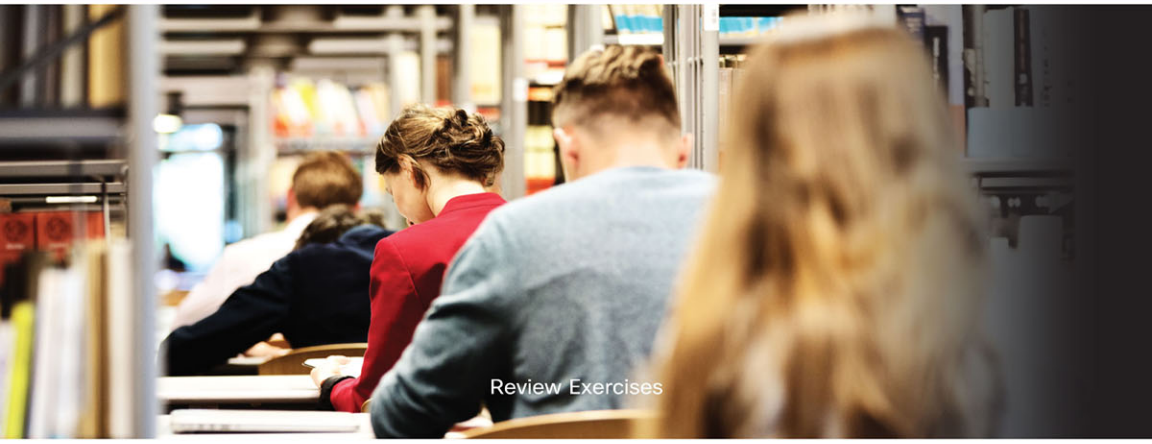

31 Days Before Your CCST Networking Exam

A Day-By-Day Review Guide for the CCST Networking 100-150 Certification Exam

ciscopress.com

Allan Johnson

FREE SAMPLE CHAPTER

31 Days Before Your

Cisco Certified Support Technician (CCST) Networking 100-150 Exam

A Day-By-Day Review Guide for the CCST-Networking Certification Exam

Allan Johnson

Cisco Press
Hoboken, NJ

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Allan Johnson entered the academic world in 1999 after 10 years as a business owner/operator to dedicate his efforts to his passion for teaching. He holds both an MBA and an MEd in training and development. He taught CCNA courses at the high school level for seven years and has taught both CCNA and CCNP courses at Del Mar College in Corpus Christi, Texas. In 2003, Allan began to commit much of his time and energy to the CCNA Instructional Support Team, providing services to Networking Academy instructors worldwide and creating training materials. He now splits his time between working as a curriculum lead for Cisco Networking Academy and as an account lead for Unicon (unicon.net) supporting Cisco's educational efforts.

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Patrick Gargano is a lead content advocate and instructor on the Technical Education team within Learning & Certifications at Cisco. Before joining Cisco in 2021, he worked as a Cisco Networking Academy instructor and instructor-trainer since 2000, and as a Certified Cisco Systems Instructor (CCSI) since 2005 for Fast Lane UK, Skyline ATS, and NterOne teaching CCNA and CCNP courses. Recently, he was responsible for developing Cisco's official ENARSI, ENSDWI, ENCC, SDWFND, and SDWSCS course content. He has published four Cisco Press books, and he holds CCNA, CyberOps Associate, and CCNP Enterprise certifications. He also holds BEd and BA degrees from the University of Ottawa and has a Master of Professional Studies (MPS) degree in computer networking from Fort Hays State University. He is a regular speaker at Cisco Live, presenting on topics related to SD-WAN and network troubleshooting. He lives in Quebec, Canada with his wife and son.

Dedications

For my wife, Becky. Thank you for all your support during this crazy whirlwind of a year. You are the stabilizing force that keeps me grounded.

Acknowledgments

As a technical author, I rely heavily on my technical editor; Patrick Gargano had my back for this work. Thankfully, when James Manly contacted him, he was willing and able to do the arduous review work necessary to make sure that you get a book that is both technically accurate and unambiguous.

