

Introduction

Genesys Works is looking for assistance at evaluating technology trends and the impacts on entry-level positions and skills required for those positions in the next three years. The MN Tech ACE Leadership program formed a team of ACE participants to assist in doing this research, present our findings, and provide a few recommendations for Genesys Works to consider.

As businesses become more and more focused on the customer and the customer experience, new technologies emerge, and new start-up companies cause disruption in all industries, it's forcing most organizations to focus on their digital transformation in order to compete, create efficiencies, and meet customer expectations. This digital transformation has led to keeping on top of the latest technology trends. There's a number of technologies that are moving from cutting edge to the new normal for organizations, and the need for people to be trained and able to leverage the new technologies has never been higher.

While not a technology trend in and of itself, there's three trends and skills that are pervasive throughout all the different technology trends; automation, coding/scripting skills, and the ways of working. Automation isn't new, but organizations are looking for ways to automate more and more and using new technologies to automate manual processes in new ways. Many of the technology trends include forms of automation. In order to utilize these new technologies and build new automations, it's critical for technology professionals to be able to read, write, and understand code/script. Many things that have historically been done manually are shifting now to be automated through code/script. Lastly, the soft/interpersonal skills needed to from technology professionals to deliver technology solutions are increasingly more important as more and more companies move to agile ways of working.

The following is a list of some of the key technologies that are becoming the new normal for organizations and areas that should be of focus for Genesys Works to educate and train new interns.

1. Cloud Computing

Organizations are moving out of hosting their own data centers and moving to hosting their infrastructure on the cloud. This has many implications to technology professionals from Network to Application Development and it requires new skills to effectively leverage the Cloud.

2. Robotic Process Automation (RPA)

Automation in general is something that's increasing in demand, and Robotic Process Automation is what technology organizations are leveraging to achieve this quickly without needing to rewrite systems or completely recreated processes.

3. Cybersecurity

As technology increases and more and more things move to digital, so too do criminals move to digital and become more sophisticated. Keeping data and organizations safe has always been important, but in this digital transformation the need and demand for cybersecurity continues to increase.

4. Artificial Intelligence / Machine Learning / Big Data

While these technology trends could be split out, the underlying importance here is data. As organizations begin to truly leverage their data as an asset and look to bring more and more data together to find trends and insights, the need for new roles and new skills are becoming more and more important. The evolution of Machine Learning and Artificial Intelligence are backed by data and skills to develop and leverage Machine Learning and Artificial Intelligence can create improved experiences, improved processes, and a competitive advantage for organizations. In some cases, Artificial Intelligence capabilities, such as chat bots, are becoming table stakes.

5. Business Intelligence

While most in depth and sophisticated skills are needed for things like Machine Learning and Artificial Intelligence, the need for other technology professionals to be able to leverage data and tools to gain improved insights and reporting for others continues to increase in importance. This allows organizations to leverage their data and turn it into actionable insights.

6. Ways of Working

When looking at technology trends, you need to look at both the technologies themselves as well as the way technology solutions are being delivered. This includes things like agile ways for working, automation of solutions through things like DevOps, and looking at the soft/interpersonal skills that are needed to be successful.

7. Other Trends

Additionally, there are other technology trends that are gaining momentum but are not yet mainstream. These technologies are things to keep an eye on to see how they are leveraged and the impacts they may have on businesses.

a. Blockchain

Blockchain is best described as a distributed ledger that can record transactions between parties in a way that's permanent and immutable. While Blockchain is being adopted now, for things like cryptocurrency and delivery of goods, it still hasn't been widely adopted by many organizations.

b. Internet of Things (IoT)

While in many senses the Internet of Things is already here. From lightning fixtures to thermostats to home security cameras for Smart Homes, IoT is already here and mainstream. However, for many organizations, IoT is not something that's been widely adopted. These types of capabilities are more commonly leveraged by manufacturing type organizations for products they create. How organizations may look to further leverage and adopt IoT is yet to be seen.

c. 5G

The emergence of 5G is expected to help continue to grow the use and adoption of IoT technologies as well as further assist in the use of AI. There's many benefits that 5G will bring and it's something to keep an eye on as to how it impacts businesses.

Cloud Computing

Some of the strongest new growth in the IT industry has been the widespread adoption of cloud technologies. According to TechRepublic, an estimated 83% of enterprises are in the cloud in some fashion as of 2020. The speed, flexibility and efficiency of cloud-based solutions means that most new IT projects will be launched on cloud platforms as well as large migration projects around moving legacy infrastructure. This has resulted in a dramatic shift in the scope and skills required for IT roles across the spectrum.

Public cloud providers

Much of currently deployed cloud infrastructure is on a small handful of public cloud providers. The most prominent three by a wide margin are Amazon AWS, Microsoft Azure and Google Cloud Platform. And understanding of these core players and a familiarity with their offerings is a must.

