All students matriculating in the MS NSA degree program are required to have a certain level of proficiency in wired and wireless data networks before engaging in graduate level course work in networking. If an incoming student has not successfully completed any data networking courses prior to matriculating in the MS NSA degree program they will be required to take a networking bridge course, during the first term of classes at RIT. Matriculating students who do have a data networking course on their transcript will be required to take a two part proficiency exam during orientation. If the student receives a grade of B or better on the written portion of the exam they will be given an orientation to our networking lab which will be followed by a practical exam in networking. Students earning a B or better on both parts of the exam are exempt from taking the networking bridge course. All other students will be required to take this bridge course the first term they are eligible to take academic course work in the MS NSA degree program.

Below is a list of the topics that will be tested and what the student should be able to do before taking graduate level courses in networking. All incoming students whether or not they have a networking course on their undergraduate transcript are welcome to prepare for the proficiency exam.

**Topics**

- Review of Communications Models – OSI Model and TCP/IP Model
- Physical layer - Ethernet II and IEEE 802.3 physical specifications
- Data Link Layer – Ethernet and IEEE 802.3 frame formats, MAC addresses, ARP
- Network Layer – IP Version 4 and IP Version 6; addressing, subnetting, packet format, operations (how the protocol works)
- Transport Layer – UDP and TCP protocols, port addressing, segment format, operations
- Wired LAN Operations and IEEE 802.3
- Wireless AP Controller topologies
- Wireless LAN Operations and IEEE 802.11
- Wireless LAN basics and signals.
- Basic antenna theory and types (electricity, magnetism, RF communications)
- Decibels, system gain and loss
- Basic Switching and Spanning Tree Protocol (IEEE 802.1D) – Forwarding tables, BPDU format, different types of switches, how switches segment traffic in a data
network, how spanning tree protocol works, the different roles the switches and their ports play in a switched topology

- VLANs – What are they, what different types are there, and how do they work
- Access Control Lists - what are they, how do they work, how are they defined, what benefit do they provide
- NAT – What is it, how does it work, what benefit does it provide, how is it configured
- Introduction to Routing, static and dynamic routes, host routing tables and router routing tables, what information to the contain and how does the routing process work end to end across multiple networks
- Routing Metrics – What are the different available metrics, how do they work
- OSPF Routing Protocol – Headers and frame formats, how does it work

Below are examples of what students should be able to do:

- Be able to locate, synthesize, and discuss current RFC’s, IEEE standards, and other related standards, as well as describe the standards bodies and the standardization process as they apply to local area networking.
- Be able to compare and contrast the OSI and TCP/IP models as they apply to contemporary communication protocols with a focus on layers 1, 2, 3, and 4.
- Be able to explain applicable mechanical, electrical, functional and procedural characteristics of the physical layer Ethernet.
- Be able to explain the specifications of contemporary and emerging (wired and wireless) communication protocols.
- Be able to explain the operation and integration of protocols operating at layers 1, 2, 3, and 4.
- Be able to explain, calculate, and apply network masks, subnetwork masks, and CIDR notation.
- Be able to explain the basic operation and characteristics of internetworking devices such as hubs, bridges, switches, routers, gateways, wireless APs, and firewalls.
- Be able to explain basic network security concepts including issues on security flaws, approaches, and patches as they apply to course content.
- Be able to use and explain common network utilities for both the Windows and Linux operating systems.
- Explain the Spanning Tree Algorithm and identify port roles, port states, and bridge roles in a network with bridging loops.
- Explain the workstation’s role in the routing process.
- Identify when a gateway is necessary and explain its use on a workstation and a router.
- Be able to build basic Ethernet and wireless LANs.
- Be able to configure Windows and Linux clients to operate in a network.
- Demonstrate the ability to solve basic problems & perform basic troubleshooting operations on LANs.
- Analyze network behavior from network data captures.
• Configure layer 2 (OSI) switches and explain their operation from the analysis of network data captures.
• Identify when a gateway is necessary and be able to configure a gateway on a workstation and a router in multiple ways.
• Configure a routed network with the use of static routes.
• Configure NAT and ACLs in a routed network
• Configure, analyze, and explain a routing protocol.
• Given a physical network topology identify the appropriate routing mechanism (gateways, static routes, and routing protocol) to employ at each point in the network.
• Configure Layer 2 (OSI) switches to provide network access by function through the use of static VLANS.
• Deploy a lab-sized wireless LAN using APs and AP controllers
• Set up a basic wireless LAN in the lab.

While there are many books available that cover these topics the following books will be used in the networking bridge course and can be used to prepare for the exam. They may be ordered online from Amazon.


Should you have any questions please direct them via email (qi.yu@rit.edu) to Professor Qi Yu, Director of Graduate Programs in the Department of Information Sciences and Technologies.