

## REVIEW OF THE B.S. IN NETWORK AND TELECOMMUNICATIONS MANAGEMENT

Classification of Instruction Programs (CIP) Code: 11.0901  
Computer Systems Networking and Telecommunications

### OVERVIEW

The **B.S. in Network and Telecommunications Management** program at Illinois State University is housed in the School of Information Technology within the College of Applied Science and Technology. The School of Information Technology houses six degree programs: a B.S. in Computer Science, B.S. in Cybersecurity, a B.S. in Information Systems, a B.S. in Network and Telecommunications Management, an M.S. in Computer Sciences, and an M.S. in Information Systems. In addition, the school offers a minor in Information Systems and Graduate certificates in Data Science: Computer Science, Enterprise Computing Systems, Information Assurance and Security, Internet Application Development, Network and Telecommunications Management, and Systems Analyst. The last review of the B.S. in Network and Telecommunications Management program occurred in 2013-2014.

The B.S. in Network and Telecommunications Management program is concerned with network technology, information systems, computer technology, business practices, and policy issues involved in data, image, video, and voice transmission. This program prepares undergraduate students to enter industry in entry-level positions with adequate preparation to assume management positions once work experience is gained. Graduates possess an in-depth technical understanding of computer networks and telecommunication systems as well as an appreciation of the economic and public policy issues that are important in the design and development of local and wide area networks, and national and multinational telecommunication systems. The curriculum focuses on the theory and application of cutting-edge technologies used to design and manage networks. This includes understanding of the policy issues dealing with data, image, video, and voice delivery. Understanding these policies is essential when designing and managing networks.

#### **Enrollment and Degrees Conferred by Plan of Study, Fall Census Day, 2014-2021** **B.S. Network and Telecommunications Management, Illinois State University** First Majors Only

	2014	2015	2016	2017	2018	2019	2020	2021
Enrollments	63	61	54	48	41	35	30	26
Degrees	19	23	9	15	16	12	10	7

Table notes: Graduating Fiscal Year consists of summer, fall, and spring terms, in that order. For example, Graduating Fiscal Year 2018 consists of the following terms: summer 2017, fall 2017, and spring 2018. Graduation numbers were unavailable for 2015.

### EXECUTIVE SUMMARY PROGRAM REVIEW SELF-STUDY REPORT

#### **Program goals**

The program educational objectives (PEO) of the network and telecommunications management program are as follows:

- Be a successful practitioner in a computer networking related field or accepted into a graduate pro-gram.
- Demonstrate independent thinking and an ability to function and communicate effectively in team-oriented settings.
- Live and work as contributing, well-rounded members of society.

### **Student learning outcomes**

At the time of graduation, a student in our network and telecommunications management program must attain the following outcomes:

- Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
- Design, implement, and evaluate networking systems to meet a given set of requirements.
- Communicate effectively in a variety of professional contexts.
- Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
- Function effectively as a member or leader of a team to accomplish a common goal.

### **Program curriculum** (2021-2022)

Graduation requirements:

120 credit hours including 76 credit hours for the degree program and 39 credit hours for General Education. The 76 credit hours for the degree program include 47 credit hours of information technology courses and 29-30 credit hours of courses external to the School of Information Technology.

### **Program delivery**

The program is offered on the Normal campus.

The program is delivered primarily through face-to-face or blended face-to-face/online instruction.

### **Department faculty** (Fall 2021)

21 tenure track faculty members (8 Professors, 5 Associate Professors, and 8 Assistant Professors)

16 non-tenure track faculty members (3 full-time, 13 part-time, totaling 7.2 FTE)

Undergraduate student to faculty ratio: 30 to 1

Undergraduate student to tenure-line faculty ratio: 41 to 1

### **Specialized accreditation**

The network and telecommunications management program is not currently an accredited program.

### **Changes in the academic discipline, field, societal need, and program demand**

According to the U.S. Bureau of Labor and Statistics (BLS), the Computer Networking jobs are expected 5 percent increase from 2018-2028. BLS aggregates most of the networking jobs under two job titles: (a) Computer Network Architect and (b) Network and Computer Systems Administrator. The median pay in 2019 for computer network architect is \$112,690; for network and computer systems administrators is \$83,510. Likely the biggest change experienced by the program since the last review is the change in demand from prospective students. As a nationwide trend, the demands from prospective students on Computer Science and Cybersecurity have been significantly increasing in the last couple of years, which is also reflected by the enrollments of different programs in the School. To be clear, the enrollment in the B.S. in Cybersecurity far exceeds the reduction in the network and telecommunications management major. That major took some of the network and telecommunications management majors but also has attracted additional students to Illinois State. However, the demand from the industry on the graduates in Computer Networking discipline remains strong. The networking paradigm in the industry has significantly shifted in the last several years from physical to virtual, from hard configuration to software defining, from enterprise computing to cloud and edge computing, and from algorithmic to intelligent networking. The industry changes have presented different requirements to the students. Accordingly, program faculty have revised the curriculum to prepare them for the new job market.

