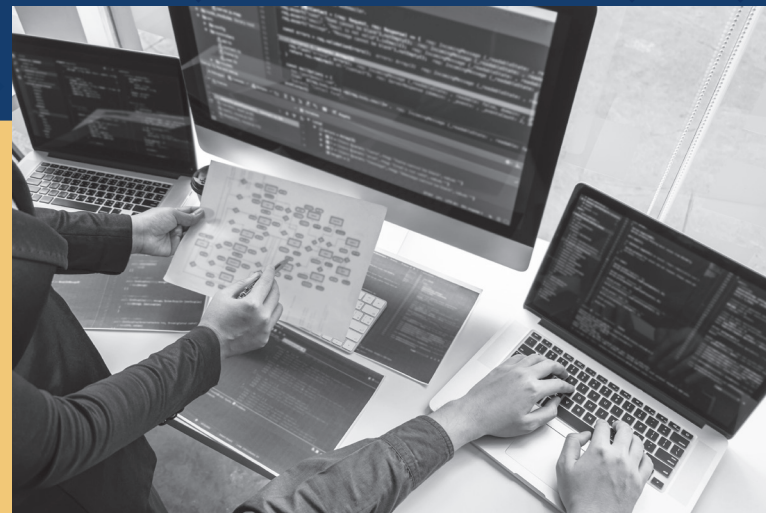


Information Technology

COMPETENCY MAP



#Prepared4PA

Pennsylvania's
STATE SYSTEM
of Higher Education



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OVERVIEW

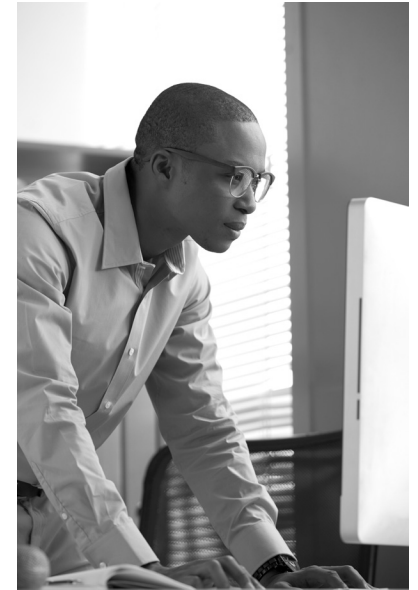
Pennsylvania's State System of Higher Education (PASSHE) is building industry-education-workforce collaboratives to foster stronger connections in our state's workforce ecosystem. This report on high-demand occupations is designed to articulate the competencies, skills, and credentials required by employers to inform quality, robust, industry-validated training and education programs.

WHY COMPETENCIES MATTER

Competencies represent sets of skills, knowledge, and attitudes necessary for broad job functions. These competencies are linked to successful performance and are desirable regardless of an individual's area of expertise or role. Competencies provide a framework to help focus individuals' behavior on things that matter most to an organization and help drive success. They can provide a common way to harmonize, select, and develop talent. Competencies help define how a person should perform a role, and they are often determined in the context of workplace demands - the knowledge, and skills needed to do a specific job or task.

HOW TO USE THESE COMPETENCY MAPS AND CAREER PATHWAYS

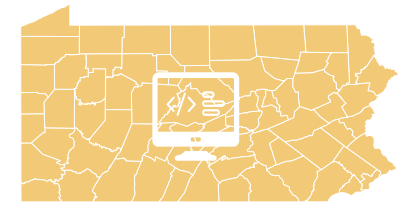
The competency maps are meant to serve as a tool for the State System and other education and training providers to develop curricula for pilot programs that meet employer needs for identified in-demand occupations. An important note about these competency maps and career pathways is that they are not an exact science - these competency maps are meant to serve as tools for what is generally required for each occupation. Requirements for competencies vary based on many factors such as employer size, preference, location, and specific need.



CAEL collaborated with the State System to develop the following Competency Maps in Key Industries across the Commonwealth. Recognizing that adult learners are the backbone of the U.S. economy, CAEL helps forge a clear, viable connection between education and career success, providing solutions that promote sustainable and equitable economic growth. CAEL opens doors to opportunity in collaboration with workforce and economic developers, postsecondary educators, and employers, industry groups, foundations, and other mission-aligned organizations. By engaging with these stakeholders, we foster a culture of innovative, lifelong learning that helps individuals and their communities thrive. Established in 1974, CAEL, a Strada Education Network affiliate, is a nonprofit 501(c)(3) membership organization.

PENNSYLVANIA'S INFORMATION TECHNOLOGY INDUSTRY

The Information Technology Industry is large and growing across the state, the \$56.1 billion sector accounts for almost 8% of Pennsylvania's total economy. At the statewide level, the following occupations within these competency maps are primarily employed within Corporate, Subsidiary, and Regional Managing Offices, Computer Systems Design Services, Customer Computer Programming Services, and State Government, Excluding Education and Hospitals sub-industries.



Digging further at the regional level, the Northern and Western Regions have Corporate, Subsidiary, and Regional Managing Offices primarily employ these occupations, whereas the Southern Region's largest is State Government Excluding Education and Hospitals and the Eastern Region has more concentration in the Customer Computer Programming Services sub-industry. Below is an example of some regional specific sub-industries within which these occupations are primarily employed:

HIGH LEVEL REGIONAL SUB-INDUSTRIES COMPARISONS WITHIN INFORMATION TECHNOLOGY

NORTHERN

- ⊗ Corporate, Subsidiary, and Regional Managing Offices
- ⊗ Wired Telecommunications Carriers
- ⊗ Computer Systems Design Services

SOUTHERN

- ⊗ State Government, Excluding Education and Hospitals
- ⊗ Corporate, Subsidiary and Regional Managing Offices
- ⊗ Computer Systems Design Services

EASTERN

- ⊗ Customer Computer Programming Services
- ⊗ Computer Systems Design Services
- ⊗ Corporate Subsidiary, and Regional Managing Offices

WESTERN

- ⊗ Corporate, Subsidiary, and Regional Managing Offices
- ⊗ Customer Computer Programming Services
- ⊗ Computer Systems Design Services

The occupations included in these competency maps are the most in-demand information technology occupations across the state, typically with varying degrees of need at regional levels. However, within this industry, Software Developers/Computer Programmers are in high demand across all regions in Pennsylvania with variations beyond that in demand for Computer User Support Specialists, Management Analysts, and Network and Computer Systems Administrators.

REGIONAL IN-DEMAND OCCUPATIONS WITHIN INFORMATION TECHNOLOGY

NORTHERN

- ⊗ Software Developers/Computer Programmers
- ⊗ Computer User Support Specialists
- ⊗ Management Analysts
- ⊗ Network and Computer Systems Administrators
- ⊗ Telecommunications Equipment Installers and Repairers, Except Line Installers

SOUTHERN

- ⊗ Software Developers/Computer Programmers
- ⊗ Computer User Support Specialists
- ⊗ Network and Computer Systems Administrators
- ⊗ Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
- ⊗ Computer and Information Systems Managers

EASTERN

- ⊗ Software Developers/Computer Programmers
- ⊗ Management Analysts
- ⊗ Network and Computer Systems Administrators
- ⊗ Computer User Support Specialists
- ⊗ Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products

WESTERN

- ⊗ Software Developers/Computer Programmers
- ⊗ Management Analysts
- ⊗ Computer User Support Specialists
- ⊗ Network and Computer Systems Administrators
- ⊗ Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products

INDUSTRY-WIDE FOUNDATIONAL SKILLS

Below, please find a list of top foundational skills within the Information Technology industry. Foundational skills are defined as core skills that provide a foundation for success in school and in the world of work. Nationally, employers have identified a link between foundational skills and job performance and foundational skills are often a prerequisite for workers to learn new industry-specific skills. Foundational skills are broken down into three categories as defined below:



INFORMATION TECHNOLOGY: INDUSTRY-WIDE FOUNDATIONAL SKILLS

PERSONAL EFFECTIVENESS COMPETENCIES

These competencies are essential for all life roles - roles as a member of a family, a community, and a larger society. These “soft skills” are increasingly valued in the labor market.

