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Generations of Software Engineering

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Abstract: Software Engineering has grown and developed from the 1960's till now a lot as our knowledge and understanding of software is increasing day-by-day due to which software is becoming increasingly reliable and cost effective. Previous research was not able to express clearly how software engineering transitioned, how new technologies and services for software came to be known and were started using in the world of software engineering, decade or year wise. I use data from different websites and research papers to tell how software engineering has evolved along with the years with details about what happened in particular years, with respect to the corresponding decades. There are also details about manifestos and the developers of computer languages. The findings indicate that the software engineering field is vast and is still far from being fully developed, in a world where we have hands on every technology possible and hence new software's and services are coming out on a regular basis now.

I. THESIS

Software Engineering has been evolved and developed from the 1960's till now with the evolution of software. Software has now become increasingly reliable and cost effective as before due to the advancements in technology.
Software Engineering has been evolved from the early 1960's and is continuing to get developed and notable in a number of areas which include the cost of hardware, emerging as a profession, processing of the software and the role of women.
With the help of the events which happened in the following years, the rise of Software Engineering occurred:

II. 1960's

In 1963, Margaret H. Hamilton, computer scientist and systems engineer for the Apollo missions, gave the term 'Software Engineering', following which Software Engineering was accepted as its own form of engineering, but it was also during this time that the software side struggled and failed to keep up with the hardware present.[1][2]
In 1964, the OS/360 operating system was also launched by IBM, which was a decade long project and produced one of the most complex software systems at the time. This operating system had the serious problem of Cost and Budget Overturns.
The 'Software Crisis' of the 1960's, 1970's, 1980's came into existence as several problems such as budget, deadlines, extensive de-bugging, failed to meet the needs of users and were difficult to maintain. Some projects even caused loss of life.[3] The main problems of the 'Software Crisis' were:

A. Cost and Budget Overruns [4]
B. Property Damage
C. Life and Death [3]

In 1968 and 1969, the NATO Science Committee sponsored two Software Engineering Conferences [5] which were designed to address the issues of the software crisis which gave the field of 'Software Engineering' its initial boost and marked the official start of the profession of Software Engineering.[6] The conference also established guidelines and best practices for the development of software.

III. 1970's

The 1970's were a time when the field of Software Engineering began its rise as new ideas, languages, and hardware were introduced. It was also the time when the 'Software Crisis' continued to make problem for programmers and Software Engineers.
The Pascal programming language by Niklaus Wirth was launched in 1970 which supported structured programming and data structures to encourage good programming practices. It is a reliable and efficient programming language.[7]
In 1972, the development of one of the most popular programming languages made by Dennis MacAlistair Ritchie called the *C programming Language* was started. C programming language had some significant features which include low-level access to memory, a simple set of keywords, and clean style which makes C language suitable for system programming like an operating system or compiler development. Many different languages have borrowed feature from C programming language.[9]
Around 1972, Dennis Ritchie and Ken Thompson, introduced the Unix Operating System to the world. It is a stable, multi-user, multi-tasking system for servers, desktops, and laptops.

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By 1975, The first PCs begin to make their debut. Although, many of these PCs were designed for business and not the home.[8] The first PCs came as kits: the MITS Altair 8800 and IMSAI 8080. Then came the Apple I, a PC made by Steve Jobs and Steve Wozniak from Apple. After this the Personal Computing market began to grow rapidly.[11]
It was finally in 1979, that Seattle University began offering a master's degree in Software Engineering.

