

Computer Network Technicians

NOC 2281

Introduction

Computer network technicians establish, operate, maintain and co-ordinate the use of local and wide area networks (LANs and WANs), mainframe networks, hardware, software and related computer equipment. They set up and maintain Internet and intranet web sites and web server hardware and software, and monitor and optimize network connectivity and performance. They are employed in information technology units throughout the private and public sectors. Supervisors of computer network technicians are included in this group.

The most important Essential Skills for computer network technicians are:

- Digital Technology
- Oral Communication
- Problem Solving

Document Sections

- Reading
- Document Use
- Writing
- Numeracy
- Oral Communication
- Thinking Skills
 - Problem Solving
 - Decision Making
 - Critical Thinking
 - Job Task Planning and Organizing
 - Significant Use of Memory
 - Finding Information
- Working with Others
- Digital Technology
- Continuous Learning
- Notes

A. Reading

Reading

Tasks	Complexity Level	Examples
Typical	1 to 4	<p>Computer network technicians:</p> <ul style="list-style-type: none"> • read short passages on product labels, for example, read handling instructions on labels of hazardous goods, such as cleaning solutions. (1)
Most Complex	4	<ul style="list-style-type: none"> • read log book entries, for example, to learn about malfunctions and how they were handled, and system upgrades to hardware and software. (2) • read emails from coworkers, colleagues, clients and suppliers, for example, read requests for information about accessing data and recovering deleted files. (2) • read text entries in forms, such as comments on request-for-service forms to learn about problems users are experiencing. (2) • read company emails, memos and bulletins, for example, about planned shutdowns of Internet servers so that they can prepare for service interruptions. (2) • read information about upcoming conferences and webinars to update skills. (2) • read files documenting past file server and operating system problems and how they were solved. (2) • read product reviews online to research and compare products for purchase. (3) • read articles, editorials and features, both paper-based and online, to keep up with current trends and to learn about new technologies. For example, they read articles about data security trends and updates to software programs. (3) • read blogs and forums to locate troubleshooting and other technical advice. (3) • read manuals, both paper-based and online, to look up troubleshooting solutions, updates, and information about configuring hardware and software including routers, modems and smart switches. (4) • read and interpret letters of understanding, agreements and contracts, for example, they read software licensing agreements to understand usage rights and restrictions. (4) • may read lengthy audit reports, for example, supervisors may read consultants' reports for opinions on current equipment and proposed upgrades to systems. (4)

Reading Summary

The symbols >, >> and >>> are explained in the Use of Symbols section.

Type of Text	Purpose for Reading			
	To scan for specific information/To locate information	To skim for overall meaning, to get the 'gist'	To read the full text to understand or to learn	To read the full text to critique or to evaluate
Forms	>>>	>>>		
Labels	>>			
Notes, Letters, Memos	>>>	>>>	>>>	
Manuals, Specifications, Regulations	>>>	>>>	>>>	>>>
Reports, Books, Journals	>>>		>>>	>>>

B. Document Use

Document Use

Tasks	Complexity Level	Examples
Typical	1 to 3	Computer network technicians: <ul style="list-style-type: none"> locate and enter information in staff contact lists for email addresses and phone numbers, shift checklists and timesheets. (1)
Most Complex	3	<ul style="list-style-type: none"> locate information on product and equipment labels, for example, locate product codes, specification and serial numbers on electronic equipment. (1) enter information into lists and tables, for example, enter information into service logs about work performed and problems experienced. (2) locate information in assembly drawings to locate parts and installation sequences for devices, such as drives and

		<p>sound cards. (2)</p> <ul style="list-style-type: none"> • locate data in graphs, such as histograms to identify the most frequent reasons for trouble calls. (2) • locate information in lists, tables, and other information in databases to track projects and connect with co-workers. (2) • locate information in and create spreadsheets to compare products and costs, and to track inventories. (3) • locate information in and create network diagrams to illustrate network operation, and to compare old and new networks. (3) • locate information in forms, for example, read work order requests for information about software and hardware malfunctions, maintenance requirements and special instructions. (3) • enter information into forms, for example, enter names, dates, passwords and restriction and access codes into account application forms. (3) • locate and interpret information in schematics, for example, architectural features and layouts, such as routing paths of routers and ports in network schematics. (3)
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Document Use Summary