Russ White's *Cisco Certified Support Technician CCST Networking 100-150 Official Cert Guide, First Edition* was one of my main sources. Russ is well known in the computer networking community where he is a highly respected expert. I recommend subscribing to the podcast *Hedge*, where Russ is a co-host.

The Cisco Network Academy authors for the online curriculum take the reader deeper, past the CCST Networking exam topics, with the ultimate goal of preparing the student not only for CCST Networking certification, but for more advanced college-level technology courses and degrees as well. Thank you especially to Rick Graziani, Bob Vachon, John Pickard, Dave Holzinger, Martin Benson, Suk-Yi Pennock, Allan Reid, Anna Bolen and the rest of the ACE team. Their excellent treatment of the material is reflected throughout this book.

James Manly, executive editor, effectively juggles multiple projects simultaneously, steering each from beginning to end. Thank you, James, for shepherding this project for me.

Thank you to the professional and thorough review of this work by development editor Ellie Bru, project editor Mandie Frank, and copy editor Bart Reed. Their combined efforts ensure that what I authored is ready for publication.

And to the rest of the Pearson family who contributes in countless ways to bring a book to the reader, thank you for all your hard work.

Contents at a Glance

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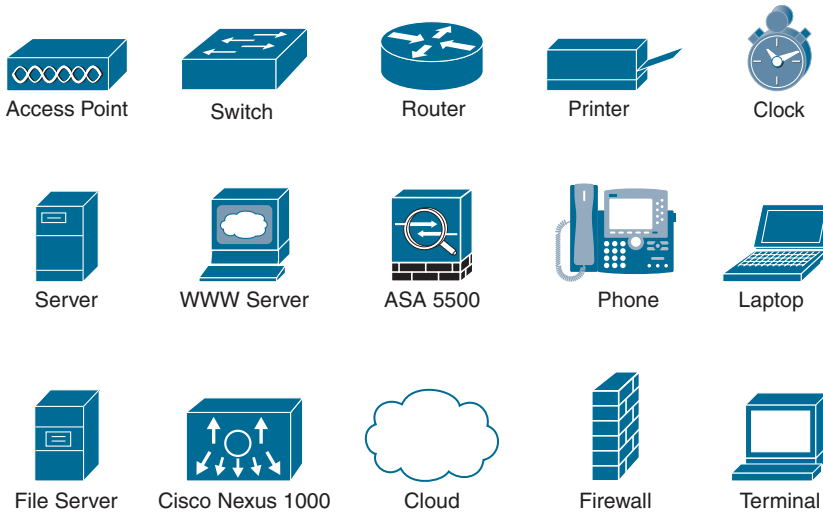

Command Syntax Conventions

The conventions used to present command syntax in this book are the same conventions used in the IOS Command Reference. The Command Reference describes these conventions as follows:

- **Boldface** indicates commands and keywords that are entered literally as shown. In actual configuration examples and output (not general command syntax), boldface indicates commands that are manually input by the user (such as a **show** command).
- *Italic* indicates arguments for which you supply actual values.
- Vertical bars (|) separate alternative, mutually exclusive elements.
- Square brackets ([ ]) indicate an optional element.
- Braces ({ }) indicate a required choice.
- Braces within brackets ([{ }]) indicate a required choice within an optional element.

Introduction

If you're reading this introduction, you've probably already spent a considerable amount of time and energy pursuing your CCST Networking certification. Regardless of how you got to this point in your travels through your studies, *31 Days Before Your Cisco Certified Support Technician (CCST) Networking 100-150 Exam* most likely represents the last leg of your journey on your way to the destination: to become a Cisco Certified Support Technician in Networking. However, if you are like me, you might be reading this book at the *beginning* of your studies. If so, this book provides an excellent overview of the material you must now spend a great deal of time studying and practicing. But I must warn you: unless you are extremely well-versed in networking technologies and have considerable experience supporting networks, this book will *not* serve you well as the sole resource for your exam preparations. Therefore, let me spend some time discussing my recommendations for study resources.

