COMPUTING CAREERS & DISCIPLINES

UPDATED FOR 2020

A QUICK GUIDE FOR PROSPECTIVE STUDENTS AND CAREER ADVISORS

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This guide provides our answers to three questions.

• **Why should you consider computing when choosing a career?**

• **What kind of computing jobs are out there?**

• **How do you get there? That is, what kind of education pathways will guide you to the computing career you desire?**

This guide provides an overview of different types of computing careers and the academic pathways to arriving at those careers. It describes the five main computing disciplines as defined by the ACM (Association of Computing Machinery), as well as six other popular computing specializations.

For each of the main disciplines, this guide provides information about sample programs and Canadian educational institutions for those disciplines and specializations.

More content can be found at: computingcareers.ca

ACKNOWLEDGMENTS

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WHY COMPUTING?

JOBS

The job market for computing graduates is very strong, and according to government estimates, demand will continue to be high well into the future.

SOCIAL

Contrary to stereotypes, computing work is often highly social, involving frequent interaction with others and rewarding communication and social skills.

MOBILITY

Demand for computing exists world-wide. A career in computing offers unparalleled mobility, allowing you to work abroad or work while travelling.

INNOVATIVE

The world of computing work can be full of innovation and creativity. The world of tomorrow is being created by computing graduates today.

FLEXIBLE

Computing work supports flexible lifestyles. You can work full-time in an office, part-time as a parent at home, or take advantage of world-wide demand for short-term computing contracts.

VARIETY

Computing work is extremely varied, from development, to design, to management. This means less chance of boredom, as your work often changes measurably from year to year.

WHAT WORK CAN I DO?

MOST COMPUTING JOBS FALL INTO ONE OF THE GENERAL CATEGORIES SHOWN IN THE BELOW DIAGRAM AND WHICH ARE EXPLAINED IN MORE DETAIL ON THE NEXT PAGE.

Management

Business

Design

Development

Infrastructure

Data

NOTICE THE PEOPLE ON THE STAIRS: THEY REPRESENT THE FACT THAT PEOPLE WORKING IN COMPUTING CAN OFTEN FIND THEMSELVES MOVING TO OTHER TYPES OF JOBS.

THERE ARE MANY, MANY, MANY DIFFERENT TYPES OF COMPUTING JOBS. COMPUTING IS MUCH MORE THAN JUST PROGRAMMING!

THIS PAGE ILLUSTRATES SOME SAMPLE COMPUTING JOB TITLES, ORGANIZED BY THE CATEGORIES SHOWN ON THE PREVIOUS PAGE.
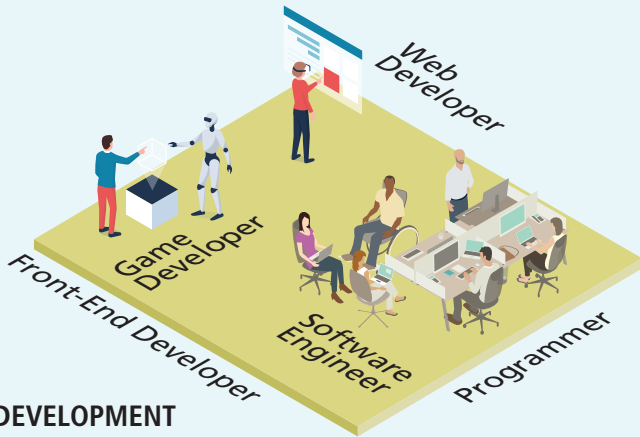
DEVELOPMENT

These are the jobs most often identified with computing. The focus here is on software development, often referred to simply as programming. As you can see, there are many different labels for developers, each with a different focus.
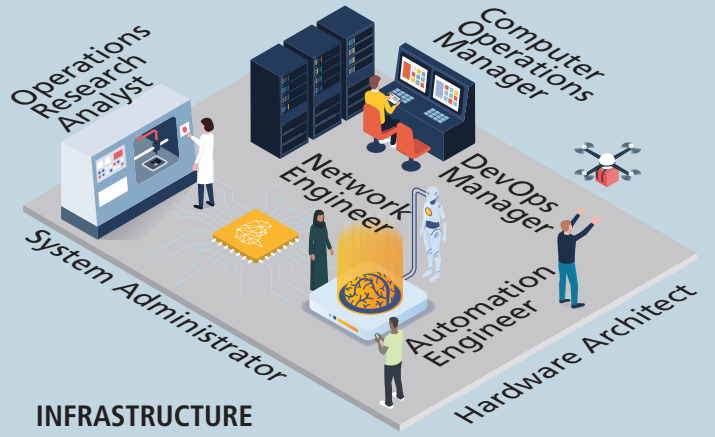
INFRASTRUCTURE

Contemporary computing is dependent upon a sophisticated systems infrastructure. The jobs in this area span a very wide range of tasks, from configuration and support, to designing and creating the devices themselves.

DATA

We live in a world that is over-flowing with digital data. Experts in this area help organize, analyze, and secure the data needs of organizations.

DESIGN

Most computing systems are used by humans, and as a result, specialists are needed to make these systems attractive and usable as well as efficient and bug-free.

BUSINESS

Ultimately, computing systems are used by businesses and organizations. Specialists are needed to help optimize computing systems for business needs, as well as adopt business processes to new innovations.
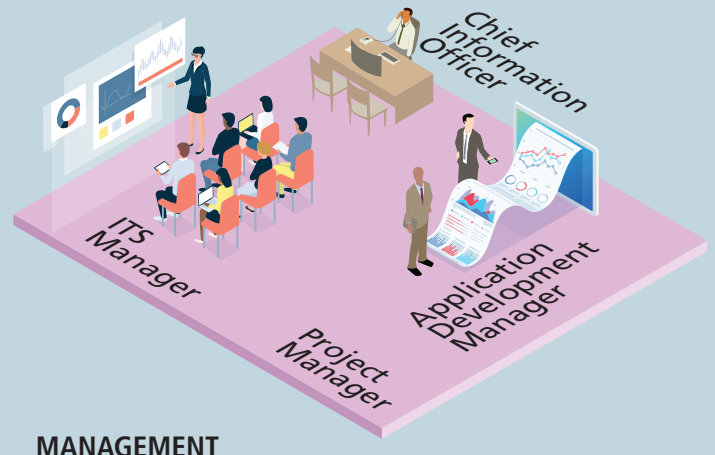
MANAGEMENT

Like other business activities, computing requires managers. A manager might oversee a project, a development team, a computing department, or the information needs of an entire corporation.

HOW DO I GET THERE?

The best way to acquire a computing career is to obtain the necessary educational credential.

But there are many potential computing education options to choose between.

This booklet guides you through the maze of options, by providing an overview of the different computing disciplines as defined by the ACM.

COMPUTER DISCIPLINES

COMPUTER SCIENCE

INFORMATION SYSTEMS

SOFTWARE ENGINEERING

ACM

INFORMATION TECHNOLOGY

COMPUTER ENGINEERING

OTHER SPECIALITIES

There is not a single computing credential because there isn't a single computing discipline.

The ACM (Association of Computing Machinery) has identified five different computing disciplines. Other speciality computing disciplines are in the process of being defined by the ACM or by different educational institutes.

The remainder of this guide describes these ACM disciplines, which may help you to decide which computing education pathway is most appropriate for you.

These discipline descriptions are designed to help support prospective students, parents, career practitioners, academic advisors, and career counsellors.

DISCIPLINE ROADMAP

TO HELP EXPLAIN THE DIFFERENCES IN THE COMPUTING DISCIPLINES, THIS GUIDE USES A CITY METAPHOR. EACH DISCIPLINE HAS ITS OWN CITY DISTRICT THAT PROVIDES AN OVERVIEW OF THE DISCIPLINE AND THEN STEPS INSIDE THAT DISCIPLINE TO DESCRIBE TYPICAL JOB TASKS.

COMPUTER ENGINEERING (CE)

is concerned with the design and construction of computers and computer-based systems.
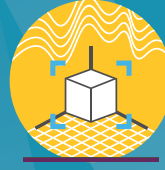
COMPUTER SCIENCE (CS)

covers the widest range of computing topics from its theoretical foundations to the development of new computing technologies and techniques.

INFORMATION SYSTEMS (IS)

is focused on integrating information technology solutions and business processes.

INFORMATION TECHNOLOGY (IT)

programs prepare students to meet the computer technology needs of business and other organizations.

SOFTWARE ENGINEERING (SE)

is the discipline of developing and maintaining large software systems.

OTHER SPECIALITIES

programs that differ from these disciplines or which expand some aspect of these disciplines.