- ⊗ **Interpersonal Skills:** Displaying skills to work effectively with others from diverse backgrounds.
- ⊗ **Professionalism:** Maintaining a professional presence when working with clients, partners, and on social media that aligns with company culture.
- ⊗ **Adaptability:** Displaying the capability to adapt to new, different, or changing requirements.
- ⊗ **Lifelong Learning:** Demonstrating a commitment to self-development and improvement of knowledge and skills.
- ⊗ **Integrity:** Displaying strong moral principles and work ethic.
- ⊗ **Initiative:** Demonstrating a commitment to effective job performance by taking action on one's own and following through to get the job done.
- ⊗ **Dependability:** Displaying responsible behaviors at work including completing work on time and being persistent in seeing issues through to resolution.

ACADEMIC COMPETENCIES

These are critical competencies primarily learned in an academic setting, as well as cognitive functions and thinking styles. These competencies are likely to apply to all organizations in a single industry or be represented by an industry association nationwide.

- ⊗ **Communication:** Listening, speaking, and signaling so others can understand using a variety of methods, including hearing, speech, American Sign Language, instant messaging, text-to-speech devices, etc.
- ⊗ **Basic Computer Skills:** Using information technology and related applications, including adaptive devices and software, to convey and retrieve information.
- ⊗ **Critical & Analytical Thinking:** Using logical thought processes to analyze information and draw conclusions.
- ⊗ **Reading:** Understanding written sentences, paragraphs, and figures in work-related documents on paper, on computers, or adaptive devices.
- ⊗ **Writing:** Using standard business English to compile information and prepare written documents on paper, computers, or adaptive devices.
- ⊗ **Mathematics:** Using mathematics to express ideas and solve problems.
- ⊗ **Science & Technology:** Using scientific rules and methods to express ideas and solve problems on paper, on computers, or on adaptive devices.

WORKPLACE COMPETENCIES

These competencies represent those skills and abilities that allow individuals to function in an organizational setting.

- ⊗ **Problem Solving/Decision Making:** Generating, evaluating, and implementing solutions to problems.
- ⊗ **Leadership:** Managing and leading team members to successful outcomes in the workplace.
- ⊗ **Teamwork:** Working cooperatively with others to complete work assignments, especially while utilizing collaborative software.
- ⊗ **Scheduling/Coordinating:** Making arrangements that fulfill all requirements as efficiently and economically as possible.
- ⊗ **Customer Focus:** Efficiently and effectively addressing the needs of clients/customers.
- ⊗ **Instruction/Teaching:** Teaching others how to do something.
- ⊗ **Detail Orientation:** Being accurate and thorough in review and development of work materials/ content.
- ⊗ **Creative Thinking:** Generating innovative and creative solutions.



INFORMATION TECHNOLOGY

COMPUTER USER SUPPORT SPECIALISTS

JOB DESCRIPTION	Provide technical assistance to computer users. Answer questions or resolve computer problems for clients in person, or via telephone or electronically. May provide assistance concerning the use of computer hardware and software, including printing, installation, word processing, electronic mail, and operating systems.	
KEY FOUNDATIONAL SKILLS	Problem Solving/Decision Making, Communications, Customer Focus, Detail Orientation, Leadership	
PRINCIPLES OF INFORMATION TECHNOLOGY	<p>Training: Develop training materials and procedures, or train users in the proper use of hardware or software.</p> <p>Maintain Records: Maintain records of daily data communication transactions, problems and remedial actions taken, or installation activities.</p> <p>Create Requirements: Establish requirements for new systems or modifications by conferring with staff, users, and management.</p>	
DATABASES AND APPLICATIONS	Monitor & Detect: Oversee the daily performance of computer systems, verify correct operations, and detect errors by entering commands and observing system functioning.	
SOFTWARE DEVELOPMENT & MANAGEMENT	<p>Referral: Refer major hardware or software problems or defective products by communicating with vendors or technicians for service.</p> <p>Installation & Repair: Install and perform minor repairs to hardware, software, or peripheral equipment by following design or installation specifications. Set up equipment for employee use by performing or ensuring proper installation of cables, operating systems, or appropriate software.</p> <p>Evaluate: Prepare evaluations of software or hardware, and recommend improvements or upgrades.</p>	
USER & CUSTOMER SUPPORT	Customer Support: Resolve problems by answering user inquiries regarding computer software or hardware operation. Investigate and resolve problems or provide technical assistance and support by reading technical manuals, conferring with users, or conducting computer diagnostics.	
COMPLIANCE	Manage Network Security: Protect data, software, and hardware by planning, coordinating, and implementing network security measures. Understand and implement cybersecurity protocols and protections.	
RISK MANAGEMENT, SECURITY & INFORMATION ASSURANCE	Manage Network Security: Protect data, software, and hardware by planning, coordinating, and implementing network security measures. Understand and implement cybersecurity protocols and protections.	
KNOWLEDGE	Security, Computers and Electronics, Customer and Personal Service, Telecommunication, Information Technology	
TECHNOLOGIES	Access software, Accounting software Administration software, Analytical or scientific software, Application server software, Authentication server software, Backup or archival software, Business intelligence and data analysis software, Calendar and scheduling software	Communications server software, Configuration management software, Content workflow software, Customer relationship management CRM software, Database management system software, Database reporting software, Database user interface and query software, Desktop communications software, Development environment software