Study Resources

Cisco Press and Pearson IT Certification offer an abundance of networking-related books to serve as your primary source for learning how to install, configure, operate, and troubleshoot small to medium-size routed and switched networks.

Safari Books Online

All the resources I reference in the book are available with a subscription to Safari Books Online (https://www.safaribooksonline.com). If you don't have an account, you can try it free for ten days.

Primary Resources

First on the list must be Russ White's *Cisco Certified Support Technician CCST Networking 100-150 Official Cert Guide 1st Edition* (ISBN: 9780138213428). If you do not buy any other books, buy this one. Russ's method of teaching, combined with his technical expertise and down-to-earth style, is unsurpassed in our industry. As you read through his book, you sense that he is sitting right there next to you walking you through the material. With your purchase, you get access to practice exams and study materials and other online resources that are worth the price of the book. There is no better resource on the market for a CCST Networking candidate.

If you are a Cisco Networking Academy student, you are blessed with access to the online version of the Networking Essentials version 3 curriculum and the wildly popular Packet Tracer network simulator. However, this content is also available for free to anyone who signs up at https://skills-forall.com. After registering and logging in, look for the Network Technician Career Path (https://skillsforall.com/career-path/network-technician). Here, you can gain access to the following four mini-courses that add up to 70 hours of training:

- Networking Basics
- Networking Devices and Initial Configuration
- Network Addressing and Basic Troubleshooting
- Network Support and Security

You can also buy *Networking Essentials Companion Guide v3: Cisco Certified Support Technician (CCST) Networking 100-150, Second Edition* (ISBN: 978-0-13-832133-8), which maps to both the Networking Essentials version 3 instructor-led online course and the four self-enroll mini-courses. You might also consider purchasing *Networking Essentials Lab Manual v3: Cisco Certified Support Technician (CCST) Networking 100-150, 2nd Edition* (ISBN: 9780138293727). You can find these books at http://www.ciscopress.com by clicking the Cisco Networking Academy link.

The Cisco Learning Network

Finally, if you have not done so already, you should register with The Cisco Learning Network at https://learningnetwork.cisco.com. Sponsored by Cisco, The Cisco Learning Network is a free social learning network where IT professionals can engage in the common pursuit of enhancing and advancing their IT careers. Here, you can find many resources to help you prepare for your CCST Networking exam, in addition to a community of like-minded people ready to answer your questions, help you with your struggles, and share in your triumphs.

So which resources should you buy? The answer to that question depends largely on how deep your pockets are or how much you like books. If you're like me, you must have it all! I admit it; my bookcase is a testament to my Cisco "geekness." Whatever you choose, you will be in good hands. Any or all of these resources will serve you well.

Goals and Methods

The main goal of this book is to provide you with a clear and succinct review of the CCST Networking objectives. Each day, we will review an exam topic, starting with the first one and proceeding through the list objectives until they are all covered. Each day is structured using the following format:

- A title for the day that concisely states the overall topic
- A list of one or more CCST Networking 100-150 exam topics to be reviewed
- A "Key Topics" section to introduce the review material and quickly orient you to the day's focus
- An extensive review section consisting of short paragraphs, lists, tables, examples, and graphics
- A "Study Resources" section to give you a quick reference for locating more in-depth treatment of the day's topics

The book counts down starting with Day 31 and continues through exam day to provide post-test information. Inside this book is also a calendar and checklist that you can tear out and use during your exam preparation.

Use the calendar to enter each actual date beside the countdown day and the exact day, time, and location of your CCST Networking exam. The calendar provides a visual for the time you can dedicate to each exam topic.

The checklist highlights important tasks and deadlines leading up to your exam. Use it to help you map out your studies.

Who Should Read This Book?

The audience for this book is anyone finishing preparation for taking the CCST Networking 100-150 exam. A secondary audience is anyone needing a refresher review of CCST Networking exam topics, possibly as a review before attempting to sit for another certification for which the CCST Networking exam topics provide a foundation.