COMPUTER ENGINEERING

CREATIVE INNOVATIVE SCIENCE TEAMWORK

CURIOUS OBJECTIVE
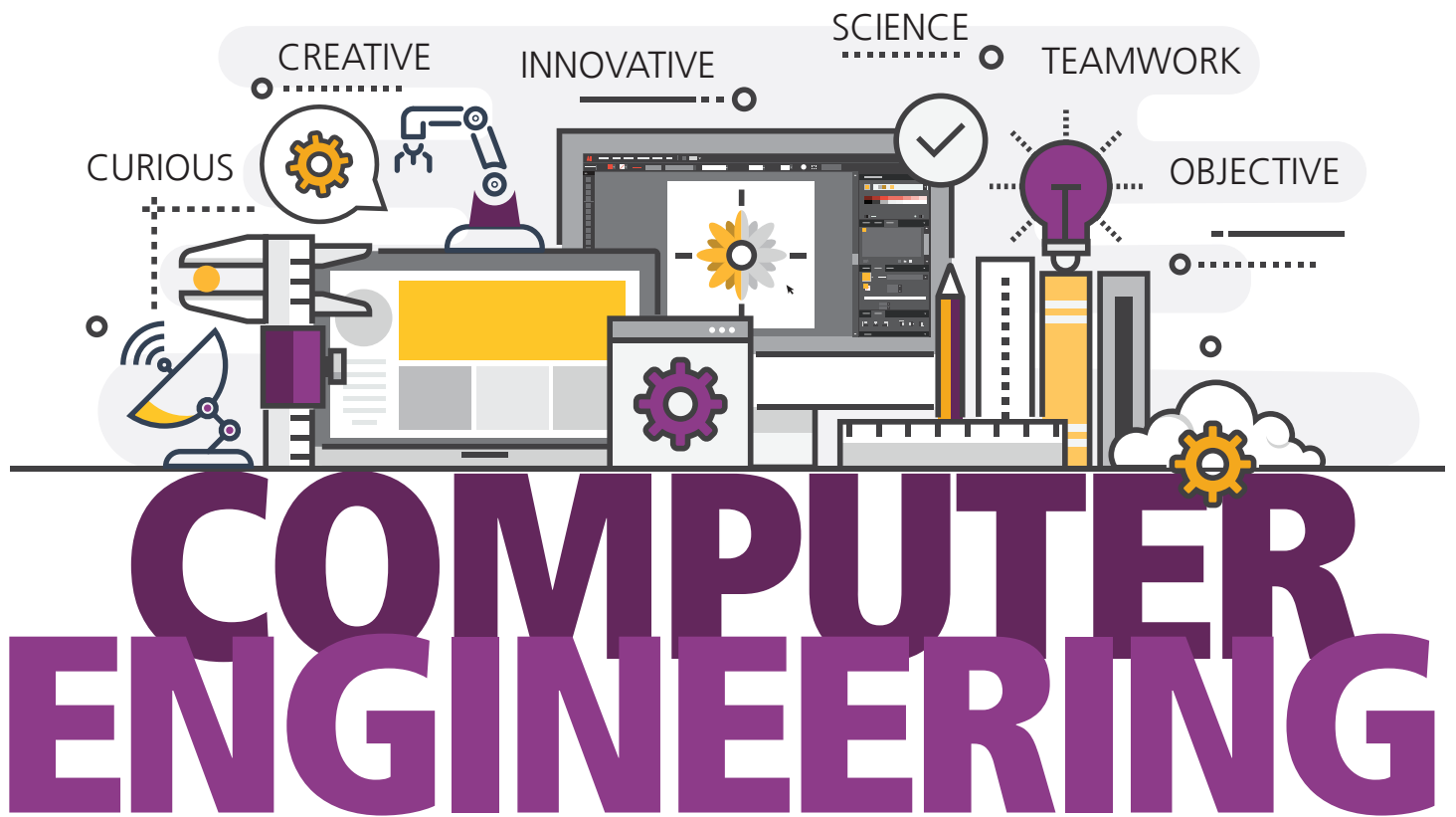
Computer Engineers are focused on the **connection between hardware and software**. A dominant area within computing engineering is embedded systems: the development of devices that have software and hardware embedded in them. Devices such as cell phones, digital audio players, digital video recorders, alarm systems, x-ray machines, and laser surgical tools all require integration of hardware and embedded software.

The emphasis here is more on hardware than on software, but CEs use both for integrated devices. CEs apply engineering theories to the problems of designing computers and computer-based devices. This is a theory-driven practice which incorporates traditional engineering and mathematics.
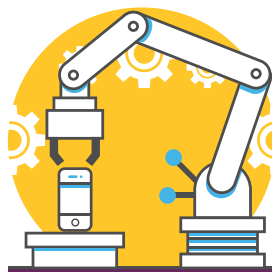
Computer Engineering (CE) is concerned with the design and construction of computers and computer-based systems.

It involves the study of hardware, software, communications, and the interaction among them.

It emphasizes hardware more than software and has a strong engineering flavour.

Its curriculum focuses on the theories, principles, and practices of traditional electrical engineering and mathematics …

… and applies them to the problems of designing computers and computer-based devices.

Let's look more closely at what a computer engineer learns and does …

COMPUTER ENGINEERING

Summary

Computer Engineering is focused on computer architecture and infrastructure, from the applied to the theoretical aspects. It also has an interest in software methods (programming) insofar as it applies to the hardware side of computing.

Organizational Issues

Application Technologies

Software Methods

System Infrastructure

Computer Architecture

CE
Computer Engineering

More Theoretical ←→ More Applied
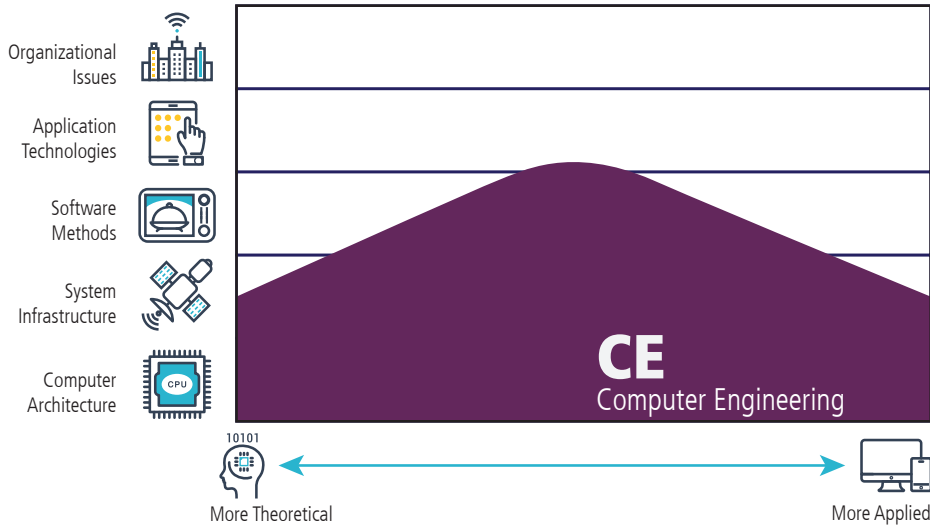
On the Job

Designs hardware to implement communication systems.

Develops hardware devices that are software-controlled, such as iPods, smart phones and gaming devices.

Focuses exclusively on hardware design, including digital electronics, with less involvement in software design.

Evaluates and improves the usability (user experience) of computing systems.

Core Courses

Circuits and Electronics

Computer Architecture and Organization

Computer Networks

Control Systems

Data and Systems Communications

Data Structure and Algorithms

Digital Design

Embedded Systems

Information Security

Internet of Things

Signal Processing

Software Design

Sample Degrees

University of Western Ontario, Bachelor of Engineering Science in Computer Engineering

University of British Columbia, Bachelor of Applied Science in Computer Engineering

University of Alberta, Bachelor of Engineering in Computer Engineering

McGill University, Bachelor of Engineering in Computer Engineering

University of New Brunswick, Bachelor of Science in Computer Engineering

University of Waterloo, Bachelor of Applied Science in Computer Engineering

University of Saskatchewan, Bachelor of Science in Engineering – Computer Engineering

St. Mary's University, Bachelor of Engineering – Electronic Systems Engineering

Ryerson University, Bachelor of Engineering in Computer Engineering

Other Pathways

Sheridan College, Computer Engineering Technician/Technology (Advanced Diploma – 3 years)

Saskatchewan Polytechnic, Computer Engineering Technology (Advanced Diploma – 3 years)

Seneca College, Computer Engineering Technology (Advanced Diploma – 3 years)

George Brown College, Computer Systems Technology, (Advanced Diploma – 3 years)

Okanagan College, Electronics Engineering Technology (Diploma plus COOP – 2.5 years)

NAIT, Computer Engineering Technology (Diploma – 2 years)

College of the North Atlantic, Computing Systems Engineering Technology (Diploma – 2 years)

Northern College, Computer Engineering Technician (Diploma – 2 years)

MATHEMATICAL

INNOVATIVE

PROBLEM SOLVER

CREATIVE

LOGICAL

PATIENT
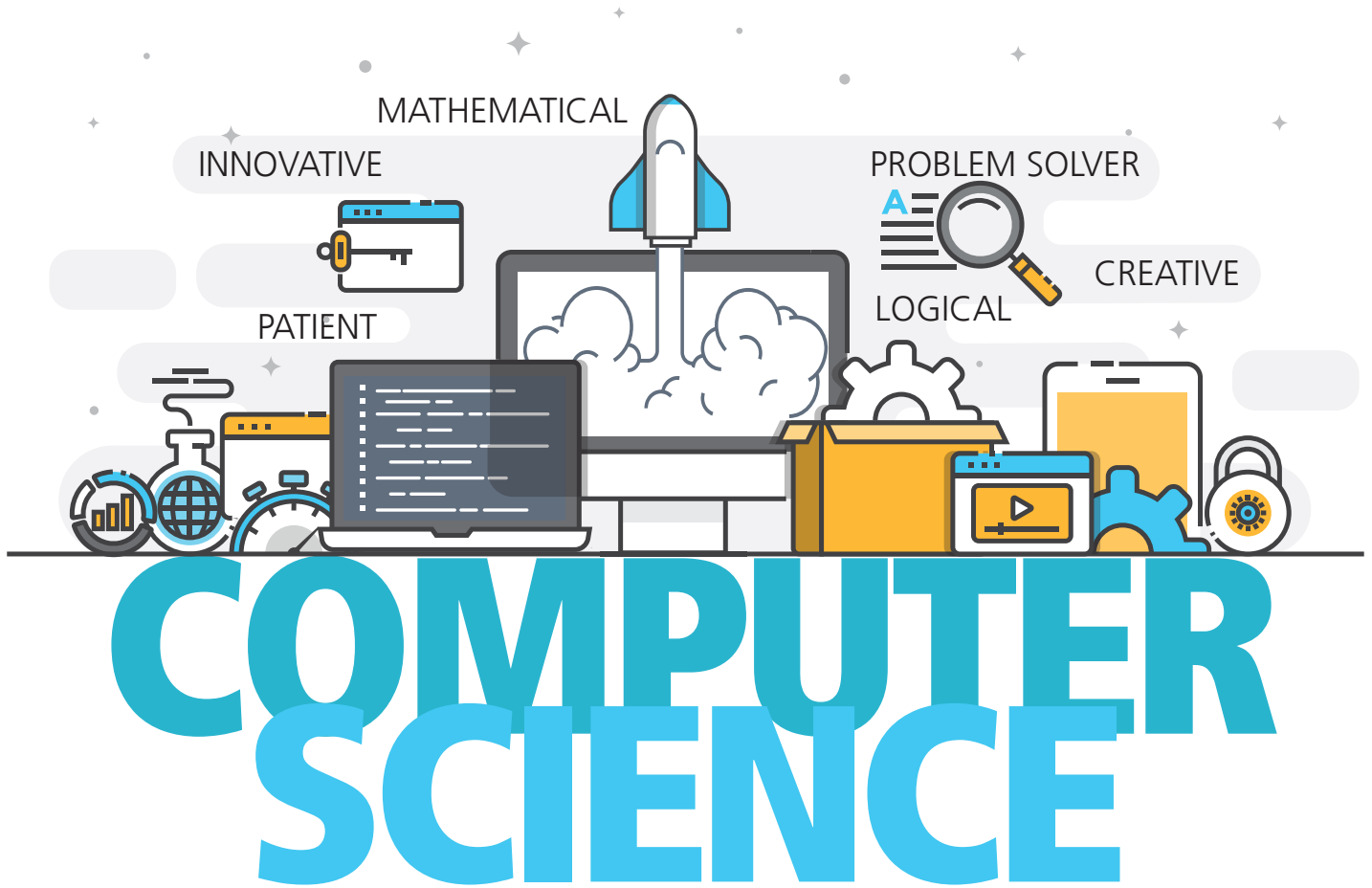
COMPUTER SCIENCE

Computer Scientists develop a **strong foundation based on mathematics and algorithms**. They are trained to discover the best solutions for new problems, generate new technologies and come up with innovative cutting-edge ideas. They design and test software that applies theory to practice, creating innovations in fields like robotics, computer vision, intelligent systems and bioinformatics.