- Read signs, labels or lists.
- Complete forms by marking check boxes, recording numerical information or entering words, phrases, sentences or texts of a paragraph or more. The list of specific tasks varies depending on what is reported.
- Read completed forms containing check boxes, numerical entries, phrases, addresses, sentences or texts of a paragraph or more.
- Read tables, schedules and other table-like text.
- Create tables, schedules and other table-like text.
- Enter information on tables, schedules or other table-like text.
- Obtain information from graphs or charts.
- Construct or draw graphs or charts.
- Read assembly drawings (e.g., those found in service and parts manuals).
- Obtain information from sketches, pictures or icons (e.g., computer toolbars).

C. Writing

Writing

Tasks	Complexity Level	Examples
Typical	1 to 3	Computer network technicians: <ul style="list-style-type: none">• write short notes and reminders, such as “To Do” lists, lists of installation task descriptions in service log books, and reminders to co-workers about performance tests that need to be done. (1)
Most Complex	4	<ul style="list-style-type: none">• write emails to co-workers, for example, when they notice something suspicious while checking an alert or monitoring software, or to ask IT to do a switch reset. (2)• write text entries into incident forms, for example, descriptions of problems and the steps taken to resolve them as part of incident reports. (2)• write emails to customers, supervisors and suppliers. For example, they respond to questions from customers, or ask suppliers about new products or technical solutions to problems. (2)• write text entries into forms that are mostly computer-based including work orders, logbooks, and customer work orders. (2)• write instructional guides, for example write guides to help inexperienced users install and update software. (3)• write proposals detailing technical requirements, steps that need to be completed and timelines. (4)• may write reports, for example, system audit reports in which they describe the quality of networks, web service and messaging systems, and make recommendations for improvement. (4)

Writing Summary

The symbols >, >> and >>> are explained in the Use of Symbols section.

	Purpose for Writing						
Length	To organize/ to remember	To keep a record/to document	To inform/ to request information	To persuade/ to justify a request	To present an analysis or comparison	To present an evaluation or critique	To entertain
Text requiring less than one paragraph of new text	>>>	>>>	>>>				
Text rarely requiring more than one paragraph		>>>	>>>		>>>		
Longer text			>>	>>	>>	>>	

D. Numeracy

The symbols >, >> and >>> are explained in the Use of Symbols section.

Numeracy

Tasks	Complexity Level	Examples
>> Money Math	1	Computer network technicians: <ul style="list-style-type: none"> may buy parts, supplies, tools and equipment using money from petty cash. (Money Math), (1)
>>> Scheduling, Budgeting and Accounting	2 to 4	<ul style="list-style-type: none"> calculate expense claim amounts, for example calculate charges for using a personal vehicle by multiplying distance traveled by per kilometre rates, and adding amounts for meals, hotel rooms and incidentals. (Scheduling, Budgeting and Accounting), (2) calculate quantities of network hardware and peripheral equipment, for example cables, routers, switches, hubs and other materials needed for new installations and

