Comparing Software Engineers and Computer Programmers

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*Abstract*—There is often confusion about the differences between software engineers and computer programmers. In this paper, we will highlight the differences between the two career paths by providing information on their unique roles and responsibilities, their salaries and projections, along with the future trends in the industries.

*Index Terms*—Computer Programmer, Software Engineer

# Roles and Responsibilities

## Software Engineer

The roles and responsibilities of a software engineer are very much an umbrella of jobs as they must be competent and knowledgeable about many aspects of computers, from programming to architecture. They typically take a supervisor role and over-watch the more specialized computer scientists that they are working under.

One of the duties software engineers must complete is conferring with systems analysts, engineers, programmers and others to design systems to obtain information on project limitations and capabilities, performance requirements and interfaces. There is also modifying existing software to correct errors, allowing it to adapt to new hardware, as well as to improve software performance. They also must analyze user needs and software requirements to determine feasibility of design within a given time frame and cost constraints. Software engineers must also consult with customers directly about software system design and maintenance. In addition, they also coordinate software system installation and monitor equipment functioning to ensure that specifications are met.

Software engineers design, develop, and modify software systems, using scientific analysis and mathematical models to predict and measure outcomes and consequences of design. They then develop and direct software system testing and validation procedures, programming, and documentation. They may also be asked to analyze information to determine, recommend, and plan computer specifications and layouts, as well as peripheral equipment modifications. On top of everything else, they must also know how to supervise the work of programmers, technologists, technicians and other engineering and scientific personnel; determine system performance standards; and even train users to use new or modified equipment. They can also be required to store, retrieve, and manipulate data for analysis of system capabilities and requirements, specify power supply requirements and configuration, and even recommend purchases of equipment to control dust, temperature, and humidity in area of system installation.

In summary, the role of the software engineer is very broad and usually not restricted to a set number of responsibilities. They assume the role of the leader and spearhead of the project and thus must be required to speak the language and guide everyone they work with in order to see the project fulfilled as intended [1].

## Computer Programmer

As for computer programmers, their roles and responsibilities can be a bit more specific. They must know how to correct errors by making appropriate changes and then rechecking the program to ensure that the desired results are produced. They must also know how to consult trial runs of programs and software applications to be sure that they will produce the desired information and that the instructions are correct. They would know how to compile and write documentation of program development and subsequent revisions, inserting comments in the coded instructions so others can understand the program.

It is also often required for programmers to 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. Programmers must also consult with managerial, engineering, and technical personnel to clarify program intent, identify problems, and suggest changes. Programmers must be competent in performing direct revision, repair, and expansion of existing programs to increase operating efficiency while also adapting to new requirements. They may also need to know how to write, analyze, review, and rewrite programs, using workflow chart and diagram, and applying knowledge of computer capabilities, subject matter, and symbolic logic. Writing or contribution to instructions or manuals to guide end users is also common. They may be asked to investigate whether networks, workstations, the central processing unit of the system, and/or peripheral equipment are responding to a program’s instructions. They may need to perform systems analysis and programming tasks to maintain and control the user of computer systems software as a systems programmer. They could have to consult with and assist computer operators or system analysts to define and resolve problems in running computer programs. Programmers can also be needed to assign, coordinate, and review work and activities of programming personnel, collaborate with computer manufacturers and other users to develop new programming methods, or even train subordinates in programming and problem coding.

In summary, the roles and responsibilities of a computer programmer are much more confined to working directly with the computer, probably with a team of other programmers, and likely under the supervision of a software engineer [2].

From the lists given, it can be seen that software engineers and computer programmers share some overlap, but their main roles and responsibilities are quite different. They both require consulting and working with other individuals within the same field, perhaps even working through some of the same tasks involving program development and writing, but it could be argued that the software engineer has more in common with the programmer than the programmer has with the software engineer as the software engineer requires a slightly broader understanding of the program development process in order to work with all of the different computer related professions that they must work with.

# Salary and Projections

Highly skilled individuals in the tech sector often receive offers of competitive and generous employer benefits and salaries. Since these individuals are in such high demand, companies must offer incentives for their employees to stay with them, rather than be recruited by another company that offers even more money or better benefits. This competition between employers contributes to the high turnover in the tech industry, and also the large jump in salary between entry level tech positions and senior level tech positions.