Computer Scientists think up new ways to use computers, explore applications and develop effective ways to solve complex computing problems. They are involved in computer programming, and may supervise programmer teams. Computer Scientists may also develop encryption and other data protection schemes. They are involved in large software development projects.
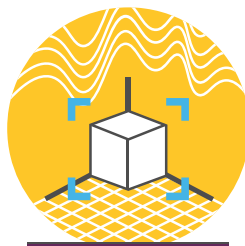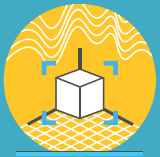
COMPUTER SCIENCE

Computer Science (CS) covers the widest range of computing topics, from its theoretical foundations to the development of new computing techniques.

The work of computer scientists falls into three categories:

They devise new ways to use computers.

They design new software architectures and implement them.
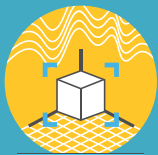
They develop effective solutions to computing problems.

Their theoretical background allows them to improve the performance of algorithms.

Let's take a closer look at what computer scientists do …

COMPUTER SCIENCE

Summary

Computer science has the widest range of computing topics. It focuses especially on the theoretical aspects of computing, leaving the more applied topics (and organizational and architecture issues) to other disciplines.

Organizational Issues
Application Technologies
Software Methods
System Infrastructure
Computer Architecture

CS
Computer Science

10101
More Theoretical — More Applied

On the Job

Use new theories to create cutting edge software.

Focus on the theoretical aspects of technology.

Utilize theory to research and design software solutions.

Use a wide range of foundational knowledge to adapt to new technologies and ideas.

Apply mathematical and theoretical knowledge in order to compare and produce computational solutions.
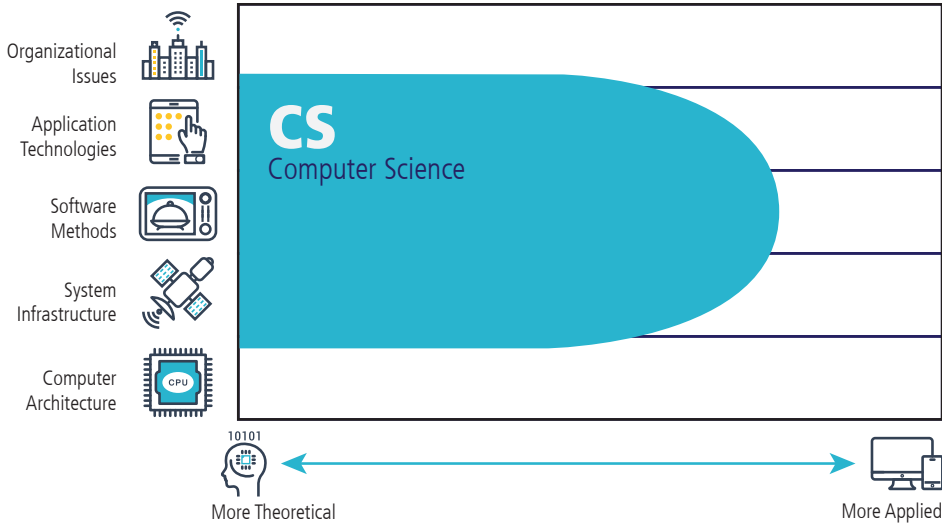
Core Courses

Artificial Intelligence

Computer Organizations and Systems

Data Structures and Algorithms

Discrete Mathematics

Formal Languages and Automata

Graphics and Visualization

Human-Computer Interaction

Linear Algebra

Networking and Communications

Numeric Computation

Operating Systems

Parallel and Distributed computing

Programming Languages

Software Development Fundamentals

Theory of Computation

Sample Degrees

University of Saskatchewan, Bachelor of Science in Computer Science

University of British Columbia, Bachelor of Computer Science

University of Manitoba, Bachelor of Computer Science

Memorial University of Newfoundland, Bachelor of Arts in Computer Science

University of Prince Edward Island, Bachelor of Science in Computer Science

University of Waterloo, Bachelor of Science in Computer Science

Université de Montréal, Bachelor of Computer Science

Acadia University, Bachelor of Computer Science

Sheridan College, Bachelor of Computer Science (Mobile Computing)

Mount Royal University, Bachelor of Science in Computer Science

Other Pathways

Thompson Rivers University, Computer Science (Diploma – 2 years)

University of Regina, Computer Science (Diploma – 2 years)

Lakehead University, Computer Science and Computer Programming (Diploma – 2 years)

Confederation College, Computer Programmer (Diploma – 2 years)

Algonquin College, Computer Programmer (Online Diploma – 2 years)

Douglas College, Computer Science (Certificate – 1 year)

Western Community College, Computer Science Fundamentals (Diploma – 1 year)

Acadia University, Computer Science (Certificate – 30 credit hours)

Cambrian College, Mobile Application Development (Graduate Certificate – 1 year)

ENTREPRENEURIAL

BUSINESS ORIENTED

TEAMS

BIG PICTURE

FUTURE FOCUSED

INFORMATION SYSTEMS
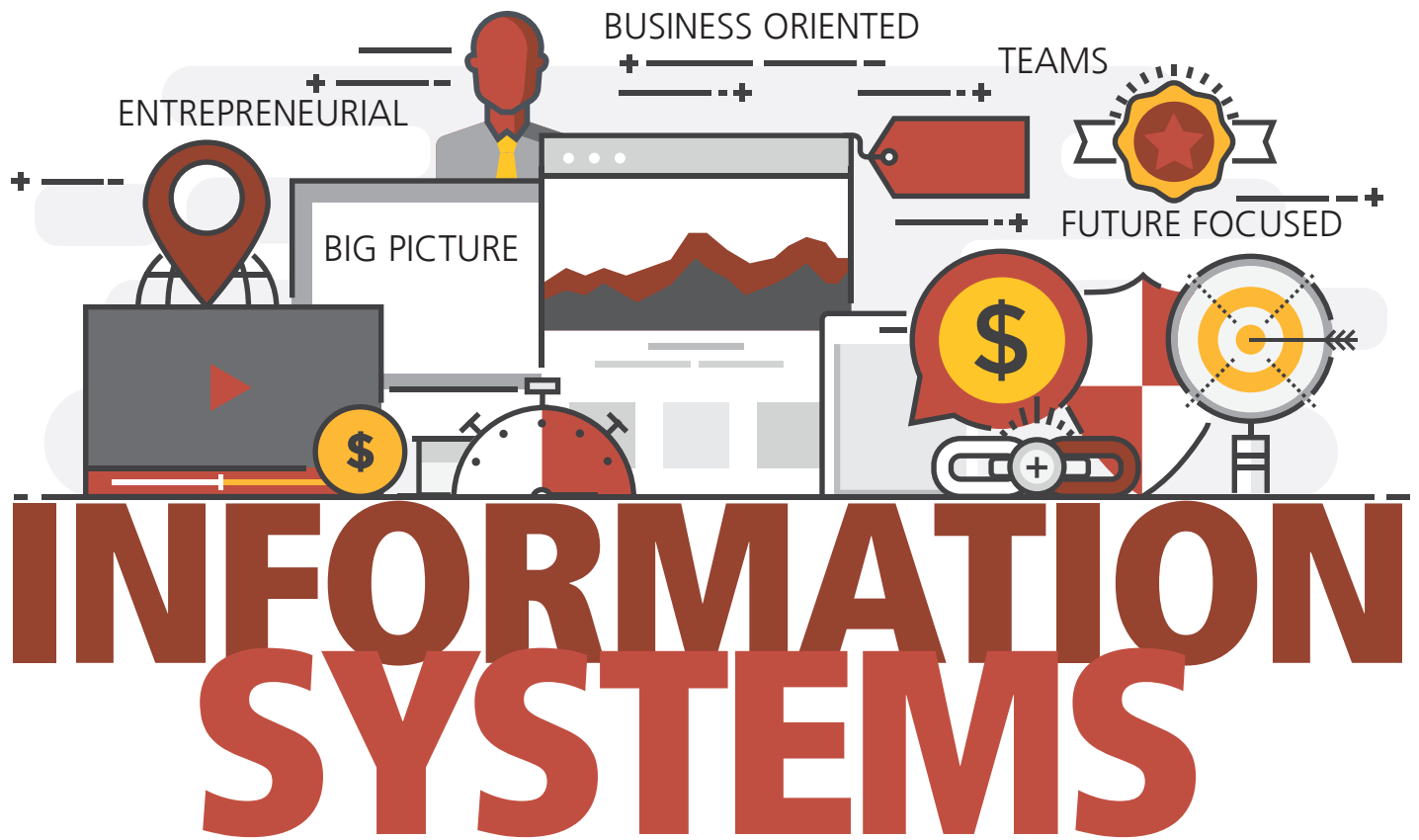
Information Systems specialists integrate information technology with business processes. They focus on the processing of information, and must have an understanding of how organizations and technology work.