Measurement and Calculation	3	<p>equipment updates. (Scheduling, Budgeting and Accounting), (2)</p> <ul style="list-style-type: none"> • manage inventories and databases of network hardware and software and data storage capacity, for example, inventories of equipment including routers, cables, switches and hard drives. (Scheduling, Budgeting and Accounting), (2)
>> Data Analysis	1 to 3	
>>> Numerical Estimation	2	<ul style="list-style-type: none"> • create and adjust schedules, timetables and timelines, for example, develop schedules for data backups, software update runs, diagnostics testing and equipment maintenance. (Scheduling, Budgeting and Accounting), (3) • calculate invoice amounts, for example calculate professional fees for services using hourly and daily rates. They add costs for supplies, apply discounts and taxes, and calculate totals and sub-totals. (Scheduling, Budgeting and Accounting), (3) • calculate unit and net prices, for example, network administrators calculate prices of individual pieces of networking software and equipment offered in bundled packages. They calculate net prices for equipment after corporate discounts. (Scheduling, Budgeting and Accounting), (3) • may create operational budgets, for example, network and system administrators calculate operating costs for networking, messaging and website systems. They consider costs for staffing, overhead, supplies, goods, services and special projects. (Scheduling, Budgeting and Accounting), (4) • use binary code on mainframe, and translate numbers into and from binary, decimal and hexadecimal numbers, for example, use binary to check IP addresses match. (Measurement and Calculation), (3) • calculate capacity requirements for computers and networks, such as bandwidth requirements for networks to determine the quantities, sizes and types of cables, routers, switches and hubs required. (Measurement and Calculation), (3) • compare counts and readings to standards and specifications to verify that network systems and computer workstations are working properly. (Data Analysis), (1) • collect data and develop statistics to describe the performance of computers and networks, for example, analyze data on input and output operations to identify changes in the usage and performance of mainframes and network systems. (Data Analysis), (3) • estimate time needed to complete work tasks, such as

		software upgrades and data backup. (Numerical Estimation), (2)
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Math Skills Summary

a. Mathematical Foundations Used

The symbols >, >> and >>> are explained in the Use of Symbols section.

Mathematical Foundations Used

Code	Tasks	Examples
		Number Concepts
>>>	Whole Numbers	Read and write, count, round off, add or subtract, multiply or divide whole numbers. For example, inventory control.
>>>	Integers	Read and write, add or subtract, multiply or divide integers. For example, reading and writing budget surpluses and deficits; reading and entering negative and positive measurement values.
>>	Rational Numbers - Decimals	Read and write, round off, add or subtract decimals, multiply or divide by a decimal, multiply or divide decimals. For example, calculating expenses and invoice amounts, and calculating unit and net prices of equipment.
>>	Rational Numbers - Percent	Read and write percents, calculate the percent one number is of another, calculate a percent of a number. For example, calculating percent discounts for invoice amounts; reading and writing performance specifications in percentages; calculating percentage of free disk space.
>>>	Other Real Numbers	Use powers and roots, scientific notation, significant digits. For example, using megabytes and gigabytes for bandwidth or to report how much space is available.
		Shape and Spatial Sense
>>>	Measurement Conversions	Perform measurement conversions. Convert between decimals, binary and hexadecimals.
		Statistics and Probability
>>>	Summary Calculations	Calculate averages. Using tables, schedules or other table-like text. Using graphical presentations. For example, locate data in graphs, such as the most frequent reason for calls.
>>	Statistics and Probabilities	Use descriptive statistics (e.g. collecting, classifying, analyzing and interpreting data). Use inferential statistics (e.g. using mathematical theories of probability, making conclusions about a population or about how likely it is that some event will happen). For example, analyze data on input and output operations to identify changes in the usage and performance of mainframes and network

		systems.
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b. How Calculations are Performed

- in head
- calculator
- computer – spreadsheet calculations, online software programs