Containers: Docker and Kubernetes

Containers are an executable unit of software in which application code is packaged, along with its libraries and dependencies, in common ways so that it can be run anywhere, whether it be on desktop, traditional IT, or the cloud. One of the most popular container technologies is Docker. All major cloud platforms have support for Docker containers. Kubernetes is a further technology that allows for the deployment, provisioning and scaling of all your Docker containers.

Serverless and Infrastructure-as-a-Service (IaaS)

Serverless computing is a method of providing backend services on an as-used basis. A Serverless architecture allows users to write and deploy code without the hassle of worrying about the underlying infrastructure. A company that gets backend services from a serverless vendor is charged based on their computation and do not have to reserve and pay for a fixed amount of bandwidth or number of servers, as the service is auto-scaling.

DevOps: Infrastructure-as-Code

Cloud computing management is very amenable to DevOps approaches. Because infrastructure assets are managed via APIs and other web-based UI, it becomes easy to deploy and manage your IT footprint with scripting. Infrastructure as Code (IaC) is the management of infrastructure (networks, virtual machines, load balancers, and connection topology) in a descriptive model, using the same versioning as DevOps team uses for source code. Using tools such as Ansible or Terraform, scripts can be run to tear down, stand up and scale in or out the entire cloud infrastructure.

Cloud Technology Skills

Skills required for careers in Cloud technologies include knowing and understanding the major public cloud providers and their offerings. Familiarity with scripting: Python or JavaScript are good places to start. Understanding of using scripting to automate infrastructure, including tools like Ansible and Terraform. Knowledge of containers and container orchestration technology.

Robotic Process Automation (RPA)

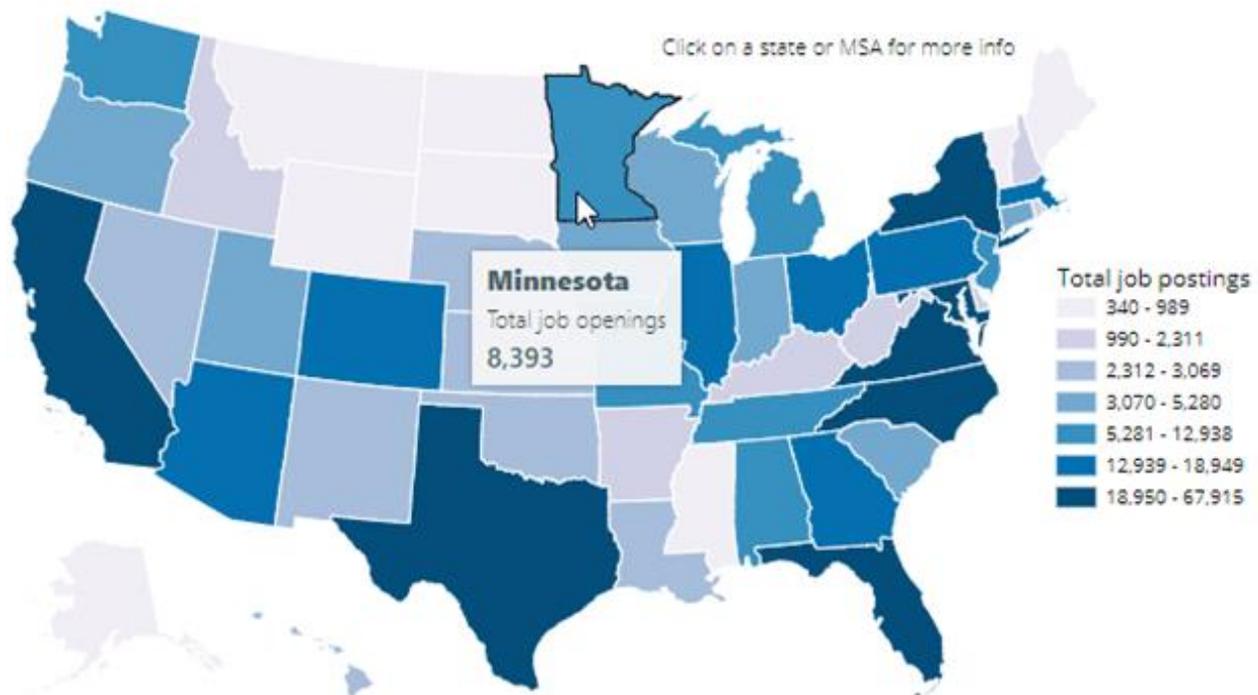
Robotic Process Automation (RPA) is a technology that utilizes pre-defined business logic, established rules and structured data to automate business processes. Software robots built on RPA are able to capture and interpret applications for processing a transaction, manipulating data, triggering responses and communicating with other digital systems. Robotic Process Automation is the ideal technology for much labor-intensive knowledge work. It handles repetitive, and rule-based, large volume tasks particularly well. RPA can be implemented across various business departments to automate numerous processes such as employee, customer, vendor onboarding, payroll processing, order processing, and report aggregation.