### **Responses to previous program review recommendations**

1. *Continue to monitor and improve the assessment plan, utilize assessment results to make program improvements, and document how this has been addressed.* The NTM assessment plan was rewritten in 2015 and revised, again in 2020. Assessment results have been regularly collected and analyzed by NTM faculty. Revisions of the program assessment plan were completed following the last program review, and systematic data collection has been done. In addition to regular data collection and some curricular changes that were based on assessment data, the School of Information Technology has implemented a process in which the faculty for each program in the School meet each semester to discuss the assessment data that was collected in the previous semester. This process encourages the faculty to consider both curricular and pedagogical changes that would enhance student learning. Minutes are taken at each program faculty meeting regarding assessment data. The assessment committee then reviews the minutes from the program faculty meetings.

2. *Design and implement a systematic program of regular communication with program alumni to collect and maintain data on alumni perceptions of the program and on alumni successes in employment and graduate studies.* The School of Information Technology instituted a program of collecting data from graduates at commencement receptions, including a non-Illinois State email and information about employment. Program faculty have also made some attempts to collect the same information from students who do not attend the receptions but have been less successful in getting data from those graduates. The program has also improved the communication outward to alumni and have increased opportunities for alumni to be engaged with current students. The program maintains multiple social media sites (Facebook, LinkedIn, Instagram) as well as sending a bi-annual newsletter (called IT matters). However, the faculty still need to improve our data collection to include a larger percentage of the alumni and the faculty also need to work on developing a more systematic program of data collection from those alumni.

3. *Coordinating efforts with the Enrollment Management and Academic Services unit on campus, establish enrollment targets consistent with program resources, prospective student demand, and employment opportunities for program graduates; then, working with the school recruitment committee, develop and implement a plan to market the program, incorporating efforts to improve gender diversity among students.* Program faculty has worked with the Enrollment Management and Academic Services unit closely to review the program and identify the marketing opportunities, participated in various relevant events, and invited the director of the admission office to the industry advisory board meeting.

4. *Continue efforts to address gender diversity among faculty members as hiring opportunities arise.* Since the last program review, the program has hired one tenure-track faculty member. However, all qualified candidates were male. Program administration will continue the effort as hiring opportunities arise in the future. However, the School of Information Technology has been successful in hiring several female faculty members in that time frame, which has an impact on program students, since they take many courses that are shared with other programs and taught by other Information Technology faculty members.

### **Major findings**

One apparent issue in network and telecommunications management, since the previous program review, has been the decreasing enrollment. However, program faculty believe there are several aspects of the program that are still working well.

- The curriculum has been routinely updated based on the feedback from its industry advisory board.
- The network and telecommunications management faculty have been actively conducting high-quality cutting-edge research in the related fields.
- The assessment plan has also been updated, and faculty have become more involved in the assessment process and especially in the process of considering assessment results and looking at pedagogical and curricular adjustments that may be suggested by the assessment process.

Program faculty believe the declining enrollment in network and telecommunications management does not accurately reflect the demands from the computer networking industry, which is increasing with the recent advances in cloud and edge computing, network function virtualization, and software defined networking. Understanding the causes of the enrollment issue is crucial for the next move of the network and telecommunications management program. As discussed earlier, one reason behind the enrollment issue is the launch of the information assurance sequence in Information Systems, and later the standalone Cybersecurity program. However, faculty believe that there are clear differences between Cybersecurity and network and telecommunications management in their curricula, prospective student groups, and targeted job markets.

### **Initiatives and plans**

Based on major findings of this program review self-study, the faculty plans to take the follow action during the next program review cycle to improve the program:

- Propose a program name change. The program name could be confusing to perspective students. The program faculty are proposing to change the program name from Network and Telecommunications Management to Computer Networking.
- Revise the curriculum: although the curriculum is up to date, there is still room for improvement. The program faculty are taking two actions now: 1) gradually revising the curriculum to be more technique oriented by removing irrelevant non-IT courses; and 2) further enhancing the curriculum with new courses representing the most desired skills in industry.
- Increase recruitment. Faculty will participate in more recruitment events to help promote the program.
- Improve student engagement. Faculty will introduce: 1) more practical project; 2) recent faculty research to the classroom; and 3) further enhance hands-on learning environment.
- Improve the program's data collection from and communication with program alumni.
- Propose a new accelerated sequence for students interested in continuing the Network and Security Management sequence in the M.S. in Information Systems program.
- Increase research opportunities with the goal of attracting more high-quality applicants (and students). Some specific actions include but not limited to periodically offering research topic courses and introducing ongoing master theses/projects as independent study opportunities to undergraduate students.

