NETWORK ENGINEERING - MASTER OF SCIENCE (MSNE)

Global interconnectivity requires the continuous expansion and evolution of network infrastructure, in response to trends in e-commerce, the Internet of Things, mobile data and enterprise operations. To assure the continuous operation of this infrastructure, companies need highly educated and technically proficient individuals with the vision to anticipate and build systems for emerging communication needs. This course-based degree prepares students to join the next generation of leaders in Internet, cloud, and intranet networking. Students will learn how to develop, build and maintain network solutions tailored to the diverse needs of your organization within the private or public sectors.

The intended audience for the Network Engineering program is both working professionals trying to develop or update their technical skills and abilities to match the latest requirements of the Internet service and cloud provider landscapes, as well as new entrants to this industry pursuing academic, professional or research success.

Bachelor's–Accelerated Master's Degree Program

Students may earn this degree as part of the Bachelor's–Accelerated Master's (BAM) degree program, which allows currently enrolled CU Boulder undergraduate students the opportunity to earn a bachelor's and master's degree in a shorter period of time.

For more information, see the Accelerated Master's tab for the associated bachelor's degree(s):

- Applied Computer Science - Post-Baccalaureate Bachelor of Science (BSACS) (https://catalog.colorado.edu/undergraduate/colleges-schools/engineering-applied-science/programs-study/computer-science/applied-computer-science-post-baccalaureate-bachelor-science-bsacs/#acceleratedmasterstext)
- Computer Science - Bachelor of Arts (BA) (https://catalog.colorado.edu/undergraduate/colleges-schools/engineering-applied-science/programs-study/computer-science/computer-science-bachelor-arts-ba/#acceleratedmasterstext)
- Computer Science - Bachelor of Science (BSCS) (https://catalog.colorado.edu/undergraduate/colleges-schools/engineering-applied-science/programs-study/computer-science/computer-science-bachelor-science-bscs/)

Requirements

Admission Requirements

Applicants for graduate study in network engineering must hold at least a bachelor's degree or its equivalent from an accredited institution. We recommend that candidates have at least some experience in network engineering, system administration, or network programming.

A minimum undergraduate GPA of 3.0 (on a scale of 4.0) is required for admission to the master's program.

GRE scores are not required for admissions to this program.

Program Requirements

Required Courses and Credits

Students must complete a total of 30 credit hours of approved graduate-level coursework with a grade of C or better and a cumulative GPA of at least 3.00.

Students will take courses in the following categories: fundamentals (6 credits), core (6 credits), advanced electives (9 credits) and electives (9 credits).

Fundamentals

The courses in the Fundamentals category are designed to provide students with the background they need to succeed in this degree. Courses in this category cover the fundamental concepts of how the internet operates; how to develop network systems; and how to administer the machines (both physical and virtual) that deploy them.

Code	Title	Credit Hours
CSCI 5010	Fundamentals of Data Communication	3
CSCI 5020	Fundamentals of Network Programming	3
CSCI 5030	Fundamentals of System Administration and Virtualization	3

Students are required to take two courses (6 credits) from the Fundamentals category unless they can demonstrate that they have acquired the necessary skills and knowledge via their undergraduate degree. Such students can petition to take up to two extra elective or advanced elective courses instead. Only 6 fundamental credits can count towards graduation.

Core

The courses in the Core category begin to lay the foundation for exploring network engineering topics in depth. All aspects of network engineering from the management of network systems to the policies that govern traffic on the internet to the wireless systems that deliver information to devices on the edge are all covered.

Code	Title	Credit Hours
CSCI 5113		
CSCI 5160	Introduction to Enterprise Networks	3
CSCI 5170	IP Routing Protocols and Policies	3
CSCI 5180	Network Management and Automation	3
CSCI 5200	Introduction to Wireless Systems	3
CSCI 5220	Wireless Local Area Networks	3
CSCI 5230	Wireless Systems Lab	3

Students are required to take two courses (6 credits) from the Core category to help set the stage for taking courses in the Advanced Electives category. Students can be guided in their choice of Core courses by using the suggested focus areas below to craft a curriculum plan that best meets their academic goals. If a student feels that they need to take more courses from the Core category, they can certainly do so by choosing to take additional Core classes and applying those credits towards meeting the credits associated with the Electives category.