The global robotic process automation market size is expected to reach USD 25.66 billion by 2027, according to a new report by Grand View Research, Inc., expanding at a CAGR of 40.6% over the forecast period. The organization's need to automate structured, repetitive processes to focus on core business activities and reduce operation time and effort is anticipated to drive the growth.

Skills required for careers in this field include strong problem-solving and analytical skills, experience with one or more RPA technologies (e.g. UiPath, Automation Anywhere, Blue Prism), and at least 2 to 4 years of professional experience in programming (including scripting /coding), SQL and relational databases, and application development.

Cybersecurity

Today, America is facing an unprecedented shortage of cybersecurity talent, and as organizations continue to progress towards more digital transformation, the demand for cybersecurity professionals will continue to grow. Unfortunately, trained talent is not readily available. According to the international cybersecurity organization (ICS)2, the current cybersecurity workforce gap in the U.S. is over 500,000 (cyberseek.org 2020), and the global gap is around 4M.



Cybersecurity supply/demand heat map. (<https://www.cyberseek.org/heatmap.html>)

There are many opportunities for workers to start and advance their careers within cybersecurity. Just 42% of a recent study by ISC2 indicated that they began their careers in cybersecurity, meaning 58% moved into the field from other disciplines. The top skills needed in cybersecurity include solid work habits, soft skills, technical skills such as; knowledge of operating systems, networking, and common programming languages such as Python or Java.

Artificial Intelligence, Machine Learning, Big Data

AI, ML, and Big data are all related technologies that are rapidly emerging in today's data-driven businesses. The world has become awash with data, and the challenge is utilizing that data in new and innovative ways that benefit businesses and society. This pursuit has prompted a high demand for people with skills in data and artificial intelligence, according to LinkedIn (2020 U.S. Jobs Trends). Demand for AI Specialists / Machine Learning Engineers has grown 74% annually in the past four years, while demand for Data Scientist has increased by 37%. Indeed, one of the most popular online job boards included Machine Learning Engineer and Data Scientist in their Best Jobs of 2019 report, coming in at number 1 and number 22, respectively. The skills required to do these jobs include; Python, data engineering, and knowledge of deep learning tools, such as TensorFlow.

Business Intelligence

Business Intelligence (BI) is a booming field that has come into vogue over the last few decades. This field refers to how businesses leverage both software and various internal and external services to transform their data into actionable decisions. An explanation of the rise in this field would not be complete without an explanation of the rise in self-service BI tools such as Tableau or Domo. Before these tools existed, BI was controlled by the iron-grip of an IT department, staffed with people with deep technical knowledge in data science. The tools and associated insights were largely inaccessible to other members of an organization e.g managers and non-technical employees. However, the rise of these tools and technologies allows people, across an organization, to dive into the data and produce actionable insights and reports without requiring a member of IT to help. This increases an organization's agility which is a core competency for building a sustainably enduring business. This need is what has ballooned every organization's demand for business intelligence practitioners.

Business Intelligence is made possible due to the robust tools that are available. These tools access and analyze large data sets and show the analytical findings in summaries, dashboards, reports, graphs, charts, and in some cases as maps; essentially detailed intelligence about the current state of the business. The reporting function is a core factor of business intelligence and the dashboard functionality is what enables it. With the proliferation of all these tools, organizations are finding it increasingly important to BI analysts. These are analysts who have an understanding of the core application and use of BI tools in driving actionable insights for the organization. BI analysts are pivotal in helping instrument and optimize an organization's existing use of its BI tools. This field is growing and will continue to see more growth as entire industries become digitized.

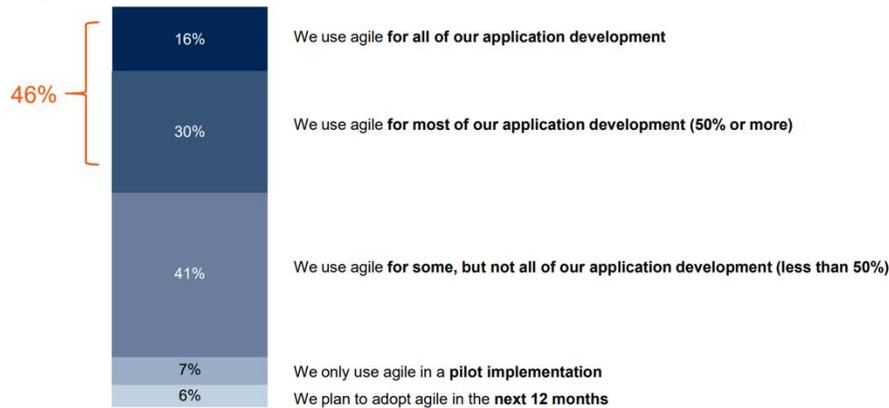
Ways of Working Trends

Agile Methodology

[Agile](#) methodologies are focused on delivering features quickly, adapting to feedback instantly and weaving value into every stage of the lifecycle.¹ Agile is an extremely popular development methodology, and our research shows that trend will not be changing anytime soon. A [2019 Gartner study on Agile in the Enterprise](#) shows how entrenched Agile is within development organizations.

