

The proposal may be done any time after the successful completion of the comprehensive examination. University rules require that the proposal be completed at least six months prior to the final defense of the dissertation. The timing of the proposal depends heavily on the student's dissertation project. The actual timing depends on the student's ability to demonstrate the project's feasibility to the committee. For some, this will occur early in the research cycle. For others this will occur later. It is generally in the student's interest to do this early rather than later, since it defines the scope of the completed dissertation. In any case, every student should complete his dissertation proposal within one year of completing the comprehensive exam.

9.3 Dissertation Advisor

In most cases, the student's academic advisor continues as the dissertation advisor and chair of the dissertation committee. By University regulations the dissertation advisor must be a graduate faculty member of the Telecommunications and Networking Program. In the event that either the student or advisor desires a change, another graduate faculty member from the

Telecommunications and Networking Program may serve as dissertation advisor and chair of the dissertation committee.

9.4 Committee and Procedure

The dissertation committee, selected by the student and major dissertation advisor, shall consist of at least five members, including the dissertation advisor, with the majority being from the Telecommunications and Networking graduate faculty. One of the members must hold a primary faculty appointment outside the TNPC. Upon the recommendation of the dissertation advisor, a member, or members, may be appointed from outside the University. The expenses involved in the attendance of the outside person at meetings are not the responsibility of the department.

Members of the dissertation committee are to be selected by the student in consultation with the dissertation advisor. The dissertation committee is responsible for monitoring the research the research, conducting and evaluating the oral defense of the dissertation, and approving the final written presentation of the dissertation. The dissertation advisor directs the dissertation research and writing, but all committee members have the responsibility to assist the student as consultants. All members of the committee may vote.

The student then schedules a presentation of the dissertation proposal, notifies the telecommunications secretary, and provides a written copy of the proposal to the committee members at least two weeks prior to the presentation date. The dissertation committee must unanimously approve the dissertation topic and research plan before the student may be admitted to candidacy for the doctoral degree. When the proposal has been successfully defended, the chair of the student's dissertation committee shall notify the Chair of the Ph.D. Committee, the director of the Telecommunications and Networking Program Committee, and the Dean of SIS that the student has achieved formal candidacy.

Written notice of the student's meeting with the dissertation committee to approve the proposal will be distributed to the TNPC faculty at least one week in advance. The notice will contain the student's name, the title of the proposal, and the date, time, and place of the

meeting. The committee will conduct the proposal hearing and must unanimously approve the dissertation topic and the research plan. After approval, major changes may not be made without approval of the student and the dissertation committee. The student is responsible for filing a copy in the SIS Library.

9.5 Candidacy

For admission to formal candidacy for the Ph.D. degree, a student must have:

- (1) Passed the preliminary examination;
- (2) Completed the minimum credit requirements (48 credits beyond a Masters degree or 72 credits beyond a Bachelor's degree depending upon admission with a QPA of 3.3 or higher;
- (3) Passed the comprehensive examination;
- (4) Successfully presented a dissertation proposal and received permission from the dissertation committee to begin research.

When these steps have been taken, the chair of the student's dissertation committee will notify the Telecommunications and Networking Ph.D. Czar, the Director of the TNPC, and the Dean of SIS that the student has achieved formal candidacy. The program Director will notify the student of his admission to doctoral candidacy in writing. A copy of the notice will be placed in the student's folder. The student is expected, at this time, to schedule and present a colloquium, on his/her research in an open forum in the School of Information Sciences.

9.6 Dissertation Research – Procedural Requirements

The student must submit all forms, letters, and questionnaires related to the dissertation research to the departmental members of the dissertation committee for approval before any such documents are publicly distributed.

The student is also responsible for meeting University requirements when human subjects are used in research. These requirements are found in the University of Pittsburgh's Guidelines to the Use of Human Subjects in Psychosocial Research. The School of Information Sciences has a faculty representative on the Psychosocial Institution Review Board who may be contacted with questions of procedure.

The student must prepare a final copy of the dissertation conforming to the University of Pittsburgh's Style and Form Manual for the format of the dissertation. Since the bibliographic style is best determined by the subject of the dissertation, a style manual of the student's choice may be used for the content of the dissertation and must be applied consistently throughout.

If University facilities and/or faculty time are used in dissertation research and/or the writing of the dissertation, then students are required to register for at least 3 credits per term or such greater amount as the School of Program deems appropriate. Students who have completed all credit requirements for the Ph.D. degree and are working full time on their dissertations, should register for the fixed-fee registration of \$500 per term. If the student is a doctoral candidate and off campus, not using University facilities and/or faculty time, the candidate need only register for 1 credit per academic year to maintain active enrollment status.

