Biography of a Software Engineer - Grace Hopper

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Grace Hopper in 1984

Grace Hopper was born in New York in 1906, to parents Walter Fletcher Murray and Mary Campbell. In 1930 she earned a master's degree in Mathematics from Yale University, and in 1934 earned a Ph.D. in Mathematics from Yale. Afterwards, she returned to Vassar College (where she had earned her Bachelor's degree) as an instructor, and was promoted to associate professor in 1941. She remained at Vassar until 1943.

At the outbreak of World War II, Hopper attempted to enlist in the US Navy, but was denied on account of her both being overage and underweight for the position. In addition to this, her position as a professor was considered crucial to the war effort. Obtaining a waiver for the weight requirement, she joined the United States Naval Reserve (WAVES). WAVES, or Women Accepted for Volunteer Emergency Service, was the women's branch of the US Naval Reserve. Established in 1942, WAVES was founded to replace men in shore operations with women, and mostly consisted of doctors and engineers. Graduating first in her class in 1944, she was assigned to the Bureau of Ordnance Computation Project at Harvard, where she served on the Mark 1 programming staff at Harvard's cruft laboratories. The Mark 1 was a mechanical computer which contributed to the Manhattan Project. Hopper also worked as a programmer for the Mark II, released in 1947. The Mark II was an improvement on the Mark I which used electromagnetic relays rather than electro-mechanical counters, drastically increasing the speed of calculations such as addition and multiplication. It was while working on the Mark II that Hopper was credited with coining the term "bug" in reference to a moth which flew into the lab through an open window and into one of the relays of the Mark II, causing the system to shut down. The moth was removed (literally "debugged") and pasted into a logbook which now resides in the Smithsonian museum.

In 1949 she joined the Eckert-Mauchly Computer Corporation as a Senior Mathematician, joining the team heading the development of the UNIVAC 1, the first commercial computer produced in the US. The UNIVAC 1 was designed from the outset to perform fast executions of relatively simple operations, such as arithmetic and data transport. This made the UNIVAC ideal for business and administrative purposes, rather than scientific purposes as with other computers. The device used 5000 vacuum tubes, weight 7.3 tons and contained a 2.25MHz clock. A word on the UNIVAC consisted of 12 characters, which allowed numbers to be represented with 11 decimal digits and a sign.

Wanting to develop a new programming language that used English words, Hopper published her first paper, "Compilers", in 1952. Eckert-Mauchly was purchased by Remington Road, and it was here that she developed her first compiler, the A-0 (Arithmetic

Language v0). She encouraged programmers to gather common code portions as subroutines, and for the A-0 gave each subroutine a call number. Programs written for A-0 were specified as subroutines (represented by call numbers) and arguments. The A-0 system would convert the specified subroutines into machine code which could be fed back into the computer to execute the program. The initial “compiler” (now considered a linker) was not widely accepted

Hopper realised that, to make computers more accessible in non-scientific applications, it was important for users to be able to write their programs in English rather than using symbols – the development of English-like programming languages. Between 1955 and 1959, Hopper developed B-0, released as FLOW-MATIC. This was the first English-like data processing language, and the first system to describe operations as separate to the description of data, via a data definition language (which was not English-like, but instead relied on the entry of pre-printed forms). FLOW-MATIC was capable of understanding twenty statements in English.

In 1959, computer experts from both industry and government attended a two-day conference known as the Conference on Data Systems Languages. Hopper acted as one of two technical advisors. It was at this Conference that the basic COBOL language design was defined. The design of COBOL was greatly influenced by FLOW-MATIC, and it was considered the only business-orientated programming language at the time. Several aspects of FLOW-MATIC were incorporated into COBOL, such as defining files in advance, separating files into input and output files, and dividing programs into sections (Computer, Directory and Compiler) to separate different parts of the program. COBOL featured an emphasis on inputs and outputs, and the only data types usable were numbers and strings. No academic computer scientists participated in the design of COBOL – all members present at CDSL were from commerce or government.

In 1966, she retired from the US Naval Reserves in accordance with Navy regulations, but was recalled in 1967. Her original reinstatement was for six months, but this was extended to an indefinite reinstatement. She worked on standardising the high-level languages used by the Navy

From 1967 to 1977, Hopper served as director for the Navy Programming Languages Group, and was promoted to the rank of Captain in 1973. Here, she developed validation software for COBOL, and implemented standards for testing computer systems and components for early programming languages such as FORTRAN. She also developed a translator program to convert non-standardised COBOL languages into the standardised version.

In 1983, Hopper was promoted to the rank of Commodore, which was later replaced by the rank of Rear Admiral, making her one of the first female Admirals in the US Navy. She retired again in 1986 at age 80, making her the oldest active duty officer at the time.

After her final retirement from the Navy, she joined Digital Equipment Corporation as a senior consultant, serving on industry committees. She worked here until her death on New Year’s Day 1992, aged 85.

Over the course of her lifetime, Hopper was awarded many prestigious honours. In 1964, Hopper was awarded the Society of Women Engineers Achievement Award "in recognition of her significant contributions to the burgeoning computer industry as an engineering manager and originator of automatic programming systems".

In 1969, she was awarded the first Computer Science Man-of-the-Year award from the Data Processing Management Associated, a US-focused non-profit group founded in 1949.

Hopper's legacy served as an inspiration for a new wave of software engineers. The Grace Hopper Celebration of Women in Computing is an annual convention for women in the field of software engineering named after Hopper to honour her influence, and to encourage women in STEM. Female engineers at Microsoft also founded an employee group named "Hoppers" and founded a scholarship in her honour.

References:

Grace Hopper Celebration of Women in Computing 1994 conference proceedings – Yale Mirror of Proceedings – Accessed 7th November 2017

Grace Hopper - Biography.com – Biography.com article on Grace Hopper – Author Biography.com Editors - Accessed 7th November 2017

COBOL – Wikipedia article describing the COBOL programming language - Accessed 9th November 2017

History-Computer.com First Compiler – Grace Hopper and her work on the A-0 system. Accessed 8th November 2017

Biography of Grace Hopper - Wikipedia – Wikipedia article on Grace Hopper - Accessed 7th November 2017

Harvard Mark I – Wikipedia article on the topic of the Harvard Mark I - Accessed 8th November 2017

Grace Hopper - Pioneering Computer Programmer – Author KeriLynn Engel - Accessed 8th November 2017

WWII Database - WAVES – Women in the WW2 US Navy - Accessed 7th November 2017

UNIVAC I – Wikipedia Article on UNIVAC I - Accessed 8th November 2017

FLOW-MATIC – Wikipedia Article on FLOW-MATIC system. - Accessed 8th November 2017