Their studies combine business and computing coursework, and may have a computing focus or a management focus. They work closely with clients to determine how information and technology can provide a competitive advantage.

INFORMATION SYSTEM

Information Systems (IS) is focused on integrating information technology and business processes.

IS professionals require a sound understanding of business practices.

They can serve as an effective bridge between the management and technical communities within an organization
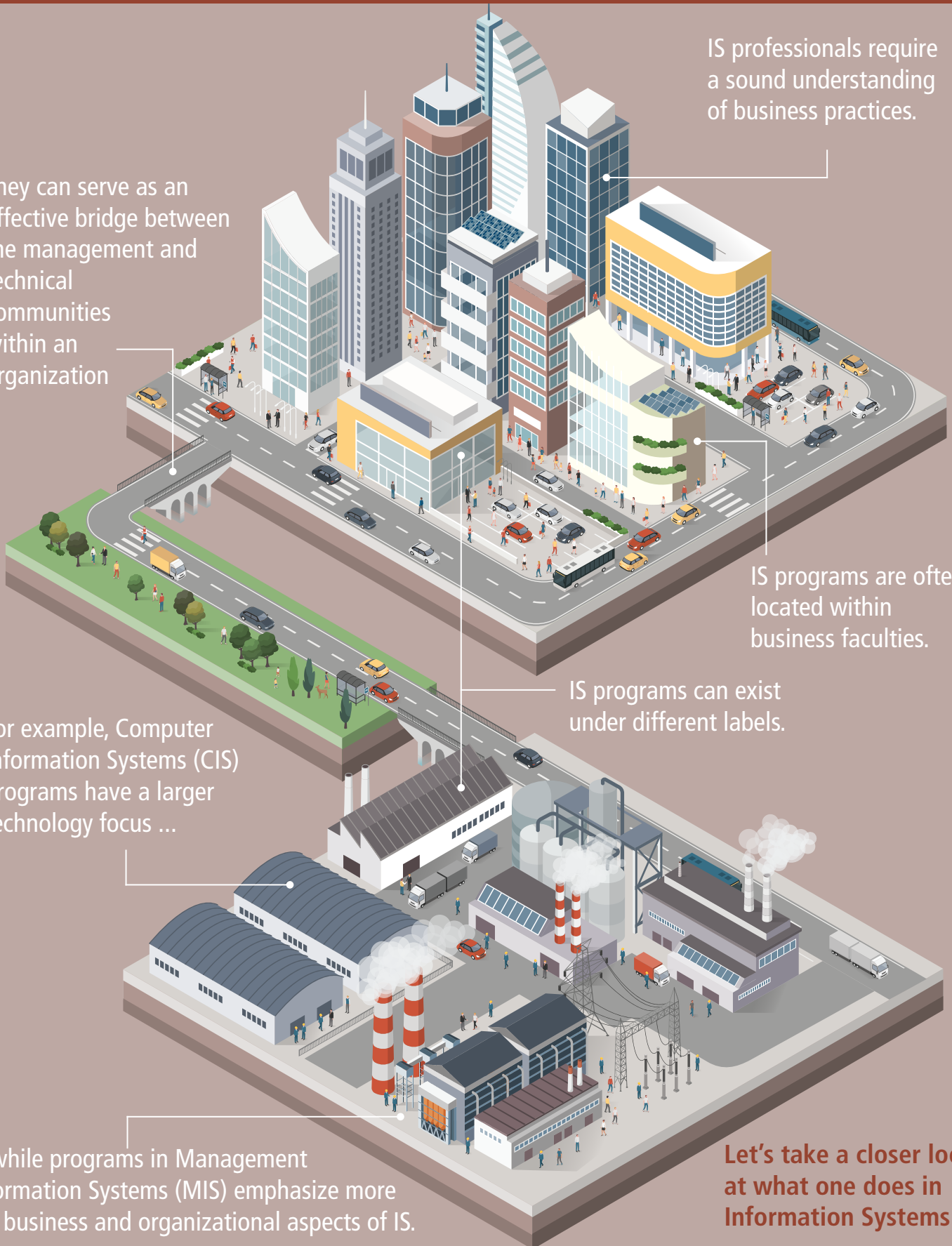
IS programs are often located within business faculties.

IS programs can exist under different labels.

For example, Computer Information Systems (CIS) programs have a larger technology focus ...

... while programs in Management Information Systems (MIS) emphasize more the business and organizational aspects of IS.

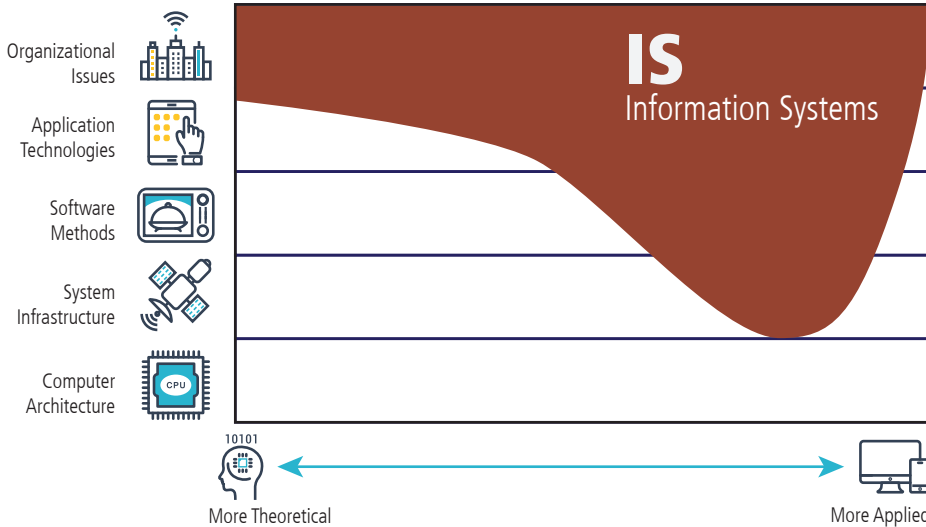Let's take a closer look at what one does in Information Systems ...

INFORMATION SYSTEMS

Summary

Information Systems is focused on the organizational issues of computing. Information Systems also has an interest in the applied aspects of application technologies and software development.

Organizational Issues
Application Technologies
Software Methods
System Infrastructure
Computer Architecture

IS
Information Systems

More Theoretical ← → More Applied

On the Job

Combines knowledge of business with knowledge of technology.

Selects computer systems to improve business processes.

Focuses on information, and views technology as a tool for generating, processing and distributing it.

Uses technology to give a business a competitive advantage.

Manages projects, teams of software developers or a computing department.

Core Courses

Application Design and Development

Data Analytics

Database Management Systems

Enterprise Architecture

Foundations of Information Systems

IT Infrastructure

Knowledge Management and Business Intelligence Systems

Management Information Systems

Managing Digital Transformation

Programming for Information Systems

Project Management

Security, Privacy and Ethics

Strategy, Management & Acquisition

Systems Analysis and Design

Sample Degrees

University of Windsor, Bachelor of Science in Computer Information Systems

Queen's University, Bachelor of Commerce in Information Systems

Mount Royal University, Bachelor of Science in Computer Information Systems

Concordia University, Bachelor of Computer Science in Information Systems

St. Francis Xavier University, Bachelor of Information Systems

University of Manitoba, Management Information Systems

Carleton University, Bachelor of Commerce in Information Systems

Saint Mary's University, Bachelor of Commerce in Computing and Information Systems.

Other Pathways

Sheridan College, Computer Systems Technology – Systems Analyst (Advanced Diploma – 3 years)

Saskatchewan Polytechnic, Business Information Systems (Diploma – 2 years)

Holland College, Computer Information Systems (Diploma – 2 years)

Douglas College, Computer and Information Systems (Diploma – 2 years)

Kwantlen Polytechnic University, Computer Information Systems (Diploma – 2 years)

British Columbia Institute of Technology, Business Information Technology Management (Diploma – 2 years)

George Brown College, Information Systens Business Analysis (Certificate – 1 year)

Athabasca University, Certificate in Computing and Information Systems (Certificate – 1 year online)