9.7 Dissertation Defense

The purpose of the final defense is to assess the student's ability to present and defend the result(s) of their original research project. The student must be able to clearly communicate the problem, the method, the assumptions, and the results of the project. He or she must be able to clearly articulate and support all assumptions and decisions that were made toward the process of completing the project. While the student's committee makes the final decision, the defense is public and questions are accepted from any attendee.

9.7.1 First Draft of the Dissertation

After completing the investigation and preparing the dissertation, the candidate is advised to submit the first draft to the dissertation advisor early in the term in which he/she expects to receive the degree. This allows time for any necessary revisions and for preparation of the final copies in an acceptable style and format. Any exceptions to the style manual approved for the School must have prior approval by the advisor. Final decisions concerning style and format rest with the student's dissertation advisor.

9.7.2 Eligibility for Dissertation Defense

To be eligible to defend the dissertation, a student must have:

- (1) Completed the residency requirement;
- (2) Requested the formal announcement of the defense in the University Times;
- (3) Distributed copies of the dissertation to the dissertation committee at least four weeks prior to the date of the defense.

9.7.3 Registration Requirements

Students completing their research work for the dissertation will be required to register for at least one credit in the term during which they expect either to complete degree requirements or have the oral defense. If a student does complete all the work in a given term, including the dissertation oral examination, and has been cleared for graduation too late to be included on the graduation list for that term, the student may apply to graduate the following term and need not enroll for any courses or any credits, subject to approval by the Dean's office.

If a student is unable to complete the work during the expected term of graduation due to some extenuating circumstances related to the School and University (beyond control of the student and attested to by the Dean's office), the student will not be required to register for additional credits in the term of graduation.

All requests for exceptions to the policy stated above should be sent to the Program Director from the advisor for clearance and recommendation and then to the Dean for approval consideration.

9.7.4 Defense of the Dissertation

The dissertation defense is scheduled by the dissertation advisor early enough in the term to allow for necessary revisions and final editing of the manuscript before the graduation deadline. The candidate must submit copies of the dissertation to the dissertation advisor and to the dissertation committee at least four weeks prior to the scheduled dissertation defense. A copy must also be filed with the secretary of the TNPC at least four weeks before the date of the dissertation defense meeting. Notice of the dissertation topic/title; the defense date, time, and location; and availability of the final draft copy of the dissertation will be posted publicly and notice sent to the TNPC and SIS faculty at least one week ahead of the scheduled defense.

Dissertation defenses must be publicly announced and are open to the University community. But only the dissertation committee may vote. A student defends his/her dissertation successfully if the dissertation committee unanimously approves it. Although the dissertation defense is dedicated primarily to the field of the dissertation, other questions relating to telecommunications may be considered at this time. The chair of the dissertation committee serves as the session moderator.

A student who successfully defends the dissertation with conditions to be completed must satisfy those conditions with the approval of the dissertation advisor within one year.

9.8 Completion of the Dissertation

The dissertation should be completed within the statute of limitations described below. If the statute of limitations is about to be exceeded and there is evidence of reasonable progress, the TNPC may extend the statute by a specific period usually not exceeding one year. It is the student's responsibility to present evidence of progress to his/her advisor along with a request

for extension prior to the end of the statute of limitation period. All requests for extension must be approved by the TNPC.

9.9 Publication of the Dissertation

As of May 2003, all candidates for a Ph.D. degree are required to submit their official dissertations electronically using the University of Pittsburgh's procedures for Electronic Theses and Dissertations (ETD). Till such time, a candidate for a Ph.D. degree can opt for a paper submission. In that case, the candidate is required to pay a fee specified by the University to Student Accounts. This fee includes binding for one copy of the dissertation and preparation of three copies of the dissertation abstract. The abstract must not be more than 350 words (2450 typewritten characters) in length. With 70 characters per line there are at most 35 lines in the abstract. The first copy of the abstract must be approved by the dissertation advisor and must be submitted with the original unbound copy of the dissertation to the dean's office. The University Microfilm Agreement and the Survey of Earned Doctorate forms must be completed at this time. The dissertation and abstract will be examined and approved by student's dissertation advisor for style, format, and related matters, In addition, the student must provide three bound copies of the dissertation to the SIS Library. Any dissertation may be published after the final defense provided that the dissertation submitted for publication is approved as to form and content by the dissertation advisor and also provided that due acknowledgement is made to the University. No form of publication, however, shall relieve the student of the responsibility for supplying the proper abstract, the specified complete copy of the thesis or dissertation for binding and deposit in Hillman Library, and the three bound copies for the SIS Library

9.10 Journal Requirement

All Ph.D. students are required to submit an article of publishable quality (based on their dissertation) to a journal before the degree is awarded. This shall be recorded when applying for graduation with signatures of the student and the advisor.