### **PROGRAM REVIEW OUTCOME AND RECOMMENDATIONS FROM THE ACADEMIC PLANNING COMMITTEE**

**Review Outcome:** The Academic Planning Committee, as a result of this review process, finds the B.S. in Network and Telecommunications Management program in the School of Information Technology to be in Good Standing.

The Academic Planning Committee recognizes that many of the efforts and activities that led to the development of the self-report were accomplished during the time period coinciding with the COVID-19 pandemic. The committee thanks the program for a comprehensive and critical self-study report that included input from multiple stakeholders including from two advisory boards.

The committee notes that the program's enrollment during the period covering the program review cycle has significantly declined over the period of review (from 63 in 2014 to 30 in 2020). The program indicates that, with current resources, this enrollment level is below their ideal target of 60 to 70 students. The percentage of students identifying as female or non-binary has remained relatively constant at 3.3 percent across the period of review. The percentage of undergraduate students from groups traditionally underrepresented in the discipline has varied over the period of review (ranging between 6.7 and 24.4 percent), typically below the University average during the period of review. The self-study report indicates that program faculty are actively engaged in efforts to increase awareness and interest in the program which they hope will lead to controlled growth of the program.

The committee commends the program faculty for their efforts to support the success of their students. We commend the program on its ability to continue to limit enrollments in many of its courses, which is in keeping with the University's commitment to fostering a small-college atmosphere with large-university opportunities. The committee commends the program for the creative and varied co-curricular options it provides its students to meet

their education and career goals. These include three student organizations, a lifestyle floor in Manchester Hall, collaboration with State Farm on an annual mobile application development competition, and opportunities to participate in other competitions and hackathons. These opportunities help the School prepare students for employment and build a strong student community in the program. The School provides some opportunities for student participation in research opportunities, including the new Next STEM Scholars program (supported through an NSF grant). The committee also notes that the School has excellent laboratory facilities and works to incorporate significant hands-on experiences into the curricula of the various programs.

The committee commends the program for the creative and varied curricular options it provides students to meet their educational and career goals. The committee commends the faculty's work to revise the curriculum during the period of review based on feedback from multiple stakeholders. We note that all undergraduate programs in the School include a professional practice requirement, usually in the form of a paid internship in the field. The committee also commends the program for their collaborations that support other programs and departments and provide opportunities for students who want to double major.

The committee commends the program faculty on the development, implementation, and revision of their plan for the assessment of student learning outcomes. During the current review cycle, faculty have used the evidence gathered through the student learning outcomes assessment plan to inform program changes, and this includes the incorporation of rubrics as tools for assessing student coursework regarding the program's learning outcomes. The committee acknowledges the use of such rubrics as one method to provide consistent reviews of student learning that can reveal potential areas for improvement. The information gathered through these measures has been used to make program changes, and several examples of these changes were specified.

The committee commends the School faculty on their success at hiring and retaining a higher number of female faculty members. We recognize the faculty members of the program for their scholarly contributions to the B.S. in Network and Telecommunications Management program. Faculty members are active researchers who publish peer-reviewed journals articles, and present at national and international professional conferences.

The committee appreciates the in-depth analysis of comparator and aspirational programs. As part of this analysis, the program faculty identified multiple institutions with similar programs that excel in ways in which our program may aspire. The committee also recognizes that faculty developed specific action plans to implement similar initiatives as those to improve the program at Illinois State University.

### **Follow-up Reports.**

The self-study report identifies a number of potential initiatives related to the program's dropping enrollments. The committee asks that the program faculty develop a plan for controlled enrollment growth. We recommend that the program faculty look to other programs within the School which have growing enrollments for potential recruitment strategies, as well as consulting with University Marketing. Given the time and energy that must be devoted to such recruitment activities, the committee notes that considering which student populations (both external, but also student transferring internally between programs) are most likely to be successful in recruiting students and prioritizing those when recruiting can provide an efficient strategy to assist in guiding these efforts. The committee also suggests that the program faculty explore potential collaborations with other programs (e.g., Creative Technologies). We ask that these discussions involve both internal and external stakeholders (e.g., alumni and the Advisory Board) as well as comparisons with the curricula of programs at comparator institutions. Accordingly, the committee asks the faculty to engage in discussions of this plan and to summarize the findings of those discussions in a report submitted to the Office of the Provost by May 15, 2024.