Nearly Half Use Agile for All or Most of their Application Development

Agile development in organizations
Percentage of Respondents



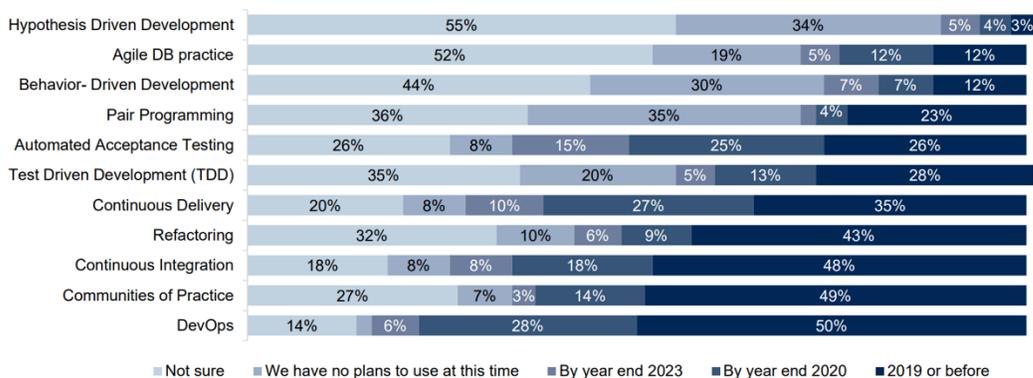
Base: n=130 Gartner Research Circle Members; Excluding 'Not sure'
S01. Which of these best describe agile development in your organization?
SOURCE: Gartner Research Circle Agile in the Enterprise

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Agile Technical Practices Will Be in Place for Most by 2020

Beginning of Agile Enterprise Practices
Percentage of Respondents



*Note: "Other" not shown due to small base size
**Note: data labels less than 3% not shown
Base: n=130 Gartner Research Circle Members
Q09. When did/will your organization begin to use each of the following agile technical practices?
SOURCE: Gartner Research Circle Agile in the Enterprise

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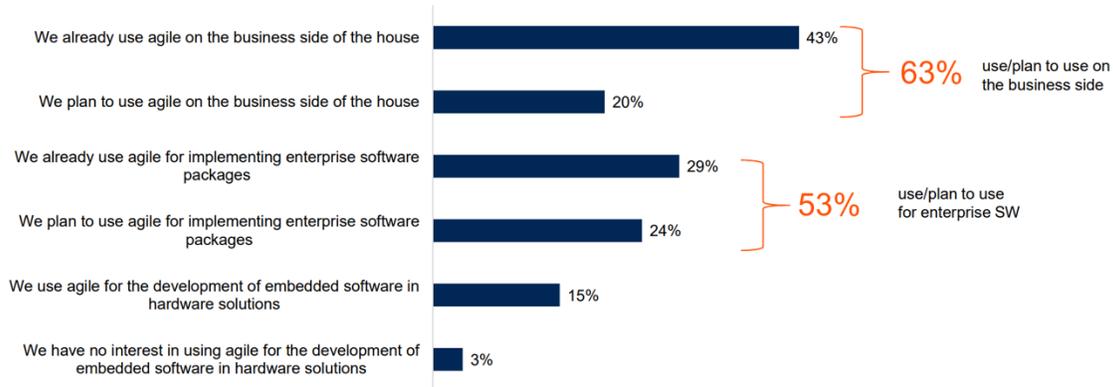


¹ [Agile in 2020: A look at the defining trends](#)

In fact, Agile has been so successful within IT that as part of business transformations, companies have begun to successfully expand their use of Agile strategies to other parts of the business, such as HR and Marketing.

A Majority Use or Plan to Use Agile on the Business Side And for Implementing Enterprise Software

Usage of Agile Outside of Application Development
Percentage of Respondents



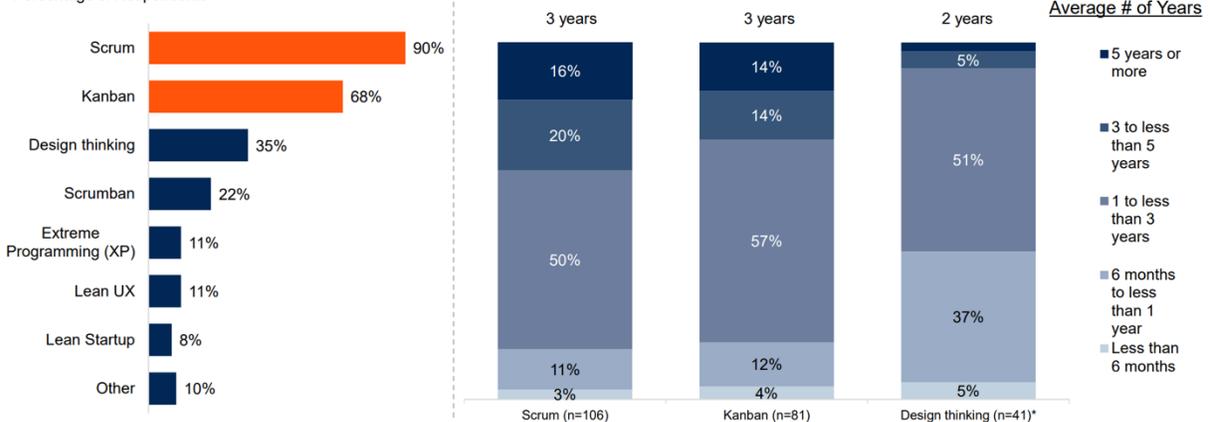
Base: n=115 Gartner Research Circle Members; Excludes 'Not sure'
SQ3. Which of these best describes the use of agile outside of application development?
SOURCE: Gartner Research Circle Agile in the Enterprise