TECHNOLOGY-FOCUSED

COMMUNICATOR

CUSTOMER SERVICE

DETAIL-ORIENTED

PATIENCE

INFORMATION TECHNOLOGY
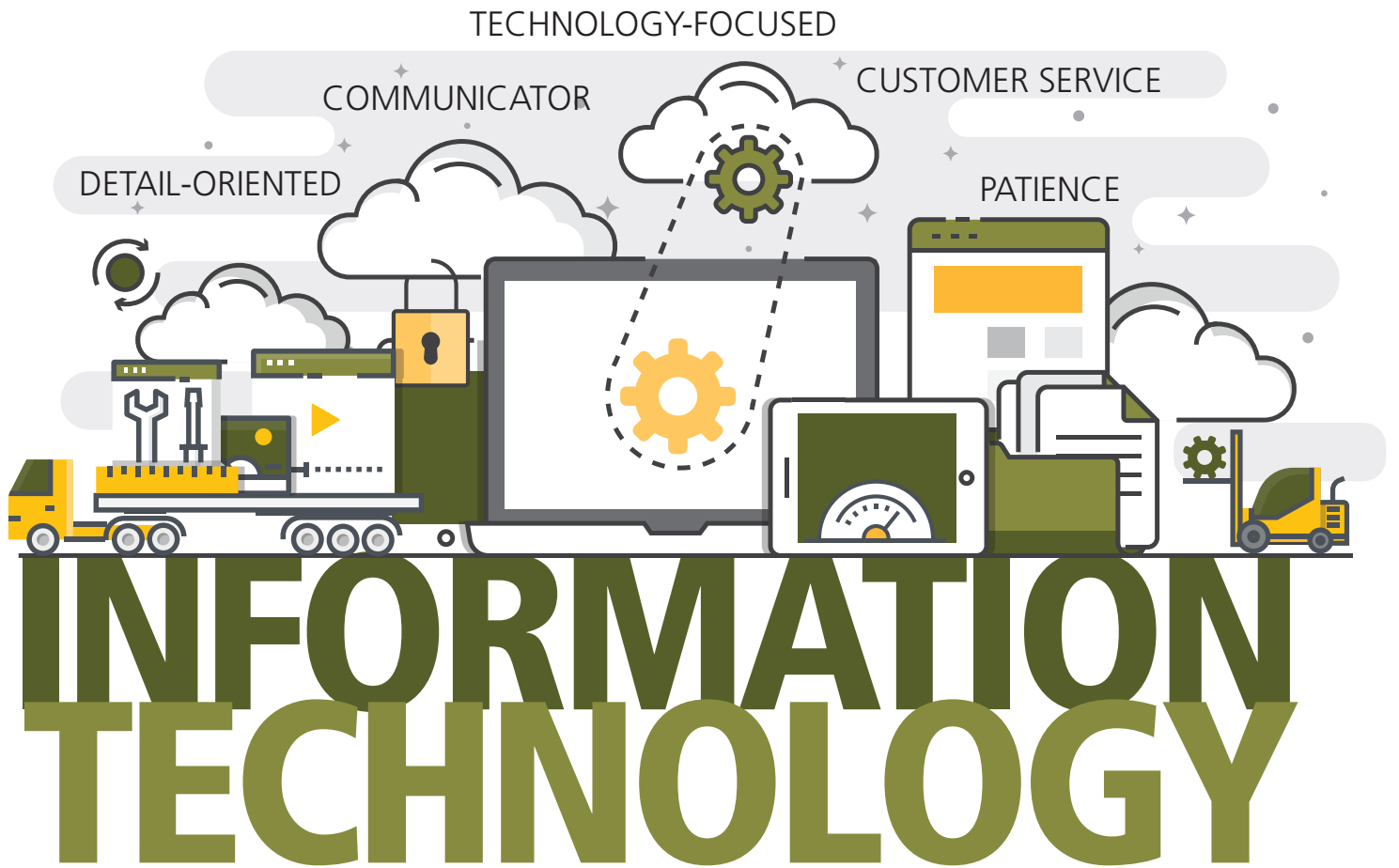
Information Technology professionals **provide customer service with a focus on technology**. They work to meet the computer technology needs of business, government, healthcare, schools, and other kinds of organizations. Their emphasis is on the technology itself more than the content or information it conveys.

IT professionals select appropriate hardware and software products for the organization, and integrate these with existing hardware. Their responsibilities may include installation of networks, security, design of web pages, multimedia resource development, and the installation of communication components such as email systems. They are responsible for planning and managing the entire technology lifecycle.

INFORMATION TECHNOLOGY

Information Technology (IT) programs prepare students to meet the computer technology needs of businesses and other organizations.

IT is a new field and its programs exist under different labels (that is, they may not use the IT label in their name).

IT specialists select hardware and software products and ...

... install, customize, and maintain those products for a variety of organizations and users.

They are especially focused on applying and integrating a wide-range of technical skills.

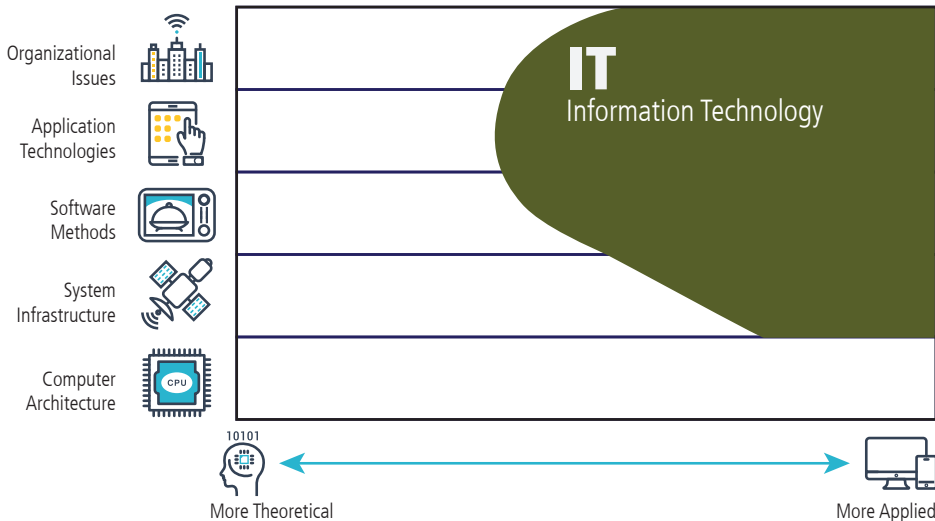**Let's take a closer look at Information Technology tasks ...**

INFORMATION TECHNOLOGY

Summary

Information Technology is focused on the applied side of computing. It covers all aspects of technology infrastructure, including hardware, operating systems, applications, data storage and communication systems.

Organizational Issues
Application Technologies
Software Methods
System Infrastructure
Computer Architecture

IT
Information Technology

More Theoretical — More Applied

On the Job

Integrates hardware and software.

Applies technology to solve practical problems.

Provides a support role, within an organization, to help others make the best use of its technical and information resources.

Uses a wide range of foundational knowledge to adapt to new technologies and ideas.

Understands both technology and business, but with a focus more on the technical side.

Core Courses

Communications and Networking

Computer Forensics

Database Systems

Fundamentals of Web Systems

Information Assurance and Security

Information Storage and Retrieval

Managing IT Infrastructure

Operating Systems

Programming Fundamentals

Project Management

System Administration and Maintenance

Technology in the Global Arena

Virtualization and Cloud Computing

Web Architecture and Administration

Sample Degrees

York University, Bachelor of Arts in Information Technology

Algoma University, Bachelor of Arts in Information Technology

Concordia University College of Alberta, Bachelor of Science in Information Technology

Bishop's University, Bachelor of Arts in Information Technology

Mount Saint Vincent University, Bachelor of Applied Arts in Information Technology

Carleton University, Bachelor of Information Technology

Seneca College, Bachelor of Technology – Informatics and Security

Trent University, Bachelor of Arts in Computing Systems

Brock University, Bachelor of Science in Computing and Network Communications.

Other Pathways

Mohawk College, Computer Systems Technology (Advanced Diploma – 3 years)

Centennial College, Computer Systems Technology – Networking (Diploma – 2 years)

Thompson Rivers University, Information Technology (Certificate – 30 credits)

Conestoga College, Information Technology Business Analysis – Operations (Certificate – 2 years)

British Columbia Institute of Technology, Computer Information Technology (Certificate – 2 years)

Red River College, Business Information Technology (Diploma – 2 years)

Nova Scotia Community College, Information Technology (Diploma – 2 years)

Dalhousie University, Information Technology (Certificate – Postgrad)

COMPLEXITY

USER FOCUSED

ENGINEERING PRINCIPLES

DESIGN

PROJECTS

SOFTWARE ENGINEERING
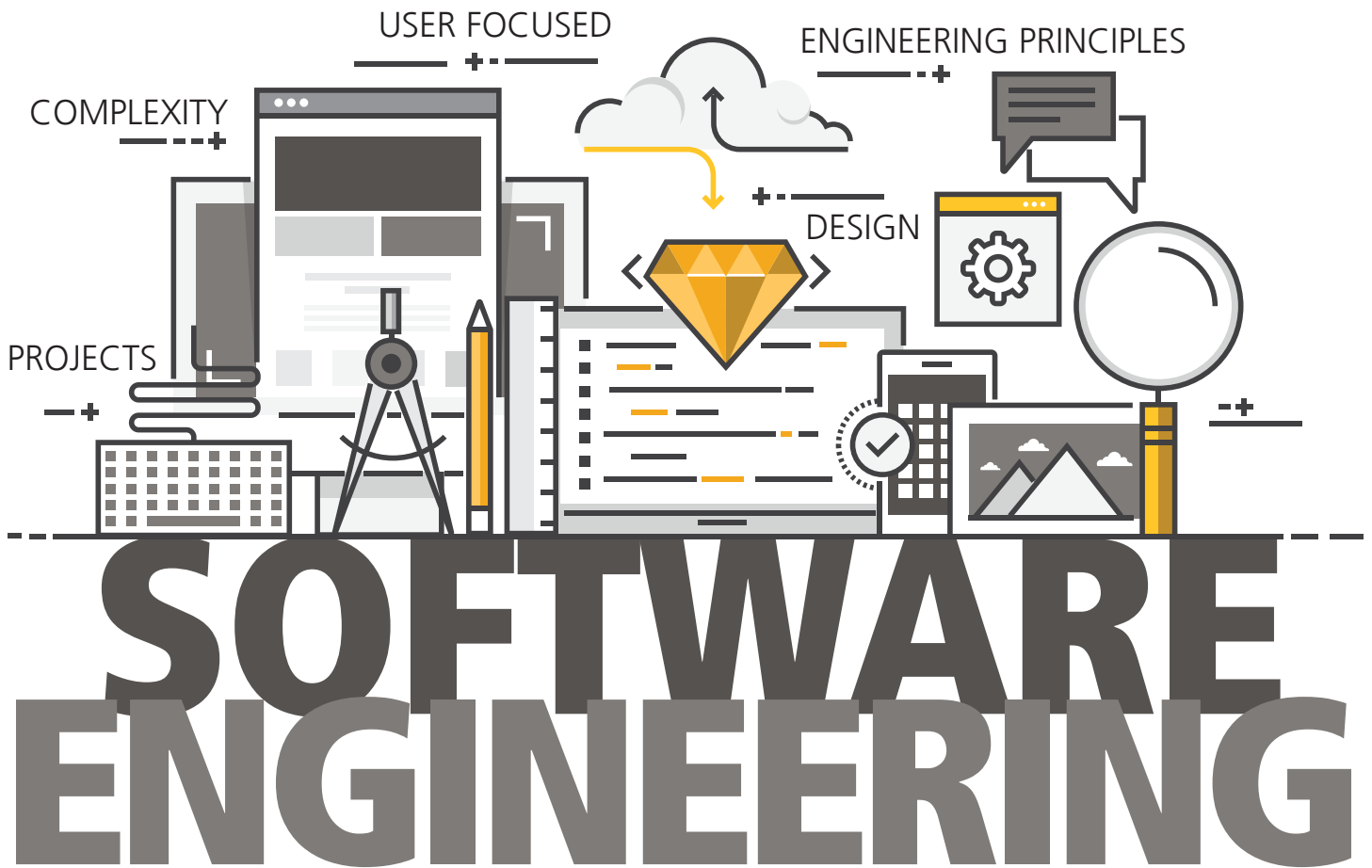
Software Engineers develop and maintain large-scale software systems. Using the principles of mathematics and computer science, and the practices of engineering, software engineers learn how to develop software that meets customer needs.