INFORMATION TECHNOLOGY

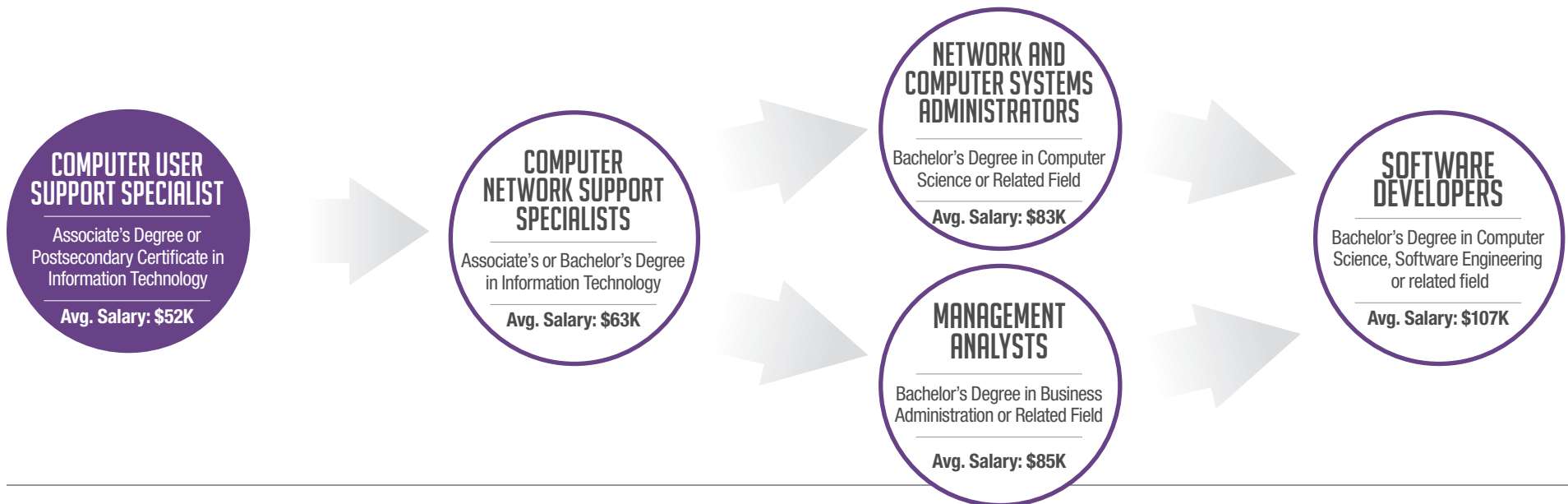
COMPUTER USER SUPPORT SPECIALISTS

SALARY RANGE	Entry Level: \$30,000 - \$50,000 (depending on region and employer)	Advanced Level: \$50,000 - \$75,000
CREDENTIALS	Required: Associate's Degree in Information Technology or related field; or short-term certificates/credentials	Optional/Dependent on Specialty: Bachelor's Degree in Information Technology or related field. License: FCC License (useful, not required) Certifications: Desktop Support/Helpdesk, Certifications in Computer Science, Information Technology or related fields, CompTIA A+ and/or CompTIA Network+; Specific Microsoft Certs, Linux+, CTECH, Certified data professional (CDP), Certified information systems security professional (CISSP), Cisco certified internetwork expert (CCIE), Cisco certified network associate (CCNA), Cisco certified network professional (CCNP) Certified information systems auditor (CISA), CompTIA A+, Microsoft technology associate (MTA), Project management professional (PMP), Oracle certified professional, Salesforce certified development lifecycle and deployment, Certified Scrum master (CSM), AWS certified solutions architect, Certified ethical hacker (CEH), Security - CISSP, Cisco IT Security Cert, Global information assurance certification (GIAC), ITIL
WORK EXPERIENCE	Entry Level: 2-3 years	Advanced Level: 3 -5 years
OTHER JOB TITLES/ROLES	Computer Specialist, Computer Support Specialist, Computer Technician, Desktop Support Technician, Help Desk Analyst, Help Desk Technician, Information Technology Specialist (IT Specialist), Network Technician, Support Specialist, Technical Support Specialist	



COMPUTER USER SUPPORT SPECIALISTS PATHWAY

The pathway below represents a typical career pathway in the ever-changing industry of Information Technology. The key occupation is represented by the colored-in circle.





INFORMATION TECHNOLOGY

TELECOMMUNICATIONS EQUIPMENT INSTALLERS AND REPAIRERS (EXCEPT LINE INSTALLERS)

JOB DESCRIPTION	Install and repair telecommunications cable, including fiber optics.
KEY FOUNDATIONAL SKILLS	Communications, Customer Focus, Problem Solving/Decision Making, Basic Computer Skills, Detail Orientation
NETWORKS, TELECOM, WIRELESS & MOBILITY	<p>Installation & Setup: Set up service for customers by installing, connecting, testing, or adjusting equipment. Install equipment such as amplifiers or repeaters to maintain the strength of communications transmissions. Use a variety of construction equipment to complete installations, such as digger derricks, trenchers, or cable plows</p> <p>Inspect, Measure & Test: Measure signal strength at utility poles by using electronic test equipment. Inspect or test lines or cables by recording and analyzing test results, to assess transmission characteristics and locate faults or malfunctions.</p> <p>Repair: Splice cables by using hand tools, epoxy, or mechanical equipment. Access specific areas by stringing lines or installing terminal boxes, auxiliary equipment, or appliances by using bucket trucks, or by climbing poles or ladders, or entering tunnels, trenches, or crawl spaces. Fill and tamp holes by using cement, earth, and tamping devices.</p> <p>String and Manage Cable: String cables between structures and lines from poles, towers, or trenches and pull lines to proper tension. Pull up cable by hand from large reels mounted on trucks. Lay underground cable directly in trenches or string it through conduits running through trenches. Dig trenches for underground wires or cables. Compute impedance of wires from poles to houses to determine additional resistance needed for reducing signals to desired levels</p>
USER & CUSTOMER SUPPORT	<p>Traveling: Travel to customers' premises to install, maintain, or repair audio and visual electronic reception equipment or accessories.</p> <p>Customer Service: Keep the customer informed by explaining cable service to subscribers after installation and collecting any installation fees that are due.</p>
RISK MANAGEMENT, SECURITY & INFORMATION ASSURANCE	<p>Manage Network Security: Protect data, software, and hardware by planning, coordinating, and implementing network security measures. Understand and implement cybersecurity protocols and protections.</p>
COMPLIANCE	<p>Clean & Maintain Equipment: Clean or maintain tools or test equipment.</p> <p>Safety: Place insulation over conductors or seal splices with moisture-proof covering.</p>
KNOWLEDGE	Telecommunication, Customer and Personal Service, Public Safety and Security, Electrical Wiring, Category 5 Cabling



INFORMATION TECHNOLOGY

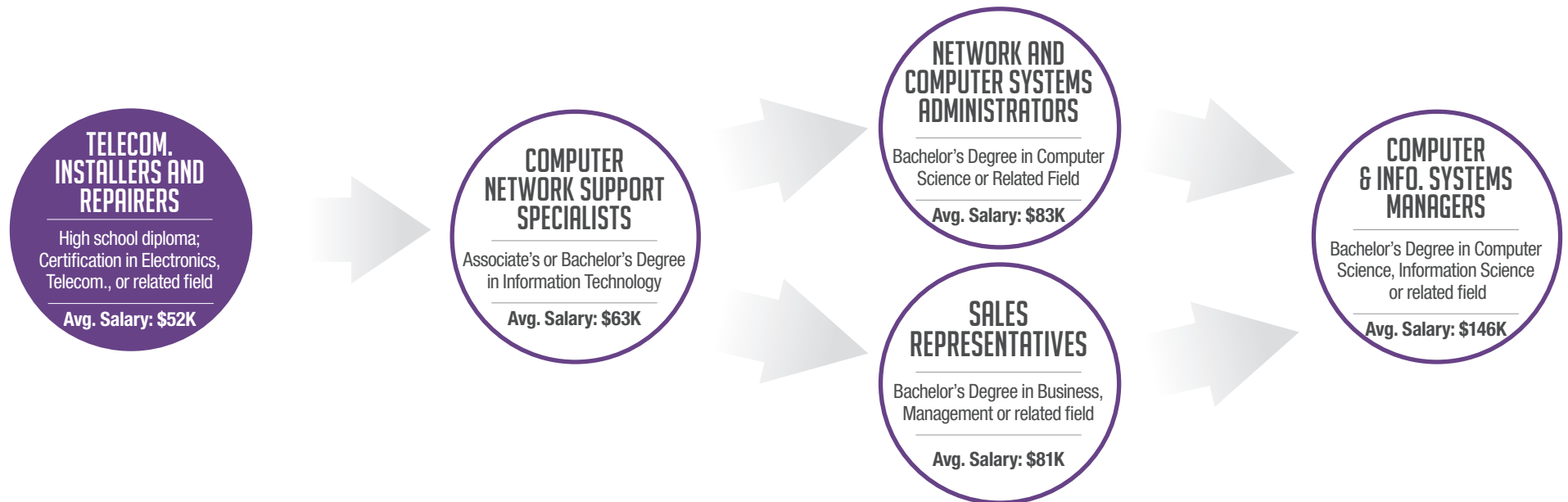
TELECOMMUNICATIONS EQUIPMENT INSTALLERS AND REPAIRERS (EXCEPT LINE INSTALLERS)

SALARY RANGE	Entry Level: \$30,000 - \$60,000 (depending on region and employer)	Advanced Level: \$60,000 - \$95,000
TECHNOLOGIES	<ul style="list-style-type: none"> ⌚ Electronic Mail Software ⌚ Enterprise Resource Planning (ERP) Software 	<ul style="list-style-type: none"> ⌚ Facilities Management Software ⌚ Office Suite Software
CREDENTIALS	Required: High school diploma, certification in Electronics, Telecommunications, Computer Technology	Optional/Dependent on Specialty: Associate degree in related fields; FOA (FiberOptic Association) Certification, CTECH
WORK EXPERIENCE	0-3 years	
OTHER JOB TITLES/ROLES	Cable Splicer, Cable Technician, Cable Television Technician (Cable TV Tech), Combination Technician, Field Service Technician, Installation and Repair Technician (I & R Technician), Installer, Lineman, Outside Plant Technician, Service Technician	



TELECOMMUNICATIONS EQUIPMENT INSTALLERS AND REPAIRERS PATHWAY

The pathway below represents a typical career pathway in the ever-changing industry of Information Technology. The key occupation is represented by the colored-in circle.