We strongly recommend that prospective technologists familiarize themselves with Agile fundamentals, such as [Scrum](#) and [Kanban](#), and practice them prior to landing their first technology job. This will enable them to hit the ground running as they become part of a Technology Agile team.

Scrum and Kanban Are Well-Established; Design Thinking Is Growing

Agile Methods Used, Duration of Agile Methods Used
Percentage of Respondents



Base: n=124 Gartner Research Circle Members whose organization's development is based on "Agile", "Iterative" or "Lean IT" methodologies; Excludes 'Not sure'
Q03A. What proportion of your organization's development/planned development is based on each of the following methodologies?
SOURCE: Gartner Research Circle Agile in the Enterprise

*Note: Methods with small base size not shown (<30)
**Note: data labels less than 3% not shown
Base: Gartner Research Circle Members; Excludes 'Not sure'
Q03B_1. How long has your organization been using each of these agile methods?
SOURCE: Gartner Research Circle Agile in the Enterprise



DevOps & DevSecOps

Another trend we see continuing to grow over the next several years is a continued movement toward DevOps.

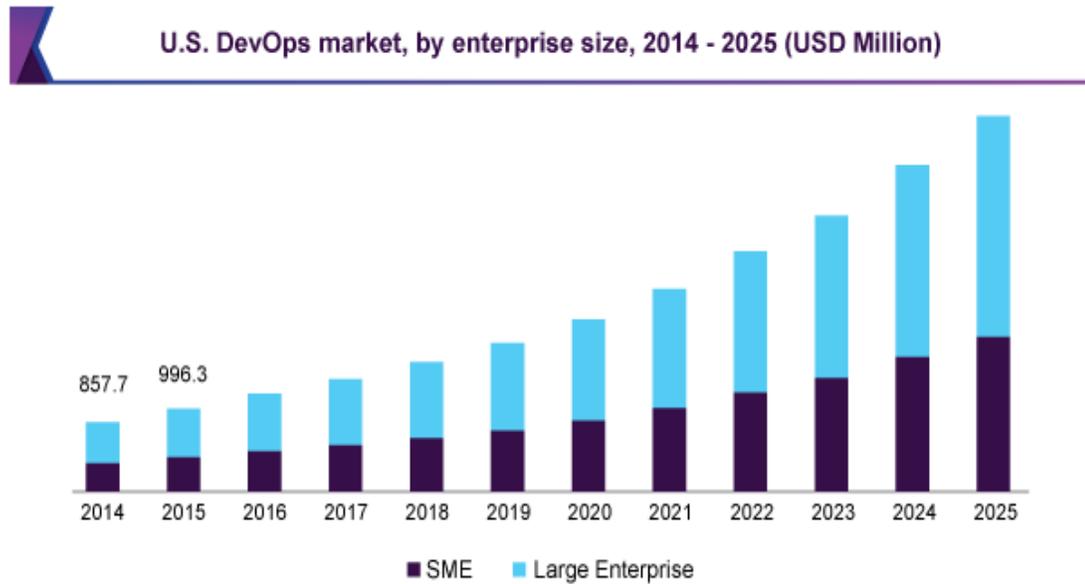


Image Source: www.grandviewresearch.com

DevOps is a set of practices that combines software development (Dev) and IT operations (Ops). It aims to shorten the systems development life cycle and provide continuous delivery with high software quality. DevOps is complementary with Agile software development; several DevOps aspects came from Agile methodology.²