c. Measurement Instruments Used

- time
- megabytes, gigabytes, terabytes – space on hard drive

E. Oral Communication

Oral Communication

Tasks	Complexity Level	Examples
Typical	2 to 3	Computer network technicians: <ul style="list-style-type: none">• discuss ongoing work with co-workers, for example, methods for troubleshooting problems that come up, or procedures for switching server systems during scheduled maintenance operations. (2)
Most Complex	4	<ul style="list-style-type: none">• explain projects to clients using terms and descriptions the client will understand, for example, how Wi-Fi access will be set up for employees on phones and computers. (2)• answer questions and give instructions to computer and network users, such as questions from users about changing access codes and recovering deleted files. (2)• ask clients and network users for information to solve problems they are experiencing, for example, they are unable to send an email or open an attachment. (2)• train clients about using their network using online training sessions and video conferencing. (3)• attend meetings with managers and co-workers to update progress on projects or to collaborate with other teams, for example, discuss difficult-to-solve problems or methods for improving an email system. (3)• discuss the technical aspects of computers and networks with co-workers, colleagues, suppliers, and network and computer users, for example, discuss malfunctions of networking hardware and software with co-workers and give instructions for repairs. (3)• may give instructions to workers they supervise, for example, computer network supervisors give instructions to carry out recovery operations and system shutdowns. (3)

		<ul style="list-style-type: none">• negotiate difficult situations with clients and network users who are upset or angry about disruptions to service. (3)• make presentations to managers, management committees, boards of directors and colleagues, for example, present plans for proposed website architecture to managers and management committees. (4)
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Modes of Communication Used

- In person
- Telephone
- Online, webinar

Environmental Factors Affecting Communication

None reported.

Oral Communication Summary

The symbols >, >> and >>> are explained in the Use of Symbols section.

Purpose for Oral Communication (Part I)						
Type	To greet	To take messages	To provide/receive information, explanation, direction	To seek, obtain information	To co-ordinate work with that of others	To reassure, comfort
Listening (little or no interaction)						
Speaking (little or no interaction)						
Interact with co-workers			>>>	>>>	>>>	
Interact with those you supervise or direct			>			
Interact with supervisor/manager			>>>	>>>	>>>	
Interact with peers and colleagues from other organization						
Interact with customers/clients/public			>>>	>>>		
Interact with suppliers, servicers			>>	>>		
Participate in group discussion			>>>	>>>	>>>	
Present information to a small group			>>			
Present information to a large group						

The symbol √ is explained in the Use of Symbols section.

Purpose for Oral Communication (Part II)						
Type	To discuss (exchange information, opinions)	To persuade	To facilitate, animate	To instruct, instill understanding, knowledge	To negotiate, resolve conflict	To entertain
Listening (little or no interaction)						
Speaking (little or no interaction)						
Interact with co- workers	>>>			>>>		
Interact with those you supervise or direct	>			>		
Interact with supervisor/manager	>>>					
Interact with peers and colleagues from other organization						
Interact with customers/clients/ public	>>>	>>>		>>>	>>	
Interact with suppliers, servicers	>>					
Participate in group discussion	>>>					
Present information to a small group	>>	>		>>		
Present information to a large group						

F. Thinking Skills

1. Problem Solving

Problem Solving

Tasks	Complexity Level	Examples
Typical	2	Computer network technicians: <ul style="list-style-type: none">• discover they do not have enough supplies for maintenance and upgrade activities, for example, not enough cables for setting up workstations. They contact alternate suppliers and create temporary set-ups to run workstations until the correct cables arrive. (2)
Most Complex	3	<ul style="list-style-type: none">• find they are unable to maintain efficient network operations because co-workers and users are not following security, storage and backup procedures. They send out memos about the risks of such activities, implement additional security controls and speak to the individuals involved. (2)• discover that the physical worksite does not match the layout shown in drawings. They advise customers and supervisors of the problem and complete other work until the needed drawings are available. (2)• figure out how to solve difficult problems, such as a credit card machine that cannot communicate with the server, by asking co-workers and searching online for solutions. For critical problems they may have to find a way to work around the problem or come up with a temporary solution. (3)

2. Decision Making

Decision Making

Tasks	Complexity Level	Examples
Typical	2	Computer network technicians: <ul style="list-style-type: none">• choose to replace hardware and upgrade software, for example, choose to upgrade security monitoring and containment software when their computers and systems fail to detect viruses during test runs. (2)
Most Complex	3	<ul style="list-style-type: none">• decide on computer purchases based on need, cost and budget. Make purchasing decisions, such as cables, compact disks, routers and switches. They seek approval for purchases of more expensive equipment, such as