As represented in the previous section, it is clear that software engineers and programmers take on different roles and responsibilities. This section will examine the differences between the salaries of software engineers and programmers along with future projections and career outlooks.

## Computer Programmer

Although the salary for computer programmers ranges largely based on location and experience, according to the Bureau of Labor Statistics, the median annual salary for programmers in the United States in 2015 was $79,530; with the median hourly wage being $38.24. For the Louisville, Kentucky area, the average programmer salary is $55,389, while in the San Francisco Bay area the average salary is $134,325. US News Money found that the cities with the highest computer programming salaries are Seattle, San Francisco, and Albuquerque.

A computer programmer typically holds a Bachelor’s degree. In 2014, there were an estimated 328,600 jobs of the title computer programmer. However, between 2014 and 2024, computer programming jobs in the United States are projected to decline by eight percent. One reason for this decline is the continuation of outsourcing jobs such as programming, which can easily be done remotely. Companies are looking to cut cost, and thus hire programmers from countries that are willing to accept lower wages and benefits.

## Software Engineer

Software engineers tend to have higher salaries and compensation when compared to computer programmers. The Bureau of Labor Statistics reports that the 2015 median annual salary for software engineers was $100,690; with a median hourly wage of $48.41. Software engineers also tend to hold a Bachelor’s degree in a field related to computer science.

The overall market for software engineers is more lucrative and has better job outlook than the programmer job market. In 2014 there were approximately 1,114,000 software engineering jobs in the United States. Between 2014 and 2024 there is a projected seventeen percent increase in job outlooks, which is much larger than average job growth projections.

# Future Trends in Software Engineering Responsibilities and Job Requirements

As changes in technology are rapidly increasing, and software becomes more prevalent in nearly every aspect of our life, it is not surprising that the responsibilities and job requirements for those in the tech industry, specifically software engineering, must also adapt.

## Privacy and Security

Since the general population is relying on software more and more every day, the amount of personal information being shared through software applications is at an all-time high. This creates the problem of maintaining the privacy and security of the personal information being shared and stored through software.

Security breaches and data hacks have become reoccurring news stories. In order for software to continue to be a viable and trustworthy way to perform transactions, software engineering is going to have to tackle this issues of privacy and security. Software engineers are going to have to take on the role of designing new technologies that are secure and efficient by utilizing tactics such as advanced encryption.

## Specialization

Evidence suggests that another future trend in software engineering is going to be the need for more specialized software engineers as time goes on. This is due to the fact that the need for software, its development, and the need for software that is maintained is growing exponentially. It is getting to a point where a specialized software engineer suited to perform a particular purpose, such as a web software engineer, would be chosen over a generally educated software engineer. Such areas of specialization we could be seeing in years to come include web software, mobile software, embedded software (devices), infrastructure software, and enterprise software. With more devices being developed and more mediums with which to deliver software, specialization is an inevitability as a generally educated software engineer becomes more mythical and unrealistic.

## Cloud Computing and Agile Software

Another trend affecting software engineering is the rise of cloud computing. This projects forward the large-scale development of software around the world, as cloud computing makes the cost of delivering software much cheaper. In addition, it is also more likely than ever to make successful software, as well developed software can be scaled up or down with cloud resources as needed. This means that small companies or even individual software engineers can provide the same level of service in the cloud as big enterprises.

There is also the recent concept of “agile software”, which simply involves the art of moving the software to the consumers as quickly as possible. It is built on the idea that the consumer knows what they want best and that stresses the importance of showing them the software early and often to ensure that it is on the right track throughout development to the best possible software. This means that in the future we may see the role of the software engineer to be much more in communication with the individuals who will be receiving it, which could possibly even develop into its own specialized area [3].

In conclusion, software engineering is often incorrectly assumed to be another name for computer programming. Although they share some similarities, this paper distinguishes the two fields through their roles and responsibilities, along with their salaries and career outlooks. Software engineering is a lucrative field that is projected to grow in the upcoming years. With this growth comes new trends in software that could alter the roles and responsibilities of software engineers.

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