Getting to Know the CCST Networking 100-150 Exam

Cisco announced the current CCST Networking 100-150 exam in January 2023. This certification is aimed at entry-level network technicians, networking students, and interns. It tests foundational knowledge and skills in network operation, including the understanding of devices, media, and protocols vital for network communication. This certification serves as an entry point into the Cisco certification program, with CCNA being the next level. The exam is targeted toward secondary and post-secondary students, as well as entry-level IT and Networking professionals. To qualify, candidates should have a minimum of 150 hours of instruction and hands-on experience, and successful candidates will be recognized as qualified entry-level network technicians and customer support technicians.

To earn your certification, you must pass a 50-minute exam composed of 35 to 50 questions. Certiport has an exam tutorial here:

https://certiport.pearsonvue.com/Educator-resources/Exam-details/Exam-tutorials/Cisco_Tutorial.pdf

If that link doesn't work, be sure to register at https://www.certiport.com and then look for the exam tutorials link. One of the nice features of the CCST Networking exam is that you can move forward and back through test items, changing your answers if desired, before the exam ends or you select **Finish**.

What Topics Are Covered on the CCST Networking Exam

The six domains of the CCST Networking 100-150 exam are as follows:

- 1.0 Standards and Concepts
- 2.0 Addressing and Subnet Formats
- 3.0 Endpoints and Media Types
- 4.0 Infrastructure
- 5.0 Diagnosing Problems
- 6.0 Security

Although Cisco outlines general exam topics, not all topics might appear on the CCST Networking exam; likewise, topics that are not specifically listed might appear on the exam. The exam topics that Cisco provides and this book covers are a general framework for exam preparation. Be sure to check Cisco's website for the latest exam topics.

Purchase an Exam Voucher and Schedule Your Exam

If you are starting *31 Days Before Your Cisco Certified Support Technician (CCST) Networking 100-150 Exam* today, register with Certiport (https://www.certiport.com) and purchase your exam voucher right now. Next, use Certiport's locator to find a testing center (https://www.certiport.com/locator). Many testing centers provide remote testing in your chosen space. In my testing experience, there is no better motivator than a scheduled test date staring me in the face. I'm willing to bet the same holds true for you. So, if you're ready, gather the following information and register right now!

- Legal name
- Social Security or passport number
- Company name
- Valid email address
- Method of payment

You can schedule your exam at any time. I recommend that you schedule it for 31 days from now. The process and available test times vary based on the local testing center you choose.

Remember, there is no better motivation for study than an actual test date. *Sign up today*.

Credits

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Day 28

Measuring Network Performance

CCST Networking 100-150 Exam Topic

- 1.2. Differentiate between bandwidth and throughput.
  - *Latency, delay, speed test vs. iPerf*

Key Topics

Today's review focuses on the different measurements for network performance, the sources of delay, testing network performance online, and testing network performance using the Windows iPerf tool.

Bandwidth, Throughput, and Goodput

There are three basic measurements for network performance: bandwidth, throughput, and goodput.

Bandwidth

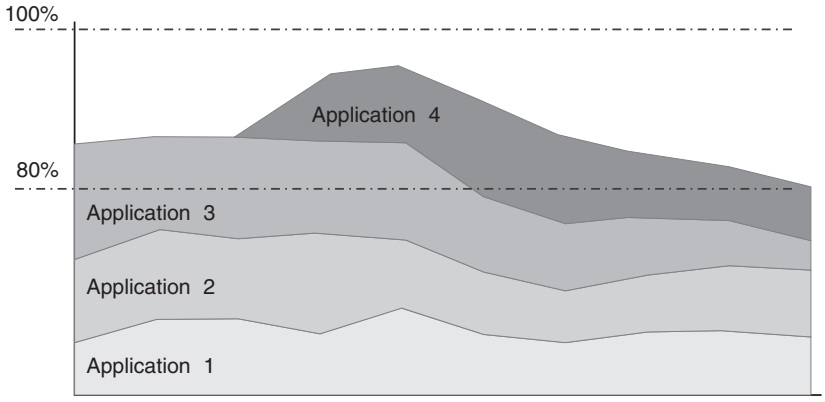
Bandwidth is determined by the medium's physical properties and is measured in bits per second. For example, 10GBASE-T Ethernet has a maximum capacity of 10Gbps (gigabits per second). The available bandwidth of a connection is how Internet service providers (ISPs) advertise and charge for their services.