10. Statute of Limitations

University policy requires all graduate degrees to be completed in a timely manner.

The purpose of the statute of limitations is to ensure that a graduate degree from the University of Pittsburgh represents mastery of current knowledge in the field of study.

All requirements for the Ph.D. degree must be completed in not more than six calendar years from the time of first registration. Students may, in extenuating circumstances, submit a formal request for extension of their statute of limitations or for a leave of absence from the program. The request must be submitted to the advisor and then presented to the TNPC.

In all other matters of policy, refer to the University publication, Regulations Governing Graduate Study at the University of Pittsburgh, October, 1991

Appendix A: Registration Requirements for International Students

In accordance with University policy, all international graduate students are required to be registered for a full course of study which is 9 credits per term for two consecutive terms. (The third term may be for fewer credits.) After completion of all required coursework, all international students must be registered for at least 1 credit per term until completion of their degree in order to maintain active status. Such regulations may change as determined by the University of Pittsburgh's Office of International Services.

New international students MAY NOT BE REGISTERED until they have taken the required TOEFL or Michigan test, administered by the English Language Institute in cooperation with the Office of International Services (OIS), and the results are available and have been reviewed by the program advisor.

New international students must take their signed registration documents to OIS for verification before submission to the Registrar's Office. Passports should be presented to OIS at this time. Other requirements (that may change) as specified by the OIS are mandatory.

Appendix B: Questions to Consider in Selecting a Dissertation Advisor

Before starting dissertation research, you must have a major advisor who agrees to supervise your work. In addition, you and your advisor will select members for your dissertation committee. You must successfully defend your proposal (at which time you are admitted to candidacy). You and your advisor must mutually agree on the advising agreement and the research topic. Both of you should enter the relationship as well informed as possible about the other. In advising relationships, "divorces" are possible, but they upset the timely progress toward a degree and are emotionally draining.

Trade-offs and compromises are to be expected in selecting an advisor. For instance, it might be preferable to choose an advisor whose students take a slightly longer time to complete

their degrees if they usually gain better jobs than those of a different faculty member. While some students may be eager to work with a famous professor, others might fear that the busiest advisors would have the least time for their students. Finally, be aware that procedures for matching students and advisors may vary by program or department.

To select the best advisor, you might meet with the faculty members for your program and talk with other graduate students in the program about the qualities of the faculty members eligible to direct dissertations. Be cautious about making assumptions, and ask questions covering a range of topics. Some points should best be discussed with the faculty member in questions, others might better be asked of advanced graduate students. To help you, here is a list of questions you might ask in selecting a dissertation advisor; it is not intended as a list of mandatory qualities that advisors should possess. Some items may pertain to other disciplines. Remember, too, that faculty members will have a number of questions for you.

1. Is the advisor an expert in the area of research or scholarship that you intend to pursue? Is his/her critical or theoretical orientation consistent with yours?
2. How much freedom will you have in your choice of dissertation topic with this advisor?
3. What is the reputation of the advisor within the discipline?
4. How responsive is the advisor? How long does it take him/her to return written materials with comments?
5. How accessible is the advisor for discussion?
6. Is the advisor likely to remain on the faculty for the durations of your degree work?
7. How many students does he/she advise? If none, why? If a large number, does this affect the attention that he/she pays to individual students?
8. How much time does he/she spend away from campus? Is he/she available during the summer?

9. How long do students take to complete their degrees their degrees with this advisor?
10. What proportion of this advisor's students successfully complete the program?
11. What is the placement record of this advisor's students? Where do they get jobs?
12. Does the advisor publish with his/her students as first author?
13. How many publications does the typical student accumulate with this advisor?
14. Do the advisor's students go to disciplinary or professional conferences?
15. Do the advisor's students make presentations of their own work at conferences? Do they make presentations of joint work with the advisor?
16. How much interaction is there with other advisees of this faculty member? Does he/she direct a research group or rather a series of individuals?
17. How much of the research is collaborative with the advisor and/or other advisees?
18. How much involvement is expected in "group" research projects that are not appropriate for inclusion in your dissertation? How much of this contributes to your professional development and marketability?
19. How is credit for collaborative work assigned?
20. Is the advisor engaged in patentable or saleable work? If so, how does he/she assign credit to the student? Does this work get published promptly?
21. Is the advisor's work funded? What are the guarantees of funding for the advisor's students? Do the advisor's students get summer support?
22. Does the advisor assist his/her students in obtaining their own funding from outside sources such as fellowship programs?
23. Does the advisor have good relations with other faculty in the program?

