

CS3012 - Biography of Influential Software Engineer

Grace Hopper, “The Queen of Software”

Grace Brewster Murray was born December 9th 1906 in New York City to Walter Fletcher Murray and Mary Campbell Van Horne. She was schooled in Hartridge School in New Jersey, and was rejected on first attempt to attend Vassar College due to her unsatisfactory marks in Latin. Still graduated from Vassar College with a Bachelor’s degree in both physics and mathematics, after being accepted the second year she applied. Originally she had wanted to be an engineer like her grandfather but soon learned “there was not place for women in engineering” when she graduated in 1928. The daughter of a Yale graduate, she later went on to earn her Master’s Degree in mathematics from her father’s alma mater. Furthermore going on to obtain her Ph.D from Yale in 1934. She worked in Vassar College from 1931 until 1943. She married Vincent Foster Hopper in 1930, who would later die in 1945 during World War II.

It was after the bombing of Pearl Harbour during World War II, that Hopper decided to enlist in the Navy, where her grandfather had previously served. Much like her first attempt to attend Vassar College, Hopper was rejected due to her age, height to weight ratio being too low, as well as her position as a professor was seen as too valuable. However the initial rejection did not deter her and she received was waiver to join the United States Naval Reserve, she graduated first in her class and was commissioned as a lieutenant in 1944, then was assigned to the Bureau of Ordnance Computation Project at Harvard University due to her knowledge of mathematics. It would be here where she would get to work on the Harvard Mark Computers within Harvard’s Cruft Laboratories. Hopper would resign from her leave of absence from Vassar in 1946 to remain at the Computation Lab as a research fellow in engineering and applied physics until 1949.

The Mark I was the first large-scale automatic calculator and a forefather of the electronic computer. Headed by Howard Aiken, Hopper worked alongside him and his team becoming the third person to program the Mark I, while also co-authoring the papers on the Mark I, writing the 561-page user manual. The 51 feet by 8 feet by 2 feet machine, could store 72 23 digit long numbers and was able to do 3 additions/subtractions in a second, where multiplication took 6 seconds, division took 15.3 seconds and a logarithm or trigonometric function would take over a minute. In the beginning it has not conditional branch, so complex programs were long, though it was later added. Each programmer kept a notebook of code, containing what they called “programs”, which would later be termed as subroutines. The team would openly share and exchange their routines.

Hopper also worked on the predecessor of the Mark I, the Mark II in 1947/48 as a programmer. This machine was much faster than the original, addition taking 0.125 seconds and multiplication only 0.750 seconds. Logarithm and some trigonometric functions took between 5 and 12 seconds. While working on the Mark II she helped popularised the term “bug” in computer errors, after they a moth was found in the circuits interfering with the relay. The remains of the “bug” can be found in the group’s logbook in the Smithsonian.

After her work in the Harvard Computation lab, Hopper move on to the Eckert-Mauchly Computer Corporation as a member of the team helping to develop UNIVAC I, the first commercial computer (designed for business) produced in the United States. Even though code was copied by hand at this time, Hopper (now an admiral) believed firmly in collaboration and encouraged her team to share common areas of code to help reduce errors and duplication. Hopper was a pioneer but also a visionary wanting to make programming more accessible to a wider audience. Putting this revolutionary idea for the time down to her own laziness, she was quoted as saying, "No-one thought of that earlier, because they weren't as lazy as I was." This desire inspired her to work on the first compiler known as the A compiler, which converted programmed instructions into machine code, making it easier for programmers to write and understand code. This series of compilers specifically translated symbolic mathematical code into machine code. It was also the ancestor to and helped in the adaption of COBOL (Common Business Oriented Language).

As the director of automatic programming her team produced the first English language data-processing compiler, FLOW-MATIC, originally known as the B-O compiler. This compiler converted the English language for typical business task ie. billing/payroll . UNIVAC I and II was the programmed to understand 20 English words. Still Hopper was told computers didn’t understand English, despite her work showing otherwise. In 1952, she would prove this wrong and publish her first compiler paper.

Despite retiring from the Navy Reserve in 1966, she was recalling into active duty due to her work in computing at the age of 60. This was to help with the standardisation of the multiple programming languages used within the Navy, she served as the director of the Navy Programming Languages Group, and was giving the rank of captain in 1973. During this time she produced validation software for COBOL and its compiler. She remained in active duty for 19 years, making her the oldest serving officer in the US armed forces. She finally retired (involuntarily) at the age of 79 in 1986, at this point she held the rank of rear admiral. Going on to work as a senior consultant in public relations for Digital Equipment Corporation, where she stayed until her passing.

Hopper has received more than 40 honorary degrees and awards, as well as being dubbed “Amazing Grace”, “Grandma COBOL”, and the “Queen of Software”. She was given Yale’s Wilbur Lucius Cross Medal, for “outstanding alumni” in 1972, and in 1973 was made a Distinguished Fellow of the British Computer Society, being both the first woman and

American. She was also awarded the 'Defense Distinguished Service Medal' in 1986 and in 1991, she was awarded the 'National Medal of Technology' by President George Bush, making her the first woman to receive it. She also has a guided military destroyer named after her. Finally in 2016, she was given the United States' highest civilian honour, the Presidential Medal of Freedom.

Despite having many notable achievements in life, she told her biographer that her greatest joy came from teaching. "If you ask me what accomplishment I'm most proud of, the answer would be all the young people I've trained over the years; that's more important than writing the first compiler." Her talents as a teacher can be seen from she was able to help communicate and visualise. She was known for her nanosecond visual aid, carrying around lengths of wire that were 30cm long, to illustrate the length light travelled in a single second. Hopper would give these "nanoseconds" out at her talks to audience members. She would also carry around packets of pepper, calling them her "