Throughput

Throughput is the actual rate of data transfer across the network and will be less than the bandwidth. This is because there is overhead on the link, such as routing protocols, Layer 2 minimum frame sizes (Ethernet), network congestion, and more.

Another important reason that throughput is less than bandwidth is because network engineers want to ensure the link has enough capacity to adjust to new demand bursts. For example, in Figure 28-1, Application 4 might not be able to start if the other three applications are consuming closer to 100% of the link's capacity. For this reason, it is common for network designers to consider a link at 80% bandwidth utilization as full utilization.

Figure 28-1 Providing Enough Bandwidth for Another Application to Start



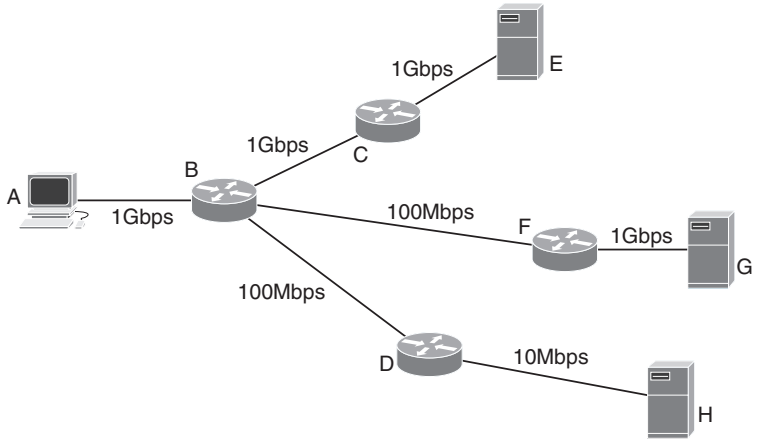
Goodput

Although less commonly mentioned, goodput is the measure of the actual payload of data that is transmitted across the network. Goodput will always be less than throughput because every data packet contains fields of overhead. For example, Ethernet has a 20-byte header and IPv6 has a 40-byte header. In addition, there will always be a small number of errors in data transmission where packets must be recent.

End-to-End Bandwidth

The bandwidth of an end-to-end path is limited by the lowest bandwidth link along the path. For example, a 1Gbps local link does not guarantee 1Gbps to all destinations. In Figure 28-2, Host A will have an end-to-end bandwidth of 1Gbps to Server E. However, Host A will be limited to 100Mbps to Server G and 10Mbps to Server H.

Figure 28-2 Lowest Bandwidth Link Determines End-to-End Bandwidth



Sources of Delay

Delay is the time it takes for a packet to travel from source to destination. Sources of delay include the following:

- The physical path length
- The time it takes to transmit data onto the wire (serialization delay)
- Queueing when there is congestion between the source and destination
- Jitter, which is the measure of difference in delay between packets

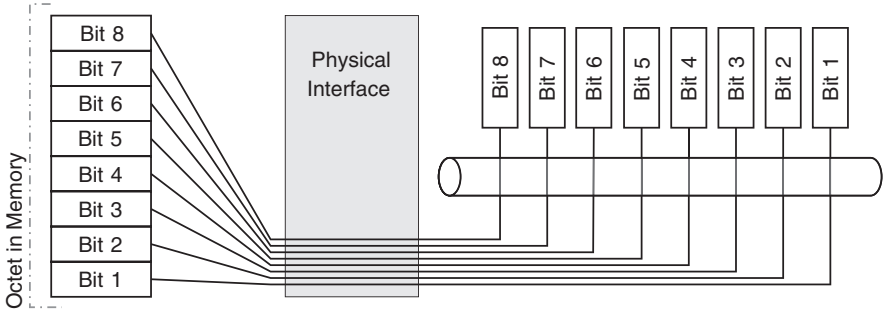
Physical Path Length

Physical path length is the actual distance that packets need to travel from the source to the destination. The physical path length is a fundamental factor in determining delay, as it contributes to the overall time it takes for a signal to traverse the distance. In general, longer physical paths result in higher delays.