The self-study report identifies a number of potential initiatives related to the program curriculum, time-to-degree, and credit hours. The committee asks that the program faculty consider these as part of a comprehensive review and evaluation of the curricula across all sequences, and develop a plan for necessary revisions. This analysis should include examining the role of the articulation of transfer courses and how they impact time-to-degree, identifying any courses that are potential bottlenecks due to high DFW rates (e.g., in the required mathematics courses and IT 168), considering the impact of limited offerings (e.g., required courses that are only offered every other year), consider the potential of offering some courses earlier to increase the visibility of the program within the School,

and investigating the availability and timing of the required internships (e.g., developing additional supports for students arranging internship opportunities). We ask that these discussions involve both internal and external stakeholders (e.g., alumni and the Advisory Board) as well as comparisons with the curricula of programs at comparator institutions. Accordingly, the committee asks the faculty to engage in discussions of this plan and to summarize the findings of those discussions in a report submitted to the Office of the Provost by May 15, 2023.

### **Recommendations.**

The Academic Planning Committee thanks faculty and staff members of the School of Information Technology for the opportunity to provide input regarding the B.S. in Network and Telecommunications Management program at Illinois State University through consideration of the self-study report submitted by faculty. The following committee recommendations to be addressed within the next regularly scheduled review cycle are provided in a spirit of collaboration with School faculty members. In the next program review self-study report, tentatively due October 1, 2030, the committee asks the program to describe actions taken and results achieved for each recommendation.

**Continue to focus on equity, diversity, and inclusion.** While the committee recognizes the efforts to increase the gender and ethnic diversity of faculty and students within the program, the committee encourages the program to continue to pursue its goals related to further developing an equitable, diverse, and inclusive environment that effectively supports students, faculty, and staff from diverse backgrounds. We encourage the program to continue refining and implementing their plans for recruiting students from groups who are traditionally underrepresented in the program and discipline. We note that many of the recruitment strategies are described at the School level, and we recommend that the program faculty explore the use of program-specific recruitment strategies (e.g., program-specific scholarships). Furthermore, we encourage the program faculty to continue to examine ways to infuse diversity, equity, and inclusion into the curriculum.

**Continue to focus on student success and retention.** The committee recommends that the program faculty develop a plan for student success. The plan should be used to increase transparency and communication around “student success” by defining the program’s goals for, assessment of, and actions towards supporting students enrolled in the program. The plan may provide an overarching structure for other plans (e.g., retention, curriculum, alumni engagement). The committee recognizes substantial work by former and current faculty members to review and update the program and its curriculum. The committee recommends continued periodic review of the program structure and content to remain current with changes in the field and to maintain program retention and graduation rates (including the percentage of graduates completing the program within four years and trying to reduce the numbers of curricular exceptions needed). The committee recommends that the program continue monitoring student retention, particularly of students from traditionally underrepresented groups. The committee suggests that faculty members investigate student interest and participation in the Honors program to ensure that students desiring to complete the program with honors have sufficient opportunities to do so.

**Continue to review and revise the curriculum.** The committee recognizes substantial work by faculty members to review and update the program and its curriculum. The committee recommends continued periodic review of the program structure and content to remain current with changes in the field. Continue to develop and expand the internship program for majors, perhaps through input from the Advisory Board in creating additional opportunities for interaction among students, alumni, practitioners, and prospective employers. The committee encourages the program to clarify the research components in the curriculum (e.g., are there potential discrepancies in required hours between professional practice and independent study) and to continue developing opportunities for student research and creative activities.

**Continue implementing and refining the student learning outcomes assessment plan.** The committee encourages faculty to continue its implementation of the student learning outcomes assessment plan for the program during the next program review cycle, to continue to utilize information gathered through plan implementation to make program revisions as necessary, and to document how that has been done. The committee encourages faculty to periodically evaluate the effectiveness of the plan in assessing student learning to identify any modifications to the plan faculty may deem necessary.

**Continue the collaborative work with Milner Library.** The committee recommends that the program work with the subject liaison librarian to examine and evaluate the library's journals and monograph collection related to network and telecommunications management to aid in both the selection and deselection process of these sources. Given recent journal cancellations and expected increases in distance and hybrid courses, we encourage the School and the Library to further collaborate to increase awareness of alternative access to resources, such as Interlibrary Loan and I-Share lending, among faculty and students. We also recommend that the School work with the subject liaison librarian to develop a tiered approach for information fluency learning outcomes for the department, align those outcomes to the curricula, and integrate those outcomes into the student learning outcomes assessment plan for the program.

**Continue to refine a plan for alumni tracking and engagement.** While program faculty have been successful at increasing scholarships through donations from alumni, the committee encourages the program faculty to continue to refine their plan for tracking program alumni and use this system to enhance alumni networking and engagement. These activities may become even more important in the years ahead as the program's alumni become more diverse. The program could benefit from increased involvement of its alumni, employers, and other external stakeholders in providing input regarding the program and in mentoring students and providing employment opportunities for program graduates.