		<p>servers. (2)</p> <ul style="list-style-type: none"> • decide on the level of urgency of problems reported by users based on various factors including complexity of the problem. (2) • may select job tasks and assignments for staff they supervise, for example assign customer service activities to technicians who are comfortable giving instructions and answering questions. They consider the complexity of job tasks and the skill and training required by workers. (2) • choose configurations for computers and networks, for example select the configuration of local and wide area networks to meet operational and business requirements. (3)
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3. Critical Thinking

Critical Thinking

Tasks	Complexity Level	Examples
Typical	2 to 3	<p>Computer network technicians:</p> <ul style="list-style-type: none"> • may evaluate the work performance of workers they supervise. For example, network and system administrators assess workers' technical skills by observing them as they carry out job tasks, inspecting the quality of their work and monitoring their productivity. (2) • assess the suitability of network hardware and software, for example, assess the suitability of exchange server software by reviewing data on compatibility with other software programs, adaptability to specific business needs and capability to block spam and manage mail. (3) • assess functionality of networks, for example evaluate the functionality of business intranets by examining security and performance data to identify transfer rates, incidence of error and failure readings, and number of unplanned shutdowns. They use their assessments to make recommendations for changes to enhance performance. (3)
Most Complex	3	

4. Job Task Planning and Organizing

Job Task Planning and Organizing

Complexity Level	Description
3	<p>Own job planning and organizing:</p> <ul style="list-style-type: none">• sequence their own job tasks. They integrate their activities with co-workers and colleagues to carry out job tasks, such as data recovery and the installation of software and hardware. They plan a variety of activities, such as monitoring, testing and upgrading networks, supporting network users and responding to their questions. They reschedule job tasks to accommodate emergency troubleshooting of system failures.

5. Significant Use of Memory

Examples

- remember the features of new or updated software to answer questions from clients.
- remember solutions for solving networking or software issues in case similar problems occur with the same or different clients
- remember client network set up to more efficiently answer client questions or deal with client issues.

6. Finding Information

Finding Information

Tasks	Complexity Level	Examples
Typical	2	<p>Computer network technicians:</p> <ul style="list-style-type: none">• ask coworkers, colleagues and supervisors for information or help with troubleshooting. (2)• refer to work orders and log book entries to learn more about customer requests and problems they are experiencing. (2)
Most Complex	3	<ul style="list-style-type: none">• find information about networking equipment and software by reviewing magazines, trade publications and suppliers' websites. (2)• participate in online technical support forums and consult other network technicians, software and hardware specialists and consultants. (3)

G. Working with Others

Working with Others

Complexity Level	Description
3	Computer network technicians coordinate and integrate job tasks with co-workers, such as programmers, technical support staff, system analysts, other network and web technicians and supervisors.

Participation in Supervisory or Leadership Activities

- Participate in informal discussions about work processes or product improvement.
- Have opportunities to make suggestions on improving work processes.
- Inform other workers or demonstrate to them how tasks are to be performed.
- Select contractors and suppliers.

H. Digital Technology

Digital Technology

Tasks	Complexity Level	Examples
Typical	1 to 4	Computer network technicians: <ul style="list-style-type: none"> • use electronic office equipment, such as printers, scanners, fax machines and copiers. (1) • use presentation software to create slide presentations. They insert and format text, tables, graphs, pictures and diagrams. (2) • may use bookkeeping, billing and accounting software to track costs and produce invoices. (2) • use communication software to exchange email and attachments with co-workers, colleagues, clients, network users and suppliers, and to manage distribution lists and schedule meetings. (2) • use the Internet to access articles to stay current on industry trends and practices. (2) • use the Internet to locate information about network software and hardware set-ups, and to visit software developer and technical support websites. (2) • use the Internet to access blogs and forums where they seek and offer advice about industry and product trends, troubleshooting, and other technical information. (2) • use the Internet to access training courses and seminars
Most Complex	5	