Serialization Delay

Serialization delay refers to the time it takes to convert digital data into a stream of bits and transmit it onto the network. This process involves encoding the data and sending it out as a series of bits, as shown for the 8 bits in Figure 28-3.

Figure 28-3 Converting Digital Bits to the Physical Medium



Queueing Delay

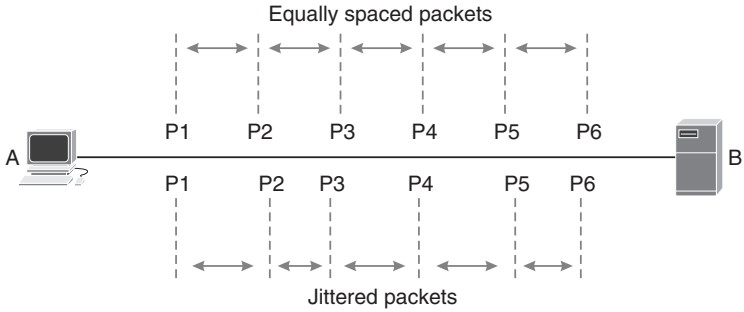
Queueing delay occurs when there is congestion or contention for resources within the network. When multiple packets are trying to traverse the same network link simultaneously, they may have to wait in a queue before they can be transmitted. This queueing delay is directly related to network traffic and the network's capacity. Higher levels of congestion lead to longer queueing delays.

Jitter

Jitter is the measure of variation in delay between packets. In an ideal network, packets would all arrive at the destination with consistent and predictable delays, as shown for the top row of packets in Figure 28-4. However, in real-world networks, factors such as varying traffic loads,

different routing paths, and queueing delays can introduce variation in the arrival times of packets, as shown in the bottom row of packets in Figure 28-4.

Figure 28-4 An Example of Equally Spaced and Jittered Packets

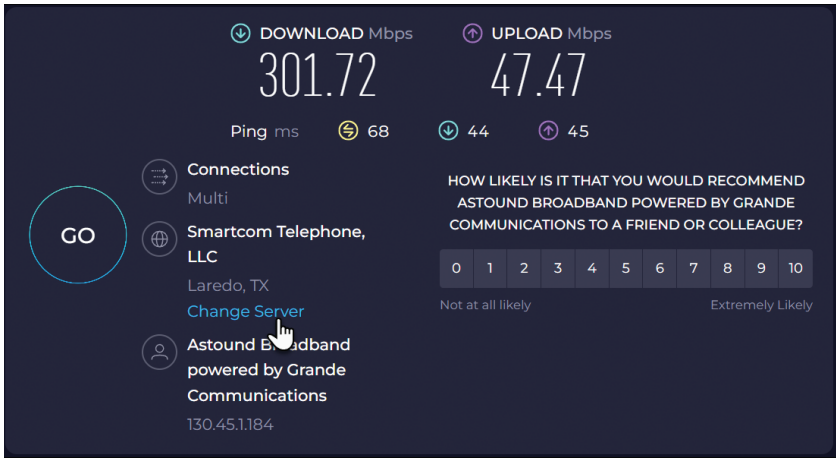


Jitter can be a significant issue in real-time applications like Voice over Internet Protocol (VoIP) or video streaming applications, where consistent timing is essential. To mitigate jitter, network engineers often use techniques like quality of service (QoS) to prioritize certain types of traffic and reduce variability in delay.