INFORMATION TECHNOLOGY

SALES REPRESENTATIVES, WHOLESALE AND MANUFACTURING, TECHNICAL AND SCIENTIFIC PRODUCTS

JOB DESCRIPTION

Sell goods for wholesalers or manufacturers where technical or scientific knowledge is required in such areas as biology, engineering, chemistry, and electronics, normally obtained from at least 2 years of post-secondary education.

KEY FOUNDATIONAL SKILLS

Communication, Customer Focus, Leadership, Scheduling/Coordinating, Problem Solving/Decision Making

PRINCIPLES OF INFORMATION TECHNOLOGY

Professional Development & Research: Study documentation or other information for new scientific or technical products. Attend sales or trade meetings or read related publications to obtain information about market conditions, business trends, environmental regulations, or industry developments.

USER & CUSTOMER SUPPORT

Negotiation, Price Quoting and Appraisal: Negotiate prices or terms of sales or service agreements. Quote prices, credit terms, or other bid specifications. Compute customer's installation or production costs and estimate savings from new services, products, or equipment. Provide customers with ongoing technical support. Appraise equipment to determine contract terms or trade-in values.

Client Support & Engagement: Visit establishments to evaluate needs or to promote product or service sales. Answer customers' questions about products, prices, availability, or credit terms. Emphasize product features, based on analyses of customers' needs and on technical knowledge of product capabilities and limitations. Select or assist customers in selecting products based on customer needs, product specifications, and applicable regulations. Inform customers of estimated delivery schedules, service contracts, warranties, or other information pertaining to purchased products

Marketing: Initiate sales campaigns to meet sales and production expectations

Client Demonstration & Advice: Advise customers on product usage to improve production. Demonstrate the operation or use of technical or scientific products.

Sales: Contact new or existing customers to discuss how specific products or services can meet their needs. Prepare sales presentations or proposals to explain product specifications or applications. Identify prospective customers, using business directories, leads from existing clients, participation in organizations, or trade show or conference attendance. Sell service contracts for technical or scientific products. Sell technical and scientific products that are environmentally sound or designed for environmental remediation.

Administrative Duties: Prepare and submit sales contracts for orders. Maintain customer records, using automated systems. Complete expense reports, sales reports, or other paperwork. Stock or distribute resources, such as samples or promotional or educational materials. Arrange for installation and testing of products or machinery. Verify customer credit ratings.

Teamwork: Collaborate with colleagues to exchange information, such as selling strategies or marketing information. Provide feedback to product design teams so that products can be tailored to clients' needs. Consult with engineers regarding technical problems with products.

RISK MANAGEMENT, SECURITY & INFORMATION ASSURANCE

Manage Network Security: Protect data, software, and hardware by planning, coordinating, and implementing network security measures. Understand and implement cybersecurity protocols and protections.

KNOWLEDGE

Customer and Personal Service, Sales and Marketing, Administration and Management, Production and Processing, Computers and Electronics, Mathematics, Selling Techniques, Customer Relationship Management, Forecasting, Business Development



INFORMATION TECHNOLOGY

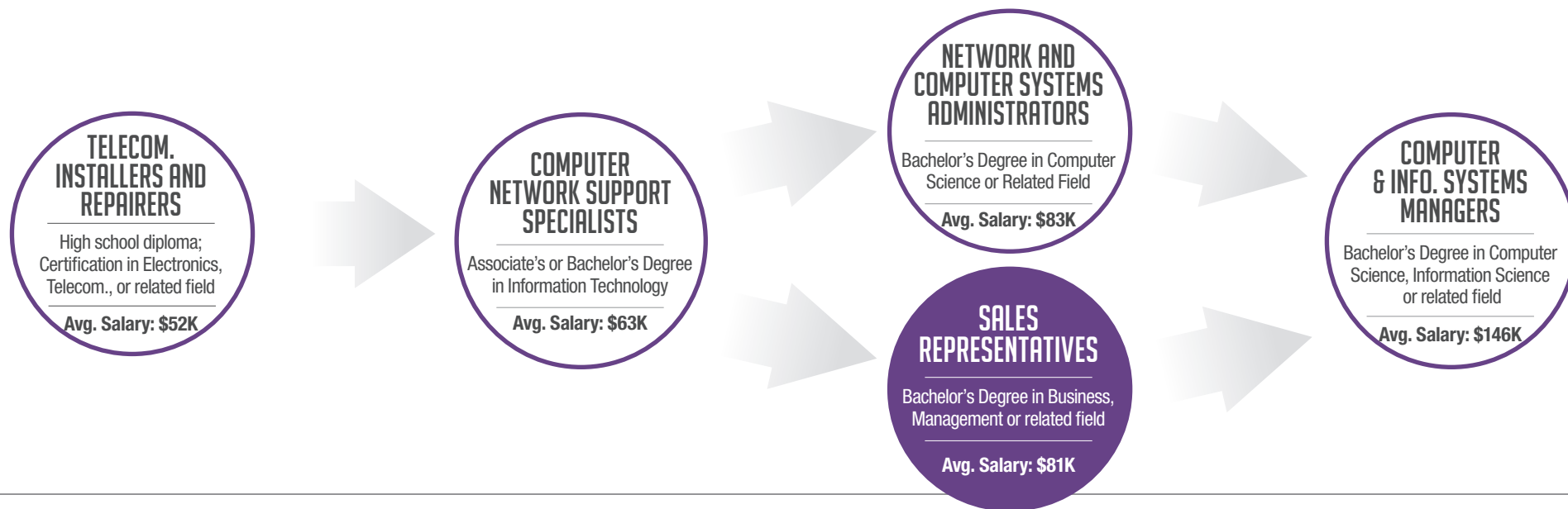
SALES REPRESENTATIVES, WHOLESALE AND MANUFACTURING, TECHNICAL AND SCIENTIFIC PRODUCTS

SALARY RANGE	Entry Level: \$40,000 - \$70,000 (depending on region and employer)	Advanced Level: \$70,000 - \$130,000
TECHNOLOGIES	<ul style="list-style-type: none"> ⊗ Access software ⊗ Accounting software ⊗ Analytical or scientific software ⊗ Business intelligence and data analysis software 	<ul style="list-style-type: none"> ⊗ Calendar and scheduling software ⊗ Customer relationship management CRM software ⊗ Database management system software ⊗ Data mining software ⊗ Electronic mail software ⊗ Enterprise application integration software ⊗ Enterprise resource planning ERP software ⊗ Information retrieval or search software ⊗ Internet browser software
CREDENTIALS	Required: Bachelor's Degree in Business, Management, or related field. Some employers will accept years of experience in lieu of a degree.	Optional/Dependent on Specialty: Inside Sales Professional Certification (CISP), Professional Sales Person Certification (CPSP), Sales Executive Certification CSE Certifications: Salesforce Certifications
WORK EXPERIENCE	2-3 years	
OTHER JOB TITLES/ROLES	Account Development Manager, Account Executive, Account Manager, Channel Sales Director, Distribution Sales Manager, Inside Sales Representative, Marketing Representative, Sales Director, Sales Manager, Sales Representative	



SALES REPRESENTATIVES, WHOLESALE AND MANUFACTURING, TECHNICAL AND SCIENTIFIC PRODUCTS PATHWAY

The pathway below represents a typical career pathway in the ever-changing industry of Information Technology. The key occupation is represented by the colored-in circle.