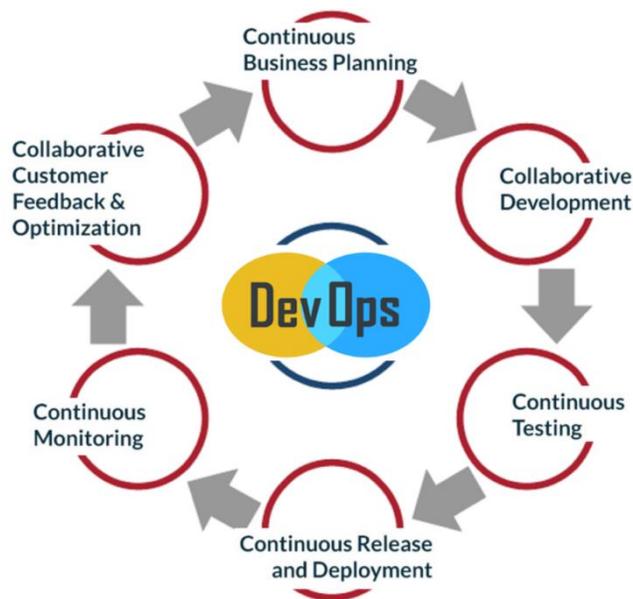


Image Source: Linux.com's 6 C's of DevOps

Automation is the ultimate need for DevOps practice and 'Automate everything' is the key principle of DevOps. In DevOps, automation kick starts from the code generation on Developers

² [DevOps, From Wikipedia, the free encyclopedia](https://en.wikipedia.org/wiki/DevOps)

machine through code deployment and even after that to monitor the application and system in production.³

There has also been a rising trend of [DevSecOps](#); DevSecOps is about injecting security first in the life cycle of application development, thus lessening vulnerabilities and bringing security closer to IT and business objectives. This model assumes everyone is responsible for security and hence less noise and dilemma on who did what and what went wrong.⁴

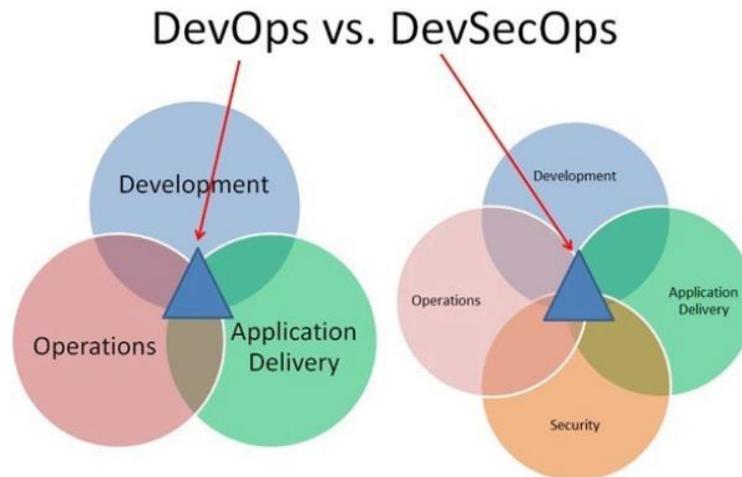


Image Source: DZone – DevOps Trends 2019

In summary, prospective technologists who are interested in a career in software development should prepare for a DevOps role -- to share responsibility for Development, Operations, Application Delivery and Security as well.

Soft Skills

As we interviewed various technology leaders throughout our companies, a singular theme emerged that wasn't related to a specific technology at all. Rather it centered around soft skills. Nearly everyone we spoke to communicated a preference to hire prospective technologists who exhibit the following characteristics and soft skills:

- Self-motivation/Drive
- Problem Solving/Troubleshooting skills
- Critical Thinking
- Strong communication
- Collaboration/Team Player
- Interest in Learning

Those we interviewed felt that if the candidate exhibited such skills, they could be easily trained to become a good technologist.

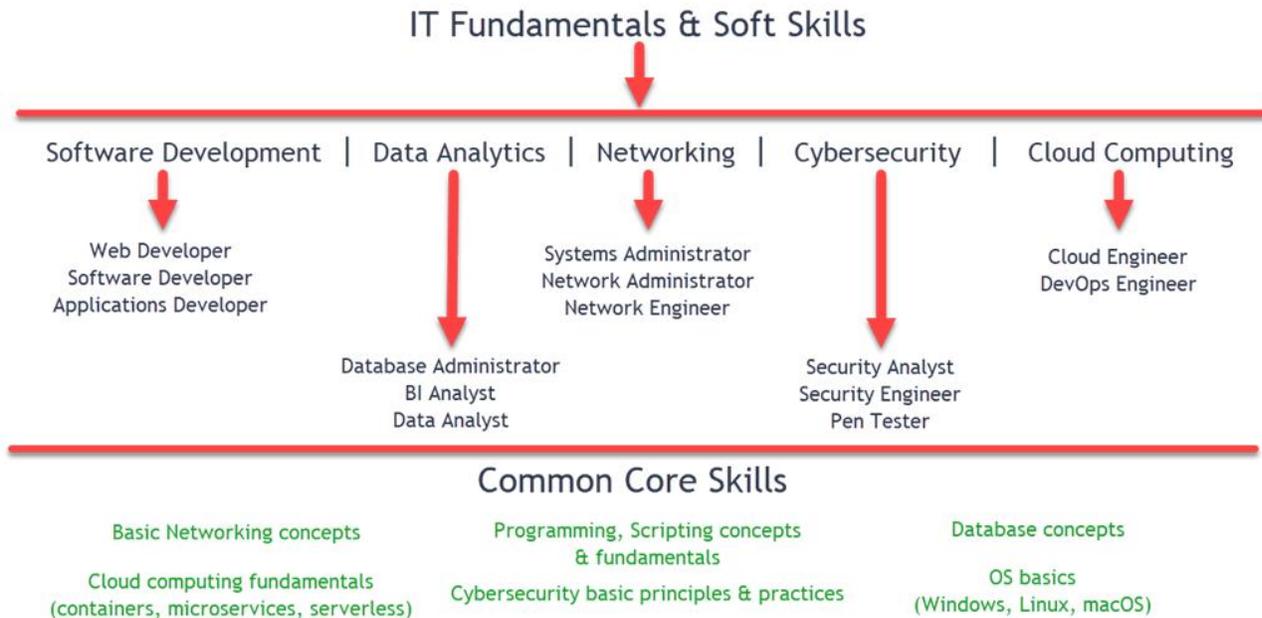
Those interested in a career in technology should prepare to be assessed for these key traits during the interview process. [Targetjobs](#) also includes a list of important soft skills to possess for a professional career and offers suggestions for how to best prepare to be assessed in these areas.