		<p>offered by suppliers, employers and schools. (2)</p> <ul style="list-style-type: none"> • use video conferencing and online training sessions. (2) • use advanced features of word processing software to write, edit and format a variety of documents. (3) • create and modify spreadsheets to organize data on network performance and usage. They use macros, insert calculation functions, merge cells, import and export data, and create graphs. (3) • use cloud technology to share, transfer and backup data on remote networks. (3) • use the Internet and intranets to make changes and complete repairs to software remotely. (3) • may use advanced features of project management applications to record activities, assign tasks to workers, schedule activities, balance workloads and print reports. (3) • use operations and infrastructure management software to monitor the performance of servers, networks and devices including routers, network attached storage, virtual hosts, Linux servers and Windows servers. (4) • use operating system software to manage network users' accounts and to establish access rights for group folders. (4) • use software to configure a variety of computer and network peripheral hardware. (4) • use advanced technical skills to create and modify databases that manage data on network computers using data-embedded graphical representations of complex systems, such as workflows, processes and business infrastructure. For example, when a client is experiencing a problem, the computer network technician will already have the history of their computer in the database. They can use this to explain how a network operates to a customer or create a visual to compare a new network to an old network. (5) • design and set-up new computer networks after assessing computer system and network needs. They install and configure operating systems to create networks. (5)
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Computer Use Summary

- use word processing
- use graphics software
- use databases
- use spreadsheets
- may use bookkeeping, billing and accounting software

- use communications software

I. Continuous Learning

Continuous Learning

Complexity Level	Description
4	Continuous learning is critical for computer network technicians as information technologies are constantly changing. They need to maintain current knowledge of networking applications and security practices. If employed by larger companies, they may be sent to conferences and for training to update their skills. Computer network technicians access online training, for example, Microsoft has certification programs. Computer network technicians also attend trade shows and webinars. (4)

How Learning Occurs

Learning may be acquired:

- As part of regular work activity.
- From co-workers.
- Through training offered in the workplace.
- Through reading or other forms of self-study
 - at work.
 - on worker's own time.
 - using materials available through work.
 - using materials obtained through a professional association or union.
 - using materials obtained on worker's own initiative.
- Through off-site training
 - during working hours at no cost to the worker.
 - partially subsidized.

J. Additional Information

In addition to collecting information for this Essential Skills Profile, our interviews with job incumbents also asked about the following topics.

Physical Aspects

Mostly sitting.

Attitudes

Computer network technicians need good troubleshooting and problem solving skills with the patience to “try and try and test things out until they work.”

Impact of Digital Technology

All essential skills are affected by the introduction of technology in the workplace. Computer network technicians' ability to adapt to new technologies is strongly related to their skills levels across the essential skills, including reading, writing, thinking and communication skills. Technologies are transforming the ways in which workers obtain, process and communicate information, and the types of skills needed to perform in their jobs. In particular, computer network technicians need enhanced digital skills to manage rapidly changing computer technologies. For instance, workers need the hardware and system skills to design, set up, maintain or repair computer systems. They also require the necessary skills to install new software, replace existing hardware and configure operating systems to create networks. New developments in network technology require these workers to continually enhance their skills in order to keep current.

Technology in the workplace further affects the complexity of tasks related to the essential skills required for this occupation. Computer network technicians need the skills to use increasingly complex and specialized software applications. For example, workers use operating system software to manage network users' accounts and to establish access rights for group folders. They also use cloud technology to share, transfer and back up data on remote networks. On the other hand, using databases and the Internet can make locating information easier for workers, just as using specialized software applications that input data automatically can help workers complete documents with speed and accuracy.

K. Notes

This profile is based on interviews with job incumbents across Canada and validated through consultation with industry experts across the country.

For information on research, definitions, and scaling processes of Essential Skills Profiles, please consult the Readers' Guide to Essential Skills Profiles.