INFORMATION TECHNOLOGY

SOFTWARE DEVELOPERS, APPLICATIONS / COMPUTER PROGRAMMERS

JOB DESCRIPTION

Develop, create, and modify general computer applications software or specialized utility programs. Analyze user needs and develop software solutions. Design software or customize software for client use with the aim of optimizing operational efficiency. May analyze and design databases within an application area, working individually or coordinating database development as part of a team. May supervise computer programmers.

KEY FOUNDATIONAL SKILLS

Communication, Problem Solving/Decision Making, Leadership, Initiative, Detail Orientation

PRINCIPLES OF INFORMATION TECHNOLOGY

Product & Market Research: Identify potential markets and factors affecting product demand by collecting and analyzing data on customer demographics, preferences, needs, and buying habits.

SOFTWARE DEVELOPMENT & MANAGEMENT

Data Analysis: Store, retrieve, and manipulate data for analysis of system capabilities and requirements. Analyze information to determine, recommend, and plan computer specifications and layouts, and peripheral equipment modifications. Determine system performance standards.

Software Program Management & Documentation: Correct errors by making appropriate changes and rechecking the program to ensure that the desired results are produced. Perform or direct revision, repair, or expansion of existing programs to increase operating efficiency or adapt to new requirements. Write, update, and maintain computer programs or software packages to handle specific jobs such as tracking inventory, storing or retrieving data, or controlling other equipment. Compile and write documentation of program development and subsequent revisions, inserting comments in the coded instructions so others can understand the program.

Software Development and Design: Design, develop and modify software systems by using scientific analysis and mathematical models to predict and measure outcome and consequences of design. Develop and direct software system testing and validation procedures, programming, and documentation. Allow existing software to adapt to new hardware, or to improve its performance by modifying to correct errors. Write, analyze, review, and rewrite programs, using workflow charts and diagrams, and applying knowledge of computer capabilities, subject matter, and symbolic logic. Develop Web sites. Ensure specifications are met by coordinating software system installation and monitoring equipment functioning.

Feasibility Analysis: Determine feasibility of design within time and cost constraints by analyzing user needs and software requirements.

Software Program Analysis and Testing: Prepare detailed workflow charts and diagrams that describe input, output, and logical operation, and convert them into a series of instructions coded in a computer language. Perform systems analysis and programming tasks to maintain and control the use of computer systems software as a systems programmer. Conduct trial runs of programs and software applications to be sure they will produce the desired information and that the instructions are correct. Investigate whether networks, workstations, the central processing unit of the system, or peripheral equipment are responding to a program's instructions.

Collaboration: Consult with managerial, engineering, and technical personnel to clarify program intent, identify problems, and suggest changes. Consult with and assist computer operators or system analysts to define and resolve problems in running computer programs. Collaborate with computer manufacturers and other users to develop new programming methods. Design systems and to obtain information on project limitations and capabilities, performance requirements and interfaces by conferring with systems analysts, engineers, programmers and others.

RISK MANAGEMENT, SECURITY & INFORMATION ASSURANCE

Manage Network Security: Protect data, software, and hardware by planning, coordinating, and implementing network security measures. Understand and implement cybersecurity protocols and protections.

USE & CUSTOMER SUPPORT

Customer Consultation: Keep customers informed by consulting with them about software system design and maintenance. Write or contribute to instructions or manuals to guide end users.

KNOWLEDGE

Security, Computers and Electronics, Engineering and Technology, Mathematics, Design