³ [DevOps Automation: How is Automation Applied in DevOps Practice](#)

⁴ [DevOps Trends 2019 – What You Need to Know](#)

Technology Trends Mapped to Roles and Competencies

The aforementioned trends bring to light the need for various roles and competencies within organizations – both now and in the future. The following graphics shows how the such trends map to various roles and common core skills. If Genesys Works can help develop future technologists with these fundamental IT skills, they can not only help fulfill a growing demand in the tech industry, but they can also have a profoundly positive impact on students’ lives in the process.



Developing Skills That Matter

The future is very bright for those entering or already working within the tech industry -- particularly as the aging baby-boomer workforce retires. With a greater number of companies transforming to digital, there will be more demand for technologists with knowledge and experience relating to the trends identified above.

We’ve analyzed the trends and technologies that support those trends and have identified a specific set of technology skills that we feel would be most beneficial for those entering the technology workforce in the next 1-3 years. This is by no means a comprehensive list. Rather it is geared toward what is foundational, popular, and where the jobs are.

Technology Category	Popular	Our Recommendation
Programming Languages	Python, JavaScript, Java, C#, PHP, Selenium	Python, JavaScript, Selenium (for test automation)
Database / Business Intelligence	SQL/Relational, NoSQL/Unstructured	MySQL
Cybersecurity	Phishing, Ransomware	GW keep existing curriculum; add Ransomware
Networking	LAN, WAN, Wireless, Automation	GW keep existing curriculum
Cloud Computing	Containers, Microservices, Serverless	Free usage, AWS Lambda, small container
DevOps	GIT, Jenkins, AzureDevOps	GIT Jenkins
Ways of Working	Agile (Scrum, Kanban, DOJO)	Agile Scrum

Python and JavaScript are scripting languages. Not only are they easier to learn than a compiled language such as Java, but they are also some of the most sought-after skills by employers, in terms of number of available positions both today and into the foreseeable future.

Top Paying and Most Popular Programming Languages in 2020

Rank by Average Salary		Rank by Volume of Job Openings	
1. Python	\$119,000	1. Python	50,000
2. JavaScript	\$117,000	2. SQL	50,000
3. Java	\$104,000	3. Java	45,000
4. C	\$103,000	4. JavaScript	38,000
5. C++	\$102,000	5. C++	29,000
6. C#	\$97,000	6. C#	21,000
7. PHP	\$94,000	7. PHP	13,000
8. SQL	\$92,000	8. C	9,000

Image Source: Code Platoon – The Best Paying and Most In-Demand Programming Languages in 2020