Speed Tests

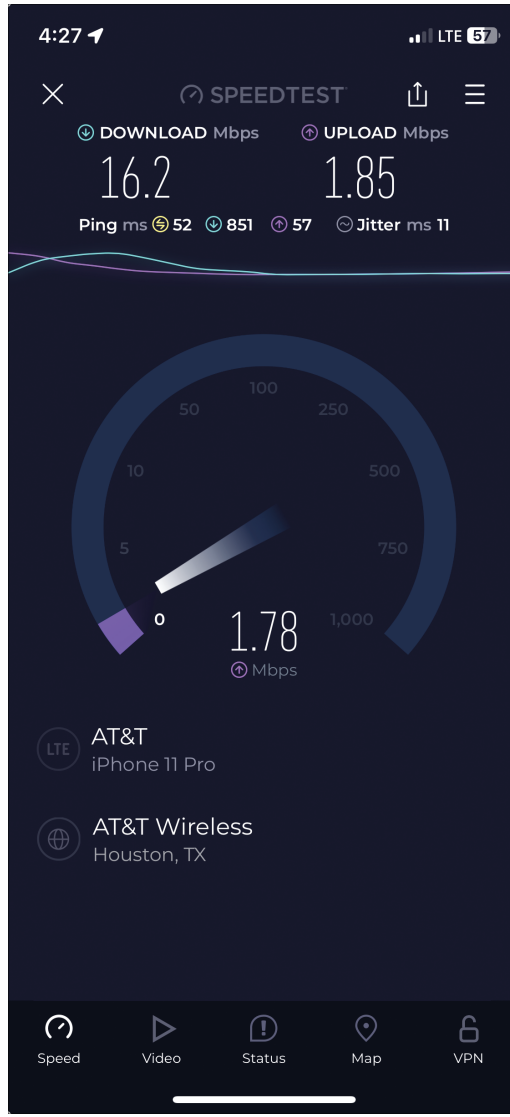
It's relatively easy for you to test the speed of your personal Internet connections. A quick Internet search will reveal several ad-supported sites that provide this service for free. Speed tests measure the throughput of your link. Specifically, they measure the throughput between you and the destination server that the speed test chooses for your test. Some speed tests, such as the one provided by Ookla, allow you to change the destination server, as shown in Figure 28-5.

Figure 28-5 Example of a Web-Based Speed Test by Ookla



Ookla also has an app you can use to test the throughput of your cellular bandwidth, as shown in Figure 28-6.

Figure 28-6 Ookla's Mobile App Speedtest



The iPerf Tool

Although there are a variety of other tools you could download for measuring your network's performance, the CCST-Networking exam specifically calls out the iPerf tool. As of this writing, iPerf is in version 3 and can be downloaded for all the major operating systems at https://iperf.fr.

Example 28-1 shows the iPerf tool running on a Windows machine, testing the connection to a public iPerf server in Dallas.

Example 28-1 Output from the iPerf Windows Tool

```
C:\tools\iperf-3.1.3-win32> iperf3 -c dal.speedtest.clouvider.net
Connecting to host dal.speedtest.clouvider.net, port 5200
[  4] local 192.168.68.106 port 61680 connected to 2.56.188.136 port 5200
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec   441 KBytes  3.60 Mbits/sec
[  4]   1.00-2.00   sec   756 KBytes  6.19 Mbits/sec
[  4]   2.00-3.01   sec   756 KBytes  6.18 Mbits/sec
[  4]   3.01-4.00   sec   693 KBytes  5.68 Mbits/sec
[  4]   4.00-5.00   sec   756 KBytes  6.20 Mbits/sec
[  4]   5.00-6.00   sec   756 KBytes  6.19 Mbits/sec
[  4]   6.00-7.00   sec   756 KBytes  6.21 Mbits/sec
[  4]   7.00-8.00   sec   756 KBytes  6.20 Mbits/sec
[  4]   8.00-9.01   sec   819 KBytes  6.62 Mbits/sec
[  4]   9.01-10.01  sec   819 KBytes  6.71 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-10.01  sec  7.14 MBytes  5.98 Mbits/sec                  sender
[  4]   0.00-10.01  sec  7.14 MBytes  5.98 Mbits/sec                  receiver

iperf Done.

C:\tools\iperf-3.1.3-win32>
```

NOTE You can easily find available iPerf public servers by doing an Internet search. The server chosen for Example 28-1 was found at https://github.com/R0GGER/public-iperf3-servers.

In Example 28-1, the number of kilobytes of data being transferred is measured every second. This value is then converted into the number of bits per second. After 10 seconds, we can see that the average throughput is 5.98Mbps for both the sender and the receiver.