IV. 1980's

This was the time when the software crisis finally began to wind down and great changes came during this period which included new tools and languages which enabled us to move towards better engineering techniques and started the move towards object-oriented programming.
During 1980, Jean Ichbiah introduced the Ada programming language which is a structured, statistically typed, imperative and object-oriented high-level programming language, extended from Pascal and other languages.[11]
In 1982, Computer-Aided Software Engineering (CASE) tools which were specially designed to reduce cost, development time and improve the quality of the system begin to appear on the market.
One of the biggest development in the field of Software engineering came when Bjane Strousop developed and conceived the C++ Programming Language in 1985. This language had functional, generic, object-oriented and procedural features. Strousop's goal was to add object-oriented programming into the C language along with some other features.[12] After this, C++ is regularly updated and has become the fourth most popular language in use.
By 1989, Internet was started being offered by some companies and was mainly used by scientists and the military.[8]

V. 1990's

In the 1990's some of the most popular programming languages used today were introduced and this period is considered as a boon for programming languages. During this time, the Internet made its proper debut, object-oriented programming began to grow which were significant changes to the software engineering industry.
Tim Berners-Lee developed the WorldWideWeb in the year 1990 which was the first web browser, while working at CERN. Automated information-sharing between scientists in universities and institutes around the world were the reasons the Web was originally conceived and developed.[13] Tim was also responsible for the creation of HTTP, HTML and the first web pages which described what he created. Also, around 1990, the already used term known as 'big-data' begins to grow. Big data is a field which primarily deals with data sets that are too large or complex to deal with by traditional data processing application software.[14]
A year after this, the Python programming language made its debut, due to its large standard library and liberal use of white space, it became one of the most popular programming languages. In 1995, two important programming languages were developed. First, was the Java programming language, developed by James Gosling at Sun Microsystems. The aim for Gosling was to develop a virtual machine and language with a well-known notation like C, but with more precision and simplicity than C/C++.[15] As the language pledged 'Write Once, Run Anywhere', it would grow to be the most popular language in use.
The second language developed in 1995 was JavaScript by Brendan Eich at Netscape which allowed for interactive web pages and was used by a majority of web sites and was also an object-oriented programming language. Its syntax is heavily inspired by C++ and Java. The first Bachelor's degree in software engineering was introduced by The Rochester Institute of Technology in the year 1996. After a couple of years in 1998, the U.S Naval Postgraduate School started to offer the first ever doctorate program in the field of software engineering.[8] In 1999, a developer named Kent Black who was handling a project at DaimlerChrysler tried to find a better way of doing software development called extreme programming. It was a type of agile software development that was designed to respond to the changing requirements of the user.[16]
Thus, the period of 1990 to 2000 was a significant period for the field of software engineering as a lot of programming languages, the internet, and the first bachelor's degree was introduced during this period

VI. 2000's

In this period, the bigger focus was on methodology of software's and less on new languages and tools by companies as developers looked to make the process more responsive to customer needs, more profitable, and easier to create.
In the year 2001, *The Manifesto for Agile Software Development* was published which focused on development via a collaborative effort by cross-functional teams and customers. The manifesto completely covered the values and principles of Agile Software Development.
By the same year, and agile process that uses iterative and incremental framework for complex software development called *Scrum* was introduced by Ken Schwaber and Mike Beedle.[17]

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Three years later, in 2004, a collaborative work known as *The Software Engineering Body of Knowledge* was introduced. It addressed numerous software issues including design, construction, maintenance and more.

In 2010, a new service which led to increased demand for software-as-a-service and provided a new avenue for software engineering called *Cloud Computing* began its rise.

A year after this Coding Bootcamps which are a way to teach the latest technology in an intensive program designed to make students ready for entry-level-employment begin to be conducted.

Hence, Software Engineering is still developing daily and is still a young discipline.