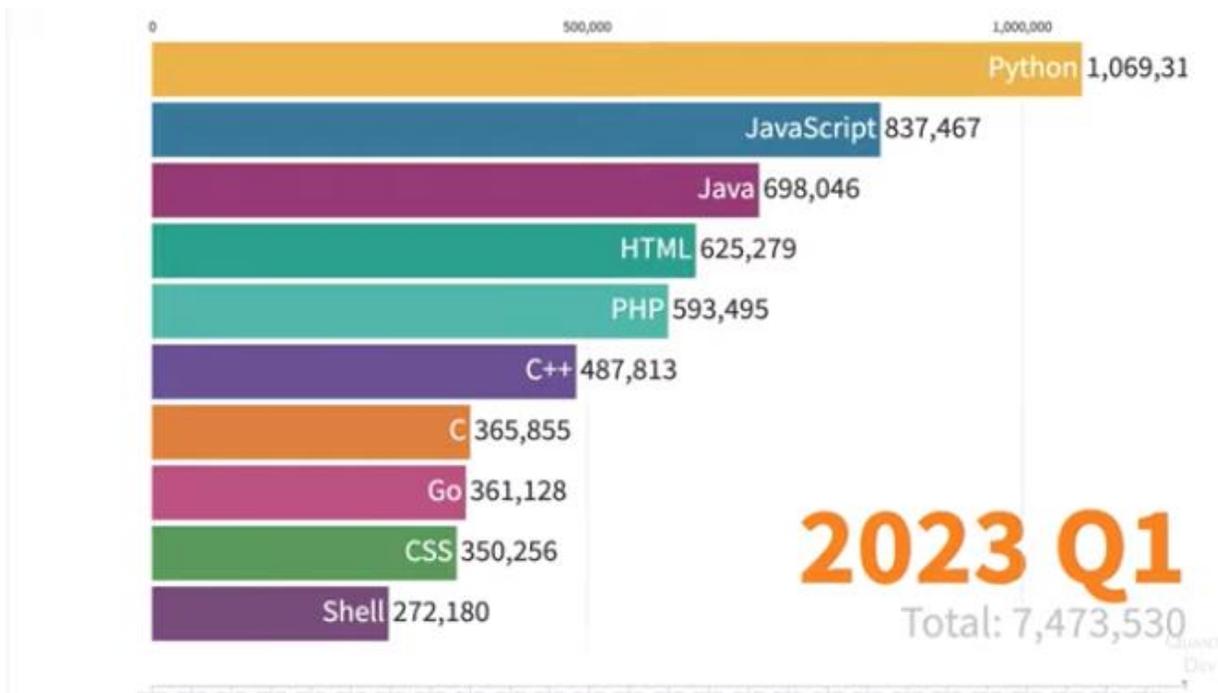


Image Source: YouTube: Most Popular Programming/Markup/Stylesheet Languages 2010 – 2023 (extrapolated) on GitHub

Recommendations for Genesys Works Intern Development

This document was created to aid Genesys Works in the development of a thorough job description and experience for their upcoming internships. In this document, we will highlight the different methods and strategies that Genesys Works could use to improve the probability of their internship experience is a success. A successful internship contributes to interns being more successful and having a high affinity for your company. We will present higher-level strategies, and then supplant these strategies with tactical action items that can be executed on.

Strategies

1. Create Learning Paths

Establishing learning paths for an intern to take part in is a definite requirement of a successful internship experience. These paths provide a framework through which the company can better analyze and assess their interns to ensure that they receive value from the situation. To make these pre-established learning paths a success, make sure to do the following:

- a. Consider creating two learning paths, one for beginner level and one for the intermediate-advanced group. Students will take part in the learning path best suited for them.
- b. Provide all interns with IT fundamentals and soft skillsets during the first few weeks.
- c. The intermediate-advanced group should spend additional time learning programming fundamentals.
- d. Provide interns with the opportunity to learn about other technology areas such as; Database concepts and Cloud computing.

2. Curriculum

In addition to creating learning paths, developing excellent curriculum will maximize an intern's value. Curricula are great tools for providing a snapshot of what one will be learning and are a proxy for the value-add training - which is the skills you gain. Additionally, interns can use great curriculums to attain the knowledge to impact the businesses they are working for positively. We have highlighted some actionable items to implement great curriculums below:

- a. The essential meta-skill for all technology jobs is the ability to read and write code/script. So an excellent curriculum will develop this ability in people.
- b. Leverage learning organizations to extend the learning capabilities of your interns. Organizations such as Google, Microsoft, and CompTIA have certification programs providing deep learning for participants. We recommend utilizing the following certifications or following their course guideline and exam topics when creating your curriculum.

IT Fundamentals:	CompTIA ITF+
Programming:	Coursera Python for Everybody
Data / BI:	Microsoft Database Fundamentals (98-364)
Cloud computing:	CompTIA Cloud Essentials+ or Cloud+
Cybersecurity:	CompTIA Security+
Networking:	CompTIA Network+
Project Management:	CompTIA Project+

- c. Providing a practical hands-on project is an excellent way for students to learn. We recommend developing practical projects that allow students to interact and use multiple technologies. For example: Writing a simple python program that pulls data from a website and stores it in file or database.
- d. Continue to focus on building soft skills capabilities within your curriculum. These soft skills can be developed with mentor programs, business etiquette programs, group projects, and many more. The soft skills you should be striving to implement within your interns are as follows:
 - **Communication skills** - done by observing the intern's email, slack, or other messaging platform etiquette and behavior.
 - **Collaboration skills** - done through having a group or shared intern specific projects for the interns to work on.
 - **Professionalism** - done through how the team, that intern is a part of, interacts with them.
 - **Presentation skills** - done through a final presentation or group project.

3. Skills recommendation by importance

- 1.Soft Skills
- 2.IT Fundamentals
- 3.Programming
- 4.Data / BI
- 5.Cloud computing
- 6.Cybersecurity
- 7.Networking
- 8.Project Management

Conclusion

Digital Technology is transforming nearly every company, yet only 7% of businesses have fully implemented it. The changes occurring in this space provide a wealth of opportunity for young individuals entering the technology workforce with the skills companies seek. By incorporating the core foundational skills we've recommended into the curriculum, Genesys Works will be well-positioned to help fill that demand with valuable talent!