Be sure you review the documentation for iPerf at https://iperf.fr/iperf-doc.php and practice different command-line options, including the following:

- **-s** sets the device to run in server mode.
- **-t** changes the amount of time in seconds to something other than the default 10 seconds.
- **-w** can be used to set the TCP window size.
- **-4** or **-6** indicate to only use IPv4 or IPv6, respectively.

Example 28-2 shows all the available options for iPerf on Windows.

Example 28-2 Windows iPerf Options

```
C:\tools\iperf-3.1.3-win32> iperf3 -h
Usage: iperf [-s|-c host] [options]
       iperf [-h|--help] [-v|--version]

Server or Client:
  -p, --port      #        server port to listen on/connect to
  -f, --format    [kmgKMG] format to report: Kbits, Mbits, KBytes, MBytes
  -i, --interval  #        seconds between periodic bandwidth reports
  -F, --file name          xmit/recv the specified file
  -B, --bind      <host>   bind to a specific interface
  -V, --verbose            more detailed output
  -J, --json               output in JSON format
  --logfile f              send output to a log file
  -d, --debug              emit debugging output
  -v, --version            show version information and quit
  -h, --help               show this message and quit
Server specific:
  -s, --server             run in server mode
  -D, --daemon             run the server as a daemon
  -I, --pidfile file       write PID file
  -1, --one-off            handle one client connection then exit
Client specific:
  -c, --client    <host>   run in client mode, connecting to <host>
  -u, --udp                use UDP rather than TCP
  -b, --bandwidth #[KMG][/#] target bandwidth in bits/sec (0 for unlimited)
                           (default 1 Mbit/sec for UDP, unlimited for TCP)
                           (optional slash and packet count for burst mode)
  -t, --time      #        time in seconds to transmit for (default 10 secs)
  -n, --bytes     #[KMG]   number of bytes to transmit (instead of -t)
  -k, --blockcount #[KMG]  number of blocks (packets) to transmit
(instead of -t or -n)
  -l, --len       #[KMG]   length of buffer to read or write
                           (default 128 KB for TCP, 8 KB for UDP)
  --cport         <port>   bind to a specific client port (TCP and UDP,
default: ephemeral port)
  -P, --parallel  #        number of parallel client streams to run
  -R, --reverse            run in reverse mode (server sends, client receives)
  -w, --window    #[KMG]   set window size / socket buffer size
  -M, --set-mss   #        set TCP/SCTP maximum segment size (MTU - 40 bytes)
  -N, --no-delay           set TCP/SCTP no delay, disabling Nagle's Algorithm
  -4, --version4           only use IPv4
  -6, --version6           only use IPv6
```

```
  -S, --tos N               set the IP 'type of service'
  -Z, --zerocopy            use a 'zero copy' method of sending data
  -O, --omit N              omit the first n seconds
  -T, --title str           prefix every output line with this string
  --get-server-output       get results from server
  --udp-counters-64bit      use 64-bit counters in UDP test packets

[KMG] indicates options that support a K/M/G suffix for kilo-, mega-, or giga-

iperf3 homepage at: http://software.es.net/iperf/
Report bugs to:     https://github.com/esnet/iperf

C:\tools\iperf-3.1.3-win32>
```

If you want to test the performance in your own network, download iPerf on the computer that will receive the iPerf packets. Use the **-s** option to start an iPerf server, as shown in Example 28-3.

Example 28-3 iPerf Running in Server Mode

```
C:\tools\iperf-3.1.3-win32> iperf3 -s
-----------------------------------------------------------
Server listening on 5201
-----------------------------------------------------------
```

NOTE You will most likely need to configure a rule on your local firewalls to allow iPerf traffic.

Study Resources

For today's exam topics, refer to the following resources for more study:

Resource	Module or Chapter
SFA Self Enroll: Networking Basics	1
SFA Self Enroll: Network Support and Security	1
SFA Instructor Led: Networking Essentials	1, 37
CCST Networking 100-150 Official Cert Guide	9

NOTE SFA: https://skillsforall.com/

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Symbols

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