24. Does the advisor have a reputation for ethical behavior?
25. Are the advisor's work habits compatible with your own?

Appendix C: Summary of Steps Leading to the Ph.D. Degree in Information Science/Telecommunications and Networking

Responsibility: Party having responsibility is underlined.

Student

1. Submits an application and supporting documents for admission to graduate study in telecommunications to:

Admissions Coordinator
University of Pittsburgh
Information Science Programs
505 SLIS Building
Pittsburgh, PA 15260

Admissions Office

2. Notifies the student of admission in writing.

Faculty Advisor and Student

3. A graduate faculty member is assigned to serve as the student's program advisor. A plan of study is jointly prepared by the student and faculty advisor. A copy of the plan of study is filed in the student's folder. The student registers with the advice and consent of his/her program advisor for at least one term each academic year.

Student

4. Prepares for the preliminary examination which must be taken within two calendar years of matriculation. Prepares a request for admission to the preliminary examination after consultation with the program advisor. Sends request to the secretary of the TNPC

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5. Admits the student to doctoral study after he/she successfully completes the preliminary examination. A copy of the letter notifying the student is placed in the student's folder.

Student

6. Completes at least 9 credits of doctoral seminars; completes the 6-credit minor requirement (not including courses related to Telecommunications and Networking); and completes the residence requirement which is three terms of full-time study, 9 or more credits in the Fall, Spring or Summer terms (sum of Summer Session I and Summer Session II must be 9 credits or more); two of these terms must be consecutive and must be taken after successful completion of the preliminary examination.

Advisor and Student

7. The program advisor verifies that the student has completed all requirements listed in Step 6. The student applies to the Chair of the TNPC for permission to take the comprehensive examination.

Student

8. Prepares a "state-of-the-art" paper and research plan. These must be submitted to the TNPC two weeks prior to the scheduled oral examination date. After successful completion of the comprehensive examination, the student selects a dissertation advisor in consultation with the program advisor.

Advisor and Student

9. Prepare a plan for the dissertation research and revise the basic program of studies, if necessary.

Student

10. Prepares a dissertation proposal with the guidance of the dissertation advisor

Student and Dissertation Advisor

11. Selects a dissertation committee

Student and Dissertation Committee

12. Meets together for formal approval of dissertation topic. The proposal must be submitted to the dissertation committee two weeks prior to the scheduled meeting date.

Student

13. Responsible for filing a copy of the approved proposal with the secretary of the Ph.D. Committee and a copy in the LIS Library.

Advisor

14. Recommends to the Department Chair that the student be admitted to doctoral candidacy following the approval of the dissertation topic.

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15. Sends a written notice of doctoral candidacy to the student and to the student's folder. Also initiates status change on the University transcript.

Student

16. Registers for dissertation credits and pursues the dissertation research. Is expected to schedule and present a colloquium on his/her research to the SIS Research Forum.

Student

17. Prepares his/her dissertation. A copy of this dissertation must be made available to the dissertation committee at least four weeks prior to the scheduled defense date. In addition, one copy of the dissertation is to be given to the secretary of the TNPC for accessibility by interested faculty at least four weeks prior to the scheduled defense date.

Dissertation Advisor

18. Schedules the final oral examination and notifies the dissertation committee (at least four weeks ahead of time) and the TNPC and GIST faculty (at least one week ahead of time) of the topic, date, place, and time of the examination. Publishes University-wide announcement in the University Times.

Student and Dissertation Committee

19. The student defends his/her dissertation. Formal approval by the dissertation committee is required.

Student

20. Submits one copy of the approved dissertation and abstract to the dean's office. Completes the Microfilm Agreement and the Survey of Earned Doctorate. Submits three bound copies to the SIS Library.

Advisor

21. Verifies that the above documents are correct and of a quality to reflect the highest standard of the School and the University of Pittsburgh.

22. Verifies that student has submitted a article to a journal.

Student

23. Applies for graduation. Application for graduation must be filed before the deadlines posted conspicuously in the IS Building each term. Pays graduation fees at the Office of Student Accounts in Room 201 Thackeray Hall.

School

24. Confers the degree at the University commencement. Graduation occurs at end of each term, but there is only one commencement usually held the last Sunday in April.