Their expertise is in software reliability, and they focus on techniques for developing and maintaining appropriate software solutions.

Software engineers work closely with customers, they learn how to assess customer needs and they often manage large, complex and/or safety-critical software projects.

Software Engineering (SE) is the discipline of developing and maintaining large software systems.

Degree programs in Computer Science and in Software Engineering have many courses in common.

SE students learn about software reliability and maintainability.

They learn best practices for engineering software applications.

They experience teamwork and focus on effective project management processes.

Some SE programs are within Engineering departments ...

... while others are specialities within Computer Science.

Let's take a closer look at what a software engineer can do ...

SOFTWARE ENGINEERING

In Software Engineering (SE) we are focused on how to best develop reliable large-scale software systems.

We use special design techniques so that software is more likely to be reliable and correct.

We may supervise a team of developers.

We are interested in learning and improving software design principles.

We also develop new testing techniques to create safer software.

We need to be able to assess user needs and develop usable software.

We are often engineers, which means we also have traditional engineering skills and training.

Our engineering perspective allows us to look deep inside complex software systems.

We sometimes do many of these same tasks over in Computer Science as well.

Computer Engineering has some similarities, but we are more focused on the connection between software and hardware.
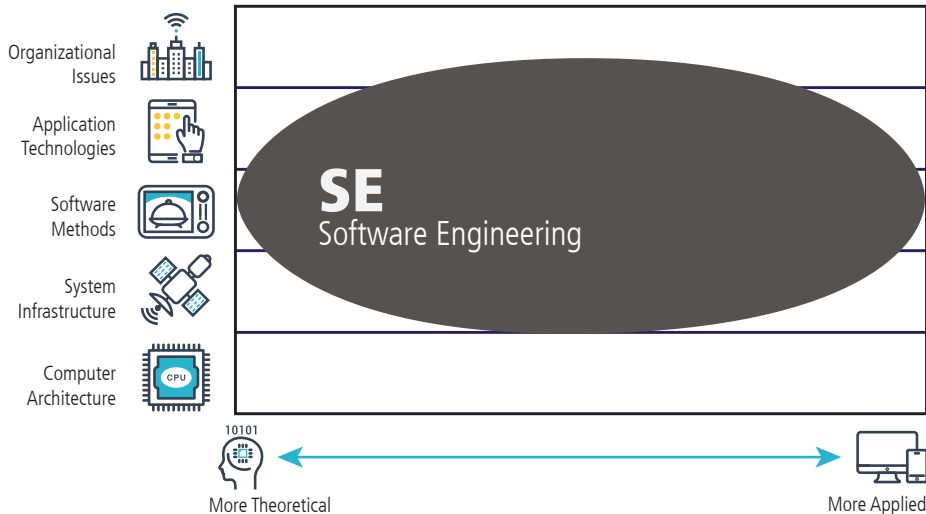
SOFTWARE ENGINEERING

Summary

Software Engineering is focused on everything (from applied to theoretical) related to software methods, that is, writing software. Infrastructure and application technologies are also part of software engineering.

Organizational Issues
Application Technologies
Software Methods
System Infrastructure
Computer Architecture

SE
Software Engineering

10101

More Theoretical · More Applied

On the Job

Focuses on large-scale systems development.

Designs testing procedures for large-scale systems.

Utilizes theory to research and design software solutions.

Develops software systems that are maintainable, reliable, efficient, and satisfy customer requirements.

Utilizes sound engineering practices to create computer applications.

Manages a team of software developers.

Core Courses

Algorithm Analysis

Computer Architecture

Data Integration and Analysis

Data Structures and Algorithms

Data Visualization

Fundamentals of Complex Systems

Mathematical and Engineering Fundamentals

Programming Fundamentals

Project Management

Requirement Analysis

Software Design and Processes

Software Modeling and Analysis

Software Testing and Quality Assurance

Sample Degrees

University of Guelph, Bachelor of Computing in Software Engineering

University of Victoria, Bachelor of Engineering in Software Engineering

University of Calgary, Bachelor of Science in Software Engineering

University of Manitoba, Bachelor of Science in Software Engineering

Concordia University, Bachelor of Engineering in Software Engineering

University of New Brunswick, Bachelor of Science in Software Engineering

University of Waterloo, Bachelor of Software Engineering

Concordia University, Bachelor of Software Engineering

Seneca College, Bachelor of Technology – Software Development

Other Pathways

Durham College, Computer Programmer Analyst (Advanced Diploma – 3 years)

Centennial College, Software Engineering Technician (Diploma – 2 years)

Sheridan College, Computer Systems Technician – Software Engineering (Diploma – 2 years)

Humber College, Computer Programming (Diploma – 2 year)

Nova Scotia Community College, IT Programming (Diploma – 2 year)

Bow Valley College, Software Development (Certificate – 1 year)

British Columbia Institute of Technology, Applied Software Development (Associate Certificate - 1 year)

George Brown College, Mobile Application Development and Strategy (Certificate – 1 year)

NETWORK TECHNOLOGY

DATA SCIENCE

GAME DEVELOPMENT

MULTIMEDIA + WEB DEV

BIOINFORMATICS

CYBER SECURITY

OTHER
SPECIALIZATIONS

Not every computing program that you find in a college or university will have one of these five ACM discipline titles. For example, there are undergraduate degrees in Game Design, Cybersecurity, and Network Technology. Many universities also offer mixed majors that combine computing with a variety of other disciplines, including Computational Science, BioInformatics, Computational Arts, and Data Science.

One-year certificates, two-year diplomas, and three-year applied or associate degrees provide dozens of other options, either as stand-alone training or post-degree specialization. These programs often use a variety of titles which don't always map to the five ACM discipline areas.

The next several pages provide more information about six popular specializations; this isn't an exhaustive list but hopefully provides some inspiration if the five ACM disciplines don't match your precise career goals.

CYBERSECURITY

Cybersecurity is a new computing-based discipline involving technology, people, information, and processes to enable assured operation.

DATA SECURITY

NETWORK SECURITY

ORGANIZATION SECURITY

SOFTWARE SECURITY

SYSTEM SECURITY

SOCIETAL SECURITY

It is an interdisciplinary course of study, including aspects of law, human factors, ethics, and risk management along with technical skills in networking, cryptography, & security best practices.

Sample programs: Bachelor of Science in Information Security (U of Toronto), Advanced Diploma in Information Security (Red River College), Graduate Certificate in Cybersecurity (Centennial College).

DATA SCIENCE

Data Science is an emerging discipline focused on the extraction of knowledge from data using techniques and theories from both computing and statistics.

DATA WRANGLING

BUSINESS ANALYTICS

ALGORITHMS

MACHINE LEARNING

PATTERN RECOGNITION

STATISTICS

VISUALIZATION
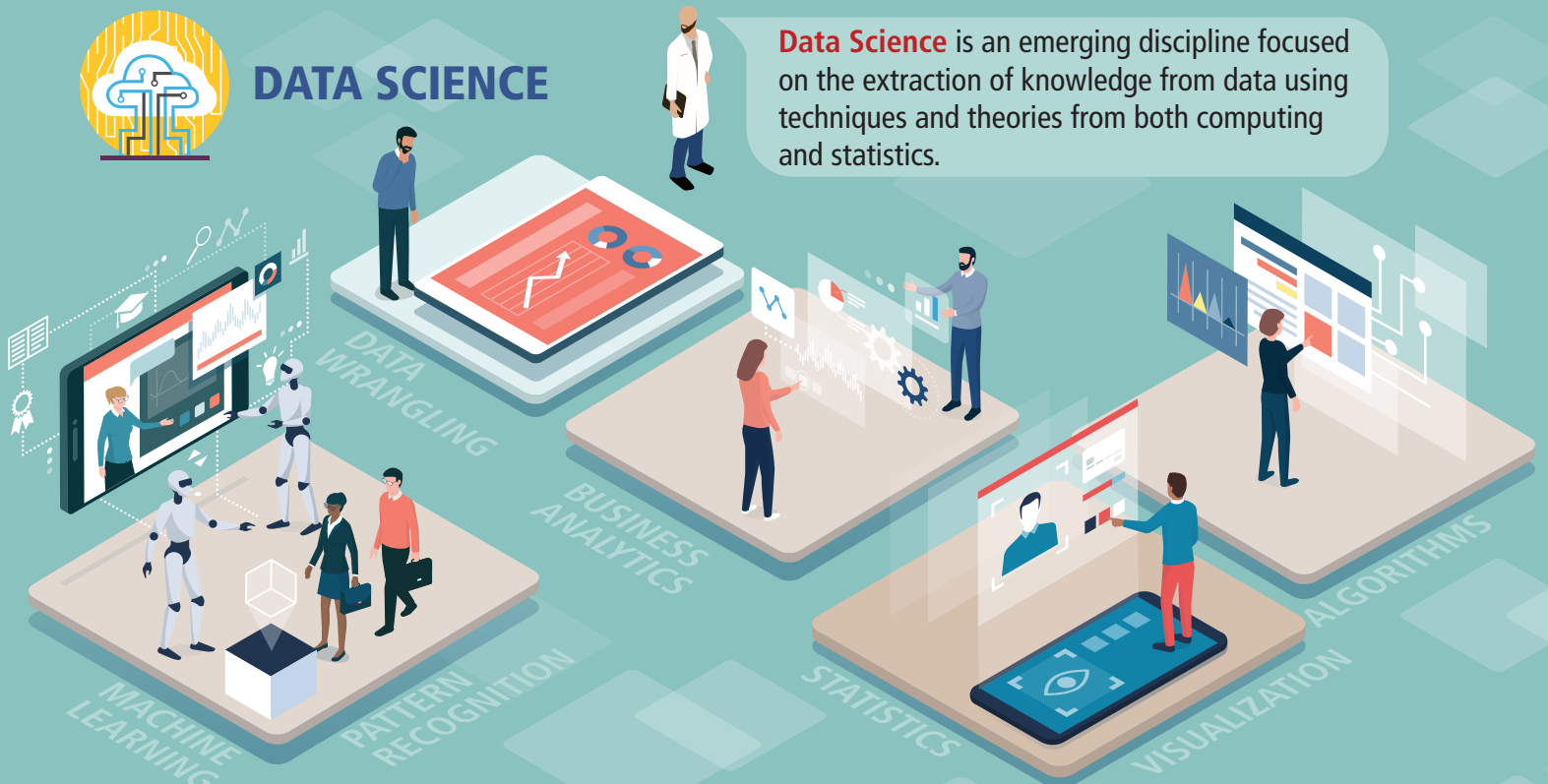
It is also an interdisciplinary study area that includes topics and theories from computing, statistics, communications, mathematics, and business.