Advanced Electives

The courses in the Advanced Electives category go in-depth on a variety of network engineering topics. Students are required to take three courses (9 credits) of advanced electives to graduate.

Code	Title	Credit Hours
CSCI 5190	Voice Over IP. Voice Network Design and Implementation	3
CSCI 5260	Datacenter Networks	3
CSCI 5270	IP Network Design	3
CSCI 5280	Software-Defined Networking	3
CSCI 5360	Internet Service Provider Networks	3
CSCI 5380	Network Virtualization and Orchestration	3
CSCI 5620	Advanced Wireless Lab	3
CSCI 5630	Wireless and Cellular Systems	3
CSCI 5840	Advanced Network Automation	3

Electives

The three courses (9 credits) associated with the Electives category allow students to customize the MS in Network Engineering degree to meet their academic goals. These credits can include any of the following options:

- Any of the remaining Core courses
- Any of the remaining Advanced Electives Courses
- Any CS 5000-level course
- At most three graduate-level courses (9 credits) from outside CS approved by petition

For the last two options, students are encouraged to submit petitions to the CS graduate committee *before* taking the courses they want to apply to the Electives category.

Suggested Focus Areas

The following sets of courses represent common focus areas that students can take to target a particular area of network engineering in depth.

Network Design and Configuration

Code	Title	Credit Hours
CSCI 5160	Introduction to Enterprise Networks	3
CSCI 5260	Datacenter Networks	3
CSCI 5360	Internet Service Provider Networks	3

Network Programmability and Automation

Code	Title	Credit Hours
CSCI 5180	Network Management and Automation	3
CSCI 5280	Software-Defined Networking	3
CSCI 5380	Network Virtualization and Orchestration	3
CSCI 5840	Advanced Network Automation	3

Wireless Networking

Code	Title	Credit Hours
CSCI 5200	Introduction to Wireless Systems	3
CSCI 5220	Wireless Local Area Networks	3
CSCI 5620	Advanced Wireless Lab	3
CSCI 5630	Wireless and Cellular Systems	3

Comprehensive Networking Solutions

Code	Title	Credit Hours
CSCI 5160	Introduction to Enterprise Networks	3
CSCI 5170	IP Routing Protocols and Policies	3
CSCI 5190	Voice Over IP. Voice Network Design and Implementation	3
CSCI 5200	Introduction to Wireless Systems	3
CSCI 5270	IP Network Design	3

Learning Outcomes

Network engineering education prepares students to become the individuals responsible for the design, construction and operation of data communication systems. Network engineering and automation teaches students how to develop, build and maintain network solutions tailored to the diverse needs of the industry within the private or public sectors.

Global interconnectivity requires the continuous expansion and evolution of its infrastructure, in response of latest trends in e-commerce, IoT, mobile data and enterprises operations. To assure the continuous operation of this infrastructure the industry needs a constant supply of highly technical individuals with both the knowledge and the vision to anticipate and build for upcoming communication needs. The professional master's in network engineering (MSNE) would prepare students via technical and management courses to be the next leaders in Internet, Cloud and Intranet networking.

The curriculum will use an applied interdisciplinary approach through lab-based courses in multiple disciplines to give students the skills they will need to:

- Design, build and deploy complex networks architectures using multi-vendor solutions.
- Utilize network programming and automation to manage, monitor and audit networks and systems to identify critical problems and proactively resolve problems at scale.
- Analyze, create and deploy software-defined solutions to augment network intelligence and resiliency.
- Plan, scope and manage complex projects and communicate efficiently with audiences of various disciplines.
- Evaluate industry best practices, policies and regulations established by the ACM, FCC, IETF, IEEE, BITAG, NANOG, MEF and other relevant consortia in the industry.