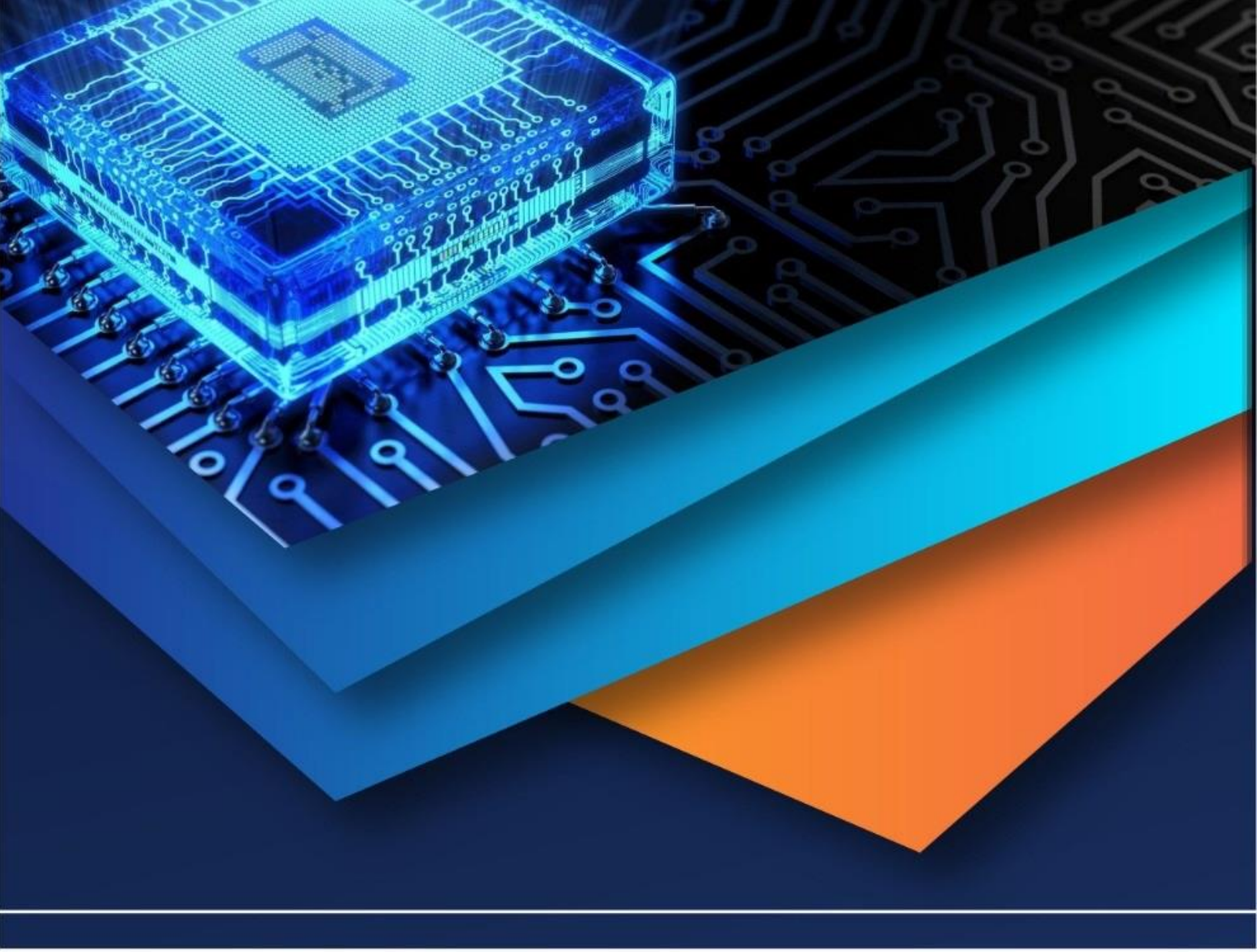
VII. CONCLUSION

Different *Generations of Software Engineering* has led to the increase in technology and software over the years. Software engineering has been evolved and developed from the 1960's till now along with the development of new software's which have now become increasingly reliable and cost effective. With the generation of new software technologies by computer scientists and developers over the years have made it possible for advanced technological advancements which have contributed to developing new programming languages and services which are better than the old ones in certain aspects. These new languages and services are making possible for new software's to be developed and used. Hence, the field of software engineering has developed over the ages and is continuing to develop with the advancement of softwares.

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