Sample programs: Bachelor of Computer Science in Data Science (Waterloo University), Data Science and Analytics Diploma (U of Calgary), Data Science Certificate (Sheridan College).

BIOINFORMATICS

Bioinformatics is an interdisciplinary study area that makes use of techniques from computer science and mathematics to solve biological problems.

DNA

SEQUENCING

DATABASES

Biology and medicine have been transformed by large datasets and computational modelling.

This course of study typically involves learning how to organize, transform, analyze, and visualize biological data by developing new algorithms and by using existing software.

ALGORITHMS

GENOME

STATISTICS

Sample programs: Bachelor of Science – Bioinformatics and Computational Biology (U of Toronto), Diploma in Bioinformatics (Langara College), Graduate Certificate in Bioinformatics (McGill University).

NETWORK TECHNOLOGY

Network Technology is a practical field focused on supporting network computer infrastructures.

OPERATIONS

CONFIGURATION

CLOUD

This study area focuses on the installation, operation, and management of real-world networking infrastructure.

SECURITY

It can be a concentration within Information Technology.

Sample programs: Bachelor of Information Technology - Network Technology (Carleton University), Advanced Diploma in Computer Systems – Networking (Centennial College), Certificate in Computer Networking (Saskatchewan Polytechnic).

GAME DEVELOPMENT

Game Development focuses on the unique programming and design tasks involved in creating video games.

It can be a concentration within Computer Science ...

... or it can be a dedicated program that covers not just programming, but also design, interaction, 3D, animation, graphic formats, and testing.

Sample programs: Bachelor of Fine Arts in Game Design & Development (Wilfrid Laurier University), Advanced Diploma in Game Development (Niagara College), Graduate Certificate in Game Development (Fanshawe College).

MEDIA DESIGN + WEB DEVELOPMENT

Media Design + Web Development is focused on learning the practical skills needed in the rapidly changing world of digital media design and web development.

This study area can focus on the key programming languages or focus instead on the visual design and usability aspects.

Sample programs: Bachelor of Arts in Interactive Digital Media (U of Toronto), Diploma in Web Development (U of Winnipeg), Certificate in Web Design + Development (Humber College).

CAREER PATHWAYS

There are many pathways to most computing careers.

While some computing jobs require very specific credentials, the overall shortage of qualified graduates has meant that employers are sometimes willing to hire people from a wide-variety of educational backgrounds.

Also, often within computing, you may find yourself moving to different types of computing work as you gain experience or technology changes.
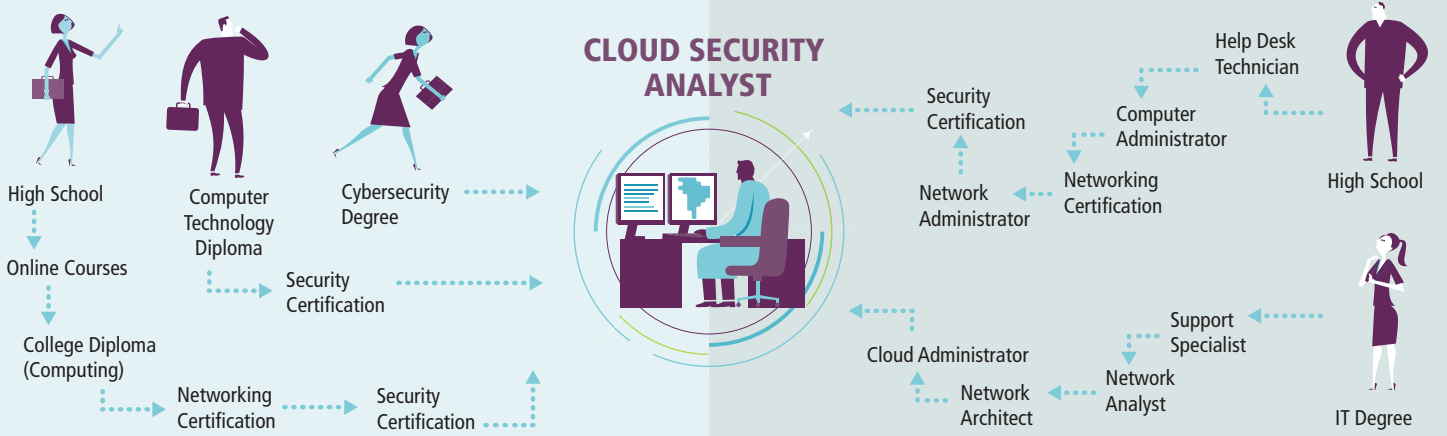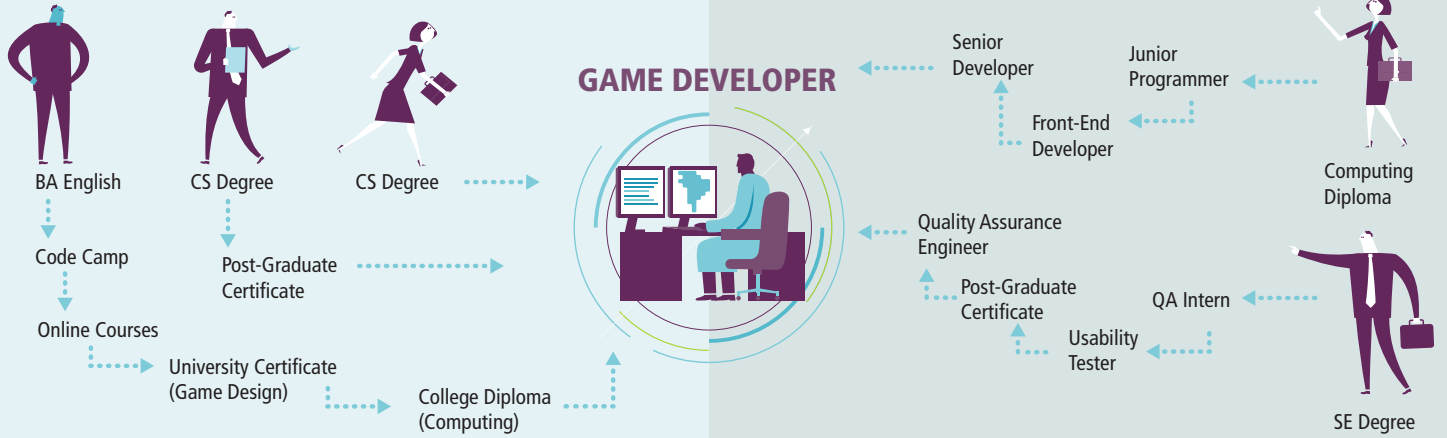
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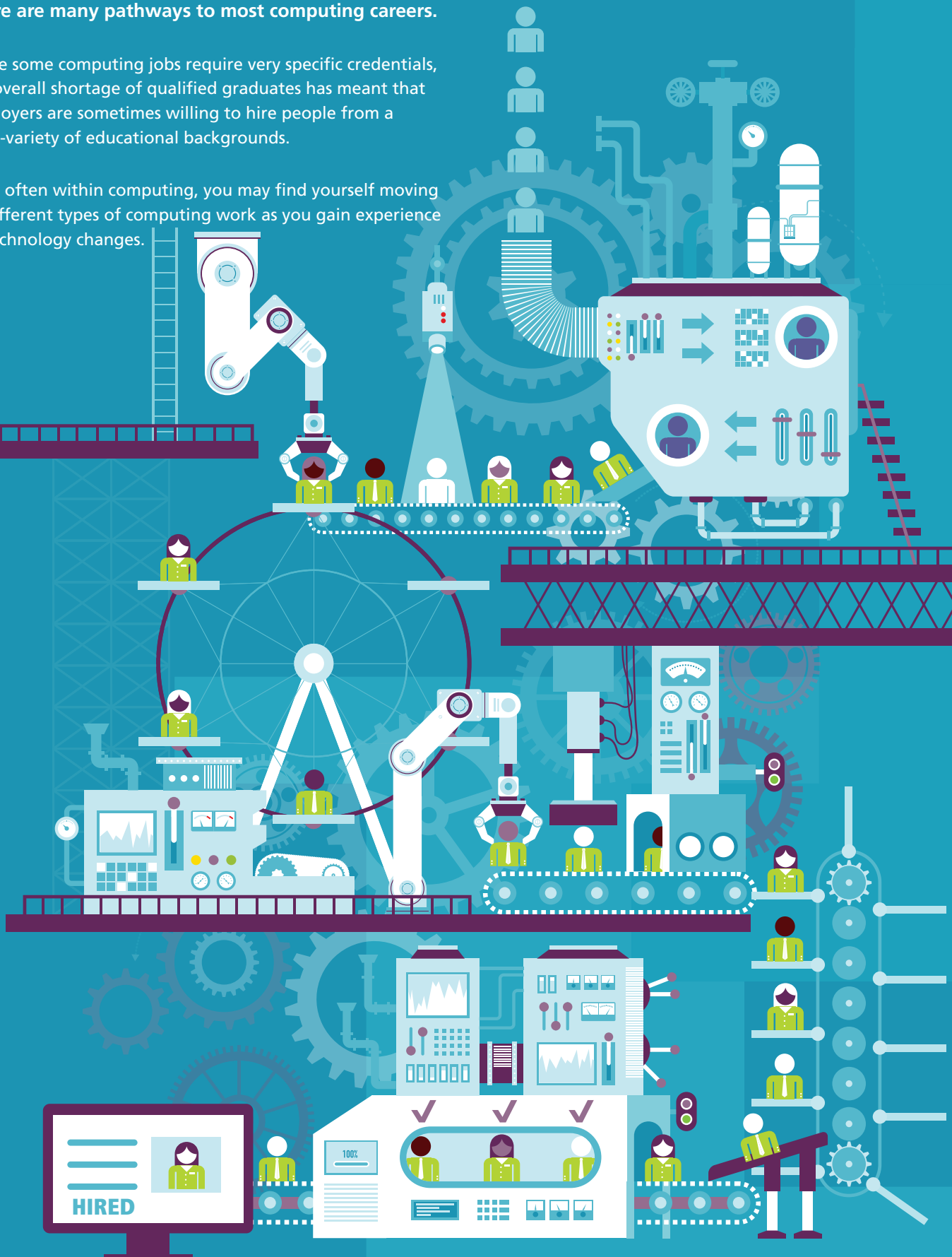
SAMPLE CAREER PATHWAYS

Here are some hypothetical examples of the different pathways that different people might take in order to arrive at the same specific job.

