GRACE HOPPER

To produce a short (2-4 page) biography of a key software engineer, discussing the work and impact of the individual.

Rear Admiral Grace Hopper was an early and influential software engineer. She is best known for her trailblazing contributions to computer programming, software development and the design and implementation of programming languages.

Early Life

Grace Brewster Murray was born in New York City on December 9, 1906 and was the eldest of three children and was educated in private schools. Attending Vassar College, she graduated Phi Beta Kappa with a bachelor's degree in mathematics and physics in 1928. Hopper had hoped to follow in her grandmother's footsteps and become an engineer however she realised that there was no place for women in engineering and instead decided to pursue an academic career in mathematics. She proceeded to Yale University and completed her MA and PhD in mathematics. During this time, she married Vincent Foster Hopper, taking his name, and becoming Grace Hopper, a name she kept even after their divorce in 1945. In 1931, she joined the Vassar faculty as an associate professor. Hopper devoted the following twelve years teaching at Vassar. Later in life, Hopper said her most important accomplishment, other than building the compiler, was "training young people" (Coding Bootcamp | The Grace Hopper Program, 2020).

World War II

After the bombing of Pearl harbour and the United States' entry into WW2, Hopper decided it was time to serve her country. She tried to enlist in the Navy but was rejected several times and at the age of 34, she was deemed too old. However, she was finally accepted in Women Accepted for Volunteer Emergency Service (WAVES) programme. Hopper joined the U.S. Naval Reserve (Women's Reserve) in December 1943. After being commissioned as a lieutenant, she was assigned to the Bureau of Ships Computation Project at Harvard University due to her extensive background in mathematics. There she programmed one of the first program-controlled computers ever built; the Navy's electromechanical Automatic Sequence Controlled Calculator. The behemoth (55 feet long, 8 feet high) is known to the world as the Mark I computer.

Mark I was designed to solve advanced mathematical physics problems. It was tasked to work out calculations for various war projects, including the Manhattan Project. Hopper had surprisingly never heard of the computer before she was thrown in the deep end. After the war, Hopper continued working with the Harvard Mark series, working on both the Mark II and Mark III.

While Hopper was at Harvard one of the computers she and her colleagues were working on shorted out. When the machine was taken apart a large moth was found inside. The term bug had been used in engineering since the 19th century to describe a problem, it had not been used in relation to a computer problem. Although Hopper didn't invent the term, she has been credited with its popularization with her instance of literal debugging.

// teaching ethos

By 1946 Hopper was released from active duty and shortly after her three-year fellowship at Harvard came to an end. In 1949, she joined the Eckert-Mauchly Computer Corporation in Philadelphia. It was around this time that Hopper began formulating some of her most influential contributions to software engineering. As head programmer she helped to design and program the UNIVAC (Universal Automatic Computer), the first known large-scale electronic computer to be on the market.

Creating the Compiler

Hopper was perhaps the first person to believe that computers should speak human languages rather than humans needing to speak computer languages. This belief was put into action in 1952, Hopper and her team developed the first mathematically oriented single-pass compiler. The program was known as the A compiler, more similar to what we now call Linker, the first version being 'A-0'. The compiler converted mathematical code into machine-readable binary code. Its creation was so ground-breaking many doubted its capability. As Hopper later said;

"Nobody believed that I had a running compiler, and nobody would touch it.

They told me computers could only do arithmetic"

(The Wit and Wisdom of Grace Hopper, 2020).

In 1954, Hopper became the first director of automatic programming for the UNIVAC division and her team released some of the first compiler-based such as MATH-MATIC (A-3) and FLOW-MATIC (B-0), a precursor to COBOL. A-2 had been released a year earlier and was possibly "the first example of free and open source software"(Strawn and Strawn, 2015) as customers were given the code and were able to suggest improvements.

CODASYL and COBOL

Dr Hopper believed that business programming should be done in a language that looked like English. After the creation of FLOW-MATIC, she and her colleagues began their push for a common language for business applications. Hopper called for more user-friendly languages, that were adapted to people and not just academics and computer scientists. They organized CODASYL, the Conference on Data Systems Languages, which took place over two days. Experts from the government and the software industry attended. Hopper served as the technical consultant and along with the other committee members they defined the new language which they named COBOL.

COBOL was introduced as the first standardized general business computer language. It was heavily inspired by FLOW-MATIC. Although many people contributed to COBOLs invention, Hopper was its main promoter and can be credited for its adoption by both military and private-sector users. Hopper also developed validation software for COBOL and its compiler as part of the Navy's COBOL standardisation program.

Return to the Navy

Hopper retired in 1966 from the Naval Reserve with the rank of Commander as she had reached the mandatory retirement age of 60. However, she was recalled to active duty for six months assignment at the request by Norman Ream. This short assignment became an "indefinite" period of service – this was because Ream wanted her to develop testing and validation procedures to tackle standardisation of across different computer languages. Nicknamed "Amazing Grace" by her subordinates, Hopper remained on active duty for 19 years. When she retired in 1986, at age 79, she was a rear admiral as well as the oldest serving officer in the service. She was honoured in a ceremony on the USS Constitution.

Later Years and Legacy

Hopper said she would have been "bored stiff" (Biography.com, 2020) if she had stopped working completely. In her post-retirement she took another job as a senior consultant in public relations and continued working for a number of years. In 1991, she became the first female recipient of the National Medal of Technology.

Rear Admiral Grace Murray Hopper died on January 1, 1992 and was laid to rest as Arlington National Cemetery. During her lifetime, Hopper oversaw the acceleration of computer technology development, from coding the Mark I in Harvard to standardising programming languages in the 1980s. Her push for user-orientated systems directly lead to the creation of COBOL. Today, over fifty years later, COBOL powers 70 percent of all business transactions and handles "95 percent of all ATM card-swipes" (Cassel, Widmann and Mok, 2020). Hoppers development of the compiler was another massive step forward in software engineering. In addition to her pioneering accomplishments in computer programming, Hopper's legacy includes her role as a visionary communicator and educator, encouraging young people to learn how to program. Therefore, I believe that Grace Hopper was a brilliant pioneer in software engineering and her work was hugely inspirational and impactful.

Citations

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