INFORMATION TECHNOLOGY

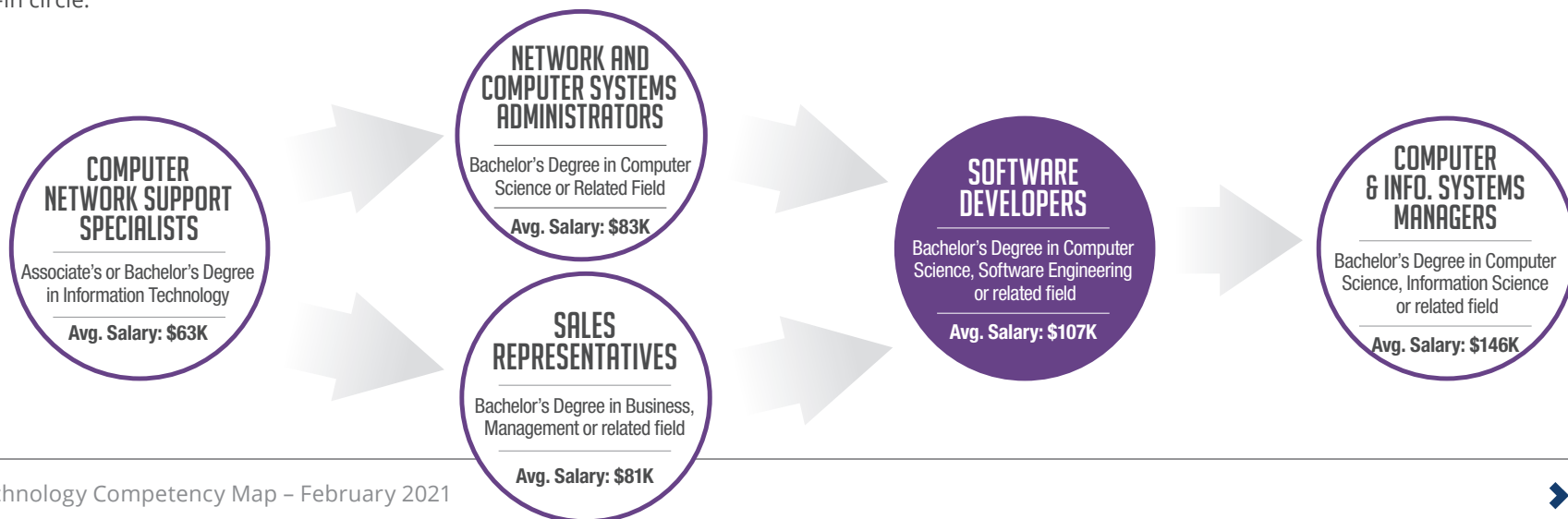
SOFTWARE DEVELOPERS, APPLICATIONS / COMPUTER PROGRAMMERS

SALARY RANGE	Entry Level: \$55,000 - \$95,000 (depending on region and employer)	Advanced Level: \$95,000 - \$140,000
TECHNOLOGIES	<ul style="list-style-type: none"> ⌚ Access software, Accounting software ⌚ Analytical or scientific software, Application server software ⌚ Backup or archival software, Business intelligence and data analysis software ⌚ Communications server software ⌚ Computer aided design CAD software ⌚ Configuration management software ⌚ Content workflow software ⌚ Customer relationship management CRM software ⌚ Database management system software 	<ul style="list-style-type: none"> ⌚ Database reporting software, ⌚ Database user interface and query software ⌚ Data mining software ⌚ Development environment software ⌚ Document management software ⌚ Electronic mail software ⌚ Enterprise application integration software ⌚ Enterprise resource planning ERP software ⌚ Enterprise system management software ⌚ Expert system software ⌚ File versioning software
CREDENTIALS	<p>Required (Software Developer): Some employers require Bachelor's degree in Computer Science, Software Engineering or related field;</p> <p>Required (Computer Programmer): Bachelor's or Master's Degree in Computer Programming, Computer Science or related field</p> <p>Preferred: Some years of experience in the field</p>	<p>Optional/Dependent on Specialty: Associate degree in software engineering technology or software systems engineering. Certificates in Computer Programming, SQL, Database Management or other specific programming language</p> <p>Certifications: Web Development, DevOps, Mobile Development or Technical Stack, C++IEE Professional Software Developer Certification (or license), Agile Cert (9 or 12 Credit), CompTIA Project+, CAPM, Microsoft SQL, Microsoft Solutions, Google Suite, AWS Suite, Scrum Master, ASQ</p>
WORK EXPERIENCE	Entry Level: 1 - 3 years	Advanced Level: 3 - 5 years
OTHER JOB TITLES/ROLES	Application Developer, Application Integration Engineer, Applications Developer, Computer Consultant, Information Technology Analyst (IT Analyst), Software Architect, Software Developer, Software Development Engineer, Software Engineer, Technical Consultant	



SOFTWARE DEVELOPERS, APPLICATIONS / COMPUTER PROGRAMMERS PATHWAY

The pathway below represents a typical career pathway in the ever-changing industry of Information Technology. The key occupation is represented by the colored-in circle.





INFORMATION TECHNOLOGY

NETWORK & COMPUTER SYSTEMS ADMINISTRATORS

JOB DESCRIPTION	Install, configure, and support an organization's local area network (LAN), wide area network (WAN), and Internet systems or a segment of a network system. Monitor network to ensure network availability to all system users and may perform necessary maintenance to support network availability. May monitor and test Web site performance to ensure Web sites operate correctly and without interruption. May assist in network modeling, analysis, planning, and coordination between network and data communications hardware and software. May supervise computer user support specialists and computer network support specialists. May administer network security measures.
KEY FOUNDATIONAL SKILLS	Problem Solving/Decision Making, Communications, Customer Focus, Leadership, Detail Orientation
NETWORKS, TELECOMMUNICATION, WIRELESS & MOBILITY	<p>Network Maintenance & Monitoring: Maintain and administer computer networks and related computing environments including computer hardware, systems software, applications software, and all configurations. Monitor the performance of computer systems and networks, and coordinate computer network access and use by operating master consoles. Determine whether adjustments need to be made, and determine where changes will need to be made in the future by monitoring network performance. Core networking skills including routing and switching networks.</p> <p>Network Improvement & Recordkeeping: Recommend changes to improve systems and network configurations and determine hardware or software requirements related to such changes. Perform routine network startup and shutdown procedures and maintain control records.</p> <p>Technical Support: Implement and provide technical support for voice services and equipment, such as private branch exchange, voice mail system, and telecom system</p>
SOFTWARE DEVELOPMENT & MANAGEMENT	<p>Software Maintenance: Configure, monitor, and maintain email applications or virus protection software.</p> <p>Software Design & Test: Design, configure, and test computer hardware, networking software and operating system software.</p> <p>Software Installation: Load computer tapes and disks and install software and printer paper or forms.</p> <p>Purchasing: Coordinate with vendors and company personnel to facilitate purchases.</p> <p>Professional Development: Research new technologies by attending seminars, reading trade articles, or taking classes, and implement or recommend the implementation of new technologies.</p>
USER & CUSTOMER SUPPORT	<p>Analysis & Repair: Diagnose, troubleshoot, and resolve hardware, software, or other network and system problems, and replace defective components when necessary. Determine the need for repair or replacement by analyzing equipment performance records.</p> <p>User Support & Training: Confer with network users about how to solve existing system problems. Train people in computer system use.</p> <p>Customer Needs Analysis: Gather data pertaining to customer needs, and use the information to identify, predict, interpret, and evaluate system and network requirements.</p>
RISK MANAGEMENT, SECURITY & INFORMATION ASSURANCE	<p>Manage Network Security: Protect data, software, and hardware by planning, coordinating, and implementing network security measures. Understand and implement cybersecurity protocols and protections.</p> <p>Backups & Maintaining Logs: Perform data backups and disaster recovery operations. Maintain logs related to network functions, as well as maintenance and repair records. Maintain an inventory of parts for emergency repairs.</p>
KNOWLEDGE	Open Systems Interconnection Model, Security, Computers and Electronics, Customer and Personal Service, Mathematics



INFORMATION TECHNOLOGY

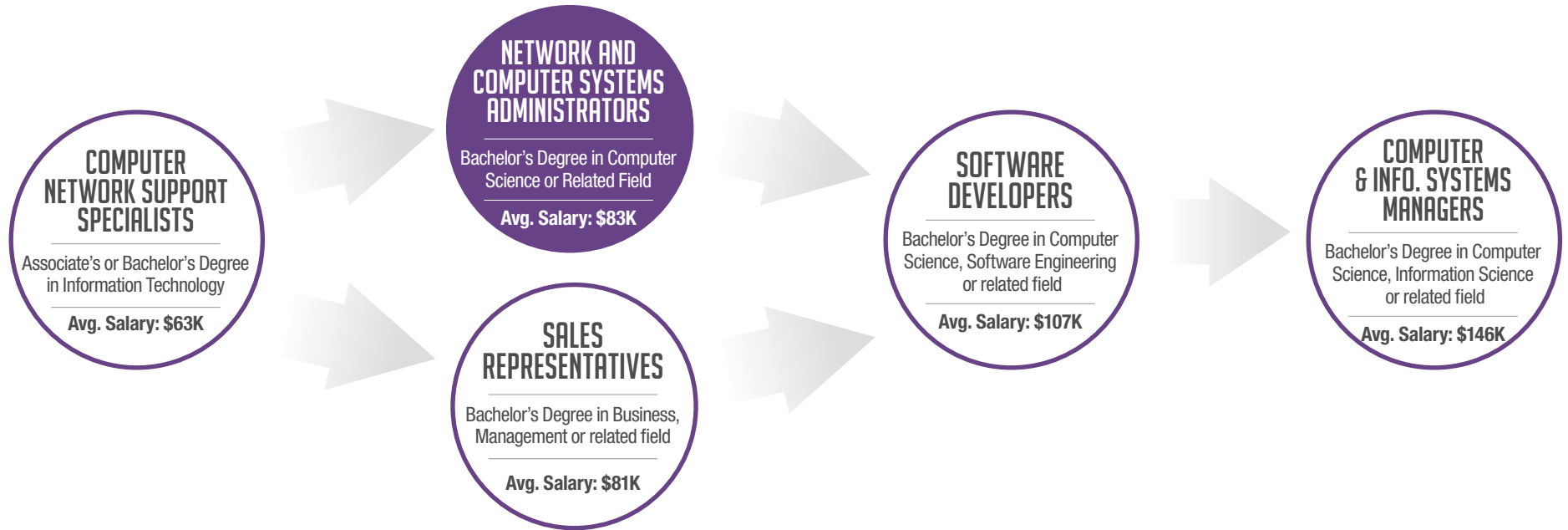
NETWORK & COMPUTER SYSTEMS ADMINISTRATORS

SALARY RANGE	Entry Level: \$45,000 - \$75,000 (depending on region and employer)	Advanced Level: \$75,000 - \$115,000
TECHNOLOGIES	<ul style="list-style-type: none"> ⊗ Access software ⊗ Administration software ⊗ Analytical or scientific software ⊗ Application server software ⊗ Authentication software ⊗ Backup or archival software ⊗ Business intelligence and data analysis software ⊗ Communications server software ⊗ Compiler and decompiler software ⊗ Computer aided design CAD software ⊗ Computer based training software ⊗ Configuration management software ⊗ Content workflow software ⊗ Customer relationship management CRM software ⊗ Database management system software 	<ul style="list-style-type: none"> ⊗ Database reporting software ⊗ Database user interface and query software ⊗ Database reporting software ⊗ Database communications software ⊗ Document management software ⊗ Electronic mail software ⊗ Enterprise application integration software ⊗ Enterprise resource planning ERP software ⊗ Enterprise system management software ⊗ Expert system software ⊗ File versioning software ⊗ Graphical user interface development software ⊗ Internet directory services software ⊗ Internet protocol IP multimedia subsystem software ⊗ Network monitoring software
CREDENTIALS	Required: Bachelor's degree in Computer Science, Information Science or related field	Optional/Dependent on Specialty: Certifications: <ul style="list-style-type: none"> ⊗ ITIL (Entry), Cisco Certified Network Associate (CCNA) (minimum) ⊗ Cisco Certified Network Professional (CCNP), CompTIA Network+, Comp TIA Server ⊗ Web Development, DevOps, Mobile Development or Technical Stack, C++/IEE Professional Software Developer Certification (or license), Agile Cert (9 or 12 Credit), CompTIA Project+, CAPM, Microsoft SQL, Microsoft Solutions, Google Suite, AWS Suite, Scrum Master, ASQ
WORK EXPERIENCE	3 - 5 years	
OTHER JOB TITLES/ROLES	Information Analyst, Information Systems Manager (IS Manager), Information Technology Specialist (IT Specialist), LAN Specialist (Local Area Network Specialist), Local Area Network Administrator (LAN Administrator), Network Administrator, Network Coordinator, Network Manager, Network Specialist, Systems Administrator	



NETWORK & COMPUTER SYSTEMS ADMINISTRATORS PATHWAY

The pathway below represents a typical career pathway in the ever-changing industry of Information Technology. The key occupation is represented by the colored-in circle.





JOB DESCRIPTION	Plan, direct, or coordinate activities in such fields as electronic data processing, information systems, systems analysis, and computer programming.
KEY FOUNDATIONAL SKILLS	Leadership, Communications, Initiative, Problem Solving/Decision Making, Customer Focus
PRINCIPLES OF INFORMATION TECHNOLOGY	<p>Department Management: Direct daily operations of the department by analyzing workflow, establishing priorities, developing standards and setting deadlines. Develop and interpret organizational goals, policies, and procedures. Control operational budget and expenditures. Control operational budget and expenditures.</p> <p>Report Review and Approval: Review and approve all systems charts and programs prior to their implementation. Prepare and review operational reports or project progress reports.</p> <p>Technology Evaluation: Evaluate the organization's technology use and needs and recommend improvements, such as hardware and software upgrades.</p> <p>Teamwork: Solicit cooperation and resolve problems by meeting with department heads, managers, supervisors, vendors, and others.</p> <p>Project Planning and Coordination: Plan and coordinate project activity by reviewing project plans.</p> <p>Personnel Management & Recruitment: Assign and review the work of systems analysts, programmers, and other computer-related workers. Recruit, hire, train and supervise staff, or participate in staffing decisions.</p> <p>Feasibility Assessment: Assess project feasibility and requirements by evaluating data processing proposals.</p>
USER & CUSTOMER SUPPORT	<p>Technical Support: Provide users with technical support for computer problems.</p> <p>Needs Assessment: Assess computing needs and system requirements by consulting with users, management, vendors, and technicians.</p>
COMPLIANCE	<p>Professional Development & Research: Stay abreast of advances in technology.</p>
RISK MANAGEMENT, SECURITY, & INFORMATION ASSURANCE	<p>Develop Resources: Develop computer information resources, providing for data security and control, strategic computing, and disaster recovery.</p> <p>Manage Network Security: Protect data, software, and hardware by planning, coordinating, and implementing network security measures. Understand and implement cybersecurity protocols and protections.</p> <p>Manage Backup: Manage backup, security and user help systems.</p>
KNOWLEDGE	Computers and Electronics, Customer and Personal Service, Administration and Management, Engineering and Technology



INFORMATION TECHNOLOGY

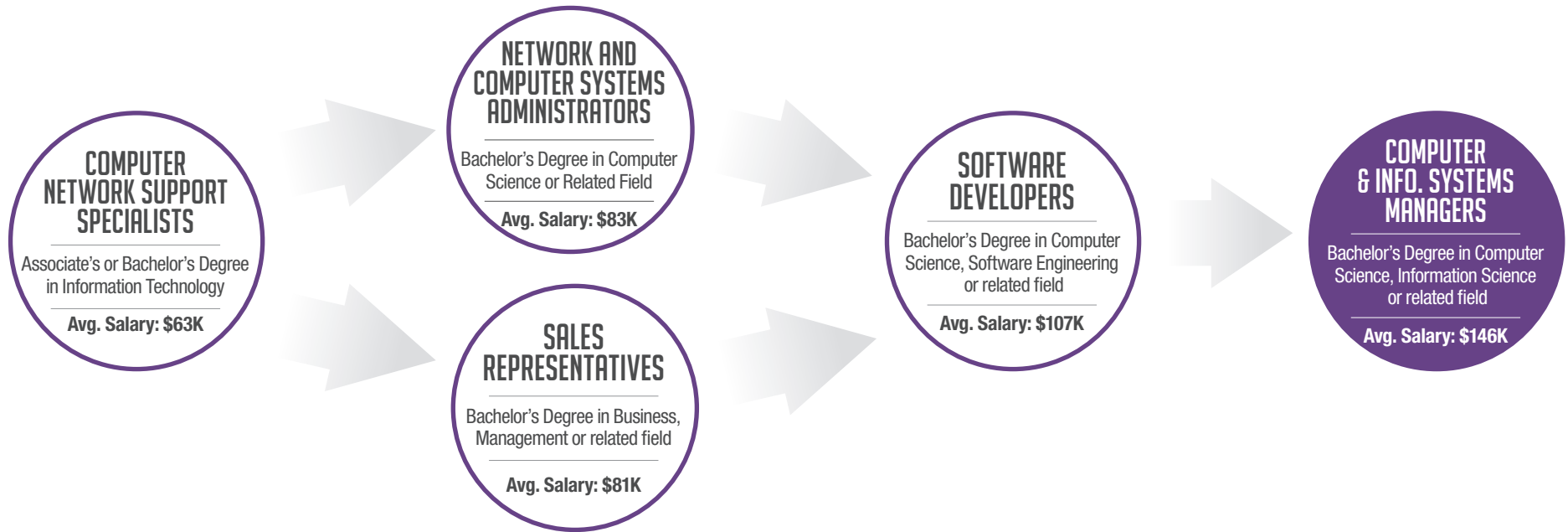
COMPUTER & INFORMATION SYSTEMS MANAGERS

SALARY RANGE	Entry Level: \$80,000 - \$130,000 (depending on region and employer)	Advanced Level: \$130,000 - \$200,000
TECHNOLOGIES	<ul style="list-style-type: none"> ⌚ Access software ⌚ Accounting software ⌚ Analytical or scientific software ⌚ Application server software ⌚ Backup or archival software ⌚ Business intelligence and data analysis software ⌚ Communications server software ⌚ Computer aided design CAD software ⌚ Configuration management software ⌚ Content workflow software ⌚ Customer relationship management CRM software ⌚ Database management system software 	<ul style="list-style-type: none"> ⌚ Database reporting software ⌚ Database user interface and query software ⌚ Data mining software ⌚ Development environment software ⌚ Document management software ⌚ Electronic mail software ⌚ Enterprise application integration software ⌚ Enterprise resource planning ERP software ⌚ Enterprise system management software ⌚ Expert system software ⌚ File versioning software
CREDENTIALS	Required: Bachelor's degree in Computer Science, Information Science or related field; Some employers require a Master's degree in Computer Science or related field	Optional/Dependent on Specialty: Certifications in specific software programs Certifications: <ul style="list-style-type: none"> ⌚ CIO Certifications ⌚ Project Management Professional (PMP) ⌚ Certified Associate in PM (CAPM) - Entry ⌚ ITIL (Entry)
WORK EXPERIENCE	7 - 10 years	
OTHER JOB TITLES/ROLES	Application Development Director, Computing Services Director, Data Processing Manager, Information Systems Director (IS Director), Information Systems Manager (IS Manager), Information Systems Supervisor (IS Supervisor), Information Technology Director (IT Director), Information Technology Manager (IT Manager), MIS Director (Management Information Systems Director), Technical Services Manager	



COMPUTER & INFORMATION SYSTEMS MANAGERS PATHWAY

The pathway below represents a typical career pathway in the ever-changing industry of Information Technology. The key occupation is represented by the colored-in circle.





JOB DESCRIPTION

Conduct organizational studies and evaluations, design systems and procedures, conduct work simplification and measurement studies, and prepare operations and procedures manuals to assist management in operating more efficiently and effectively. Includes program analysts and management consultants.

KEY FOUNDATIONAL SKILLS

Communications, Leadership, Problem Solving/Decision Making, Detail Orientation, Initiative

USER & CUSTOMER SUPPORT

Data Analysis: Develop solutions or alternative methods of proceeding by analyzing relevant data.

Recommend Changes: Document findings of study and prepare recommendations for implementation of new systems, procedures, or organizational changes. Design, evaluate, recommend, and approve changes of forms and reports

Interview & Assess: Interview personnel and conduct on-site observation to ascertain unit functions, work performed, and methods, equipment, and personnel used

Training: Gather and organize information on problems or procedures.

Information Gathering: Gather and organize information on problems or procedures.

Teamwork: Confer with personnel concerned to ensure successful functioning of newly implemented systems or procedures. Review forms and reports and confer with management and users about format, distribution, and purpose, identifying problems and improvements.

COMPLIANCE

Records Management: Develop and implement records management program for filing, protection, and retrieval of records, and assure compliance with programs.

RISK MANAGEMENT, SECURITY & INFORMATION ASSURANCE

Manage Network Security: Protect data, software, and hardware by planning, coordinating, and implementing network security measures. Understand and implement cybersecurity protocols and protections.

KNOWLEDGE

Administration and Management, Customer and Personal Service



INFORMATION TECHNOLOGY

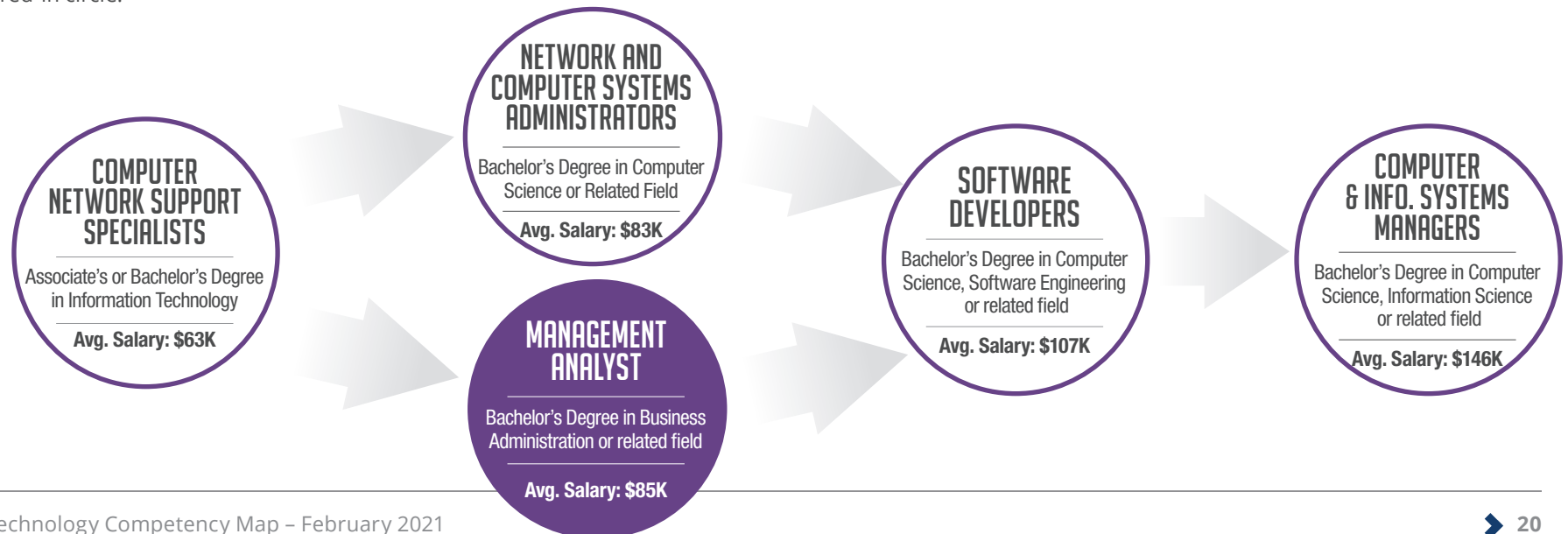
MANAGEMENT ANALYSTS

SALARY RANGE	Entry Level: \$45,000 - \$80,000 (depending on region and employer)	Advanced Level: \$80,000 - \$130,000
TECHNOLOGIES	<ul style="list-style-type: none"> ⊗ Access software ⊗ Accounting Software ⊗ Analytical or scientific software ⊗ Application server software ⊗ Backup[or archival software ⊗ Business intelligence and data analysis software ⊗ Communications server software ⊗ Configuration management software ⊗ Content workflow software 	<ul style="list-style-type: none"> ⊗ Customer relationships management CRM software ⊗ Database management system software ⊗ Database reporting software ⊗ Database user interface and query software ⊗ Data mining software ⊗ Development environment software ⊗ Document management software ⊗ Electronic mail software ⊗ Enterprise application integration software ⊗ Enterprise resources planning ERP software ⊗ Enterprise system management software
CREDENTIALS	Required: Bachelor's degree or Master's degree in Business Administration or related field	Optional/Dependent on Specialty - Certifications: <ul style="list-style-type: none"> ⊗ Certified Management Consultant (CMC) ⊗ CAPM ⊗ Project Management Professional (5+ years exp) ⊗ CompTIA Project+ ⊗ BI Certs (more employer specific)
WORK EXPERIENCE	5 - 7+ years	
OTHER JOB TITLES/ROLES	Administrative Analyst, Business Analyst, Employment Programs Analyst, Leadership Development Manager, Management Analyst, Management Consultant, Organizational Development Consultant, Principal Consultant, Program Management Analyst, Quality Control Analyst	



MANAGEMENT ANALYSTS PATHWAY

The pathway below represents a typical career pathway in the ever-changing industry of Information Technology. The key occupation is represented by the colored-in circle.



Pennsylvania's
STATE SYSTEM
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Link Learning and Work