These are only examples. One of the amazing (but confusing) aspects of computing is the wide variety of paths to any given job!

STUDY PATHWAYS | WORK PATHWAYS

GAME DEVELOPER

Study Pathways:
- BA English → Code Camp → Online Courses
- CS Degree → Post-Graduate Certificate
- CS Degree
- University Certificate (Game Design) → College Diploma (Computing)

Work Pathways:
- Senior Developer → Front-End Developer → Junior Programmer → Computing Diploma
- Quality Assurance Engineer → Post-Graduate Certificate → Usability Tester → QA Intern → SE Degree

CLOUD SECURITY ANALYST

Study Pathways:
- High School → Online Courses → College Diploma (Computing) → Networking Certification → Security Certification
- Computer Technology Diploma → Security Certification
- Cybersecurity Degree

Work Pathways:
- Help Desk Technician → Computer Administrator → Networking Certification → Network Administrator → Security Certification → High School
- Cloud Administrator → Network Architect → Network Analyst → Network Analyst → Support Specialist → IT Degree

MACHINE LEARNING SPECIALIST

Study Pathways:
- Engineering Diploma → Data Analytics Certification → University Certificate (Machine Learning)
- IS Degree → Statistics Online Course
- Data Science Degree

Work Pathways:
- Web Developer → Web Architect → Recommendation Engine Specialist → CS Degree
- Data Science Certificate → Web Analytics Specialist → Web Content Marketer → Business Diploma

For new technological areas within computing, precise educational pathways often don't exist yet or are only newly emerging.

The value of a general computing credential in one of the ACM disciplines, is that they prepare their graduates to learn these new areas when they eventually emerge.

ALUMNI STORIES

"Ok, this does sound interesting ... but what do graduates really think about their studies, their work, and computing in general?"

The next two pages provide a small sampling of some stories and experiences from real computing graduates across the country. There are of course as many different stories as there are graduates, but we hope this selection of quotes gives you another picture of what a computing career can look like.

Michelle Findlay-Olynyk
Software Engineer @ Google, Los Angeles
Bachelor in Science, then Education, then Computer Science

If I could go back to my 20-year-old self, I'd say take a little more time to be sure of what you want, and find allies who will help you achieve it.

General problem-solving skills (which can be improved!) are more important than knowing specific language features.

Stefan Radeta
CTO @ TLink Golf; CEO @ BridgeWater Labs, Alberta
Bachelor in CIS

I really recommend taking a minor in business ... you get a whole picture and a diverse skillset. It is no longer enough to be technically strong; the workforce needs creative thinkers too.

Jay Gandhi
SAP Solutions Architect, Ontario
Bachelor in MIS, SAP Certificates

When you first start out, instead of becoming a specialist I would recommend becoming a generalist to get a wide breadth of exposure and experience to continue learning in all facets.

Pranay Patel
IT Solution Analyst, Alberta + Ontario
Bachelor in CIS, Masters in Management Science

Building a strong and long-lasting career is a process. It is full of setbacks, challenges, and changes. For a successful career, you will need a positive attitude, willingness to learn, adaptability to change, and most importantly patience.

You may not find the right opportunity at first, but if you keep up and stay committed to these core principles you will succeed.

Aida E
Digital Architect, Finance Industry
PhD in CE, specializing in SE

Be patient, work on your problem solving skills; don't be afraid of failure; be curious and search about anything that is new to you, don't be afraid of not knowing something ...

J J Nixdorf
Technical Director @ Kabam Games, British Columbia
Bachelor in CS, Masters CS

I have overseen teams of software engineers, computer scientists, and IT professionals, and learning to manage change early on in my career was an asset.

The prospects in the entertainment industry are better than any time before. ... the industry is a bit of a roller coaster, but a thrill nonetheless.

Change may be scary, but it is among the best teachers that you can find ... The tech industry has a variety of jobs, roles and cultures. You can't see them all from just one place.

Richard Catudal
Analyst @ R2I, Quebec
Diploma in IT, CISCO certification

My job as a support technician and analyst is very rewarding. You will have tons of fun in the IT profession and never run out of work if you posses the following: self-discipline, problem-solving skills, attention to detail, great communication skills, and a passion for technology.

Ladi Tella
Senior Network Solution Designer @ Suncor Energy, Alberta
Bachelor in Agricultural Engineering, various certificates in IT

After graduation I worked for 2 years ... then started taking professional IT courses using a self-study approach. I have taken over 30 professional certifications in the various branches of IT to prepare me for what I am doing now.

Jude Okoro
Information Security Specialist @ NTT Data, Nova Scotia
Bachelor in CS, Masters in IS, Certificates in Security

The ever dynamic and rapidly changing information security technology landscape is quite challenging ...Anyone pursuing a career in information security is also required to be very diligent and have a means to stay up to date with changes in the industry.

Samaneh Rajabi
Software Developer, Alberta
Bachelor in SE, Masters in IT

Working in a young, small company is challenging but you will have the opportunity to learn from a variety of responsibilities and grow with the company.

It takes a lot of practice to become a competent programmer ... If anything, I would have got more coding practice during my time at university.

RELATING JOB TITLES TO THE ACM COMPUTING DISCIPLINES

The following table provides examples of how some sample job titles relate to the five ACM disciplines, and shows where additional training may be needed.

As you can see, there is a lot of overlap. One of the amazing things about the computing industry is that over one's career, one can potentially have a variety of different jobs.

| Job Title | Computing Discipline | | | | | Possible Additional Training |
	CE	CS	IS	IT	SE	
Business System Analyst			★		★	Business/Commerce
Computational Scientist		★				Mathematics, Sciences
Computer Network Support Specialist	★			★		
Data Analyst		★	★			Statistics
Database Administrator		★	★	★		
Gaming & Multimedia Specialist		★			★	Graphic Design, Creative Writing
Hardware Engineer	★					Electrical/Electronic Engineering
Information Security Analyst		★	★	★		
IT/IS Consultant		★	★	★		
Medical Computing / Bioinformatics		★				Biology, Health Sciences, Statistics
Project Manager	★	★	★	★	★	
Quality Assurance Specialist	★	★	★	★	★	
Software Developer	★	★	★	★	★	
Systems Administrator	★			★		
Systems Analyst and Designer		★	★		★	
Web Developer / Designer		★	★	★	★	Graphic Design

RESURCES

For more occupational information, consider these free Canadian resources.

Canada – explore careers, wages, etc:
www.jobbank.gc.ca/trend-analysis
www.guichetemplois.gc.ca/analyse-tendances (french)

Canadian Occupational Projection System:
occupations.esdc.gc.ca/sppc-cops

Simply Hired (Canada)
www.simplyhired.ca
fr.simplyhired.ca (french)

Working in Canada:
www.workingincanada.gc.ca/home-eng.do
www.guichetemplois.gc.ca/accueil-fra.do (french)

Ontario – Job Profiles:
www.ontario.ca/page/labour-market
www.ontario.ca/fr/page/marche-du-travail (french)

Québec – Exploring Trades and Occupations
www.quebec.ca/en/employment/trades-occupations/explor
ing-trades-occupations
www.quebec.ca/emploi/metiers-et-professions/decou
vrir-des-metiers-et-des-professions (french)

Alberta – Occupational Information:
www.alis.gov.ab.ca/occinfo

British Columbia: Work BC
www.workbc.ca/Jobs-Careers/Explore-Careers.aspx

Manitoba – Career Development:
www.manitobacareerdevelopment.ca

New Brunswick – Explore Careers:
www.nbjobs.ca/explore

Newfoundland and Labrador:
www.gov.nl.ca/labourmarketinformation

Nova Scotia – Explore Careers:
explorecareers.novascotia.ca

PEI – Career Development:
www.cdspei.ca

Saskatchewan – Jobs, Working, Training:
https://www.saskatchewan.ca/residents/jobs-working-
and-training

Yukon – Explore careers:
yukonworkfutures.gov.yk.ca

For additional information about computing education and careers, consider these additional sites.

The Information and Communications Technology Council (ICTC):
www.ictc-ctic.ca

Canada's Assocaition of IT Professionals (CIPS):
www.cips.ca

Information Technology Association of Canada:
www.itac.ca

CS-CAN / Info-Can
cscan-infocan.ca

Association for Computing Machinery (ACM):
www.acm.org

IEEE Computer Society
computer.org

ACM Computing Curricula Recommendations:
www.acm.org/education/curricula-recommendations

Careers in Computing:
www.computerscienceonline.org

Computer Occupations (US Bureau of Labor):
www.bls.gov/ooh/computer-and-information-technology/
home.htm

Association for Women in Computing:
www.awc-hq.org

To download a free copy of this guide
in English or French, go to:
ceric.ca

**To view additional content for this handbook, which
includes additional interviews, links, and references,
visit:**
computingcareers.ca

COMPUTING CAREERS & DISCIPLINES
A QUICK GUIDE FOR PROSPECTIVE STUDENTS AND CAREER ADVISORS

Why should you consider computing when choosing a career?

What kind of computing jobs are out there?

What kind of education pathways will guide you to the computing career you desire?

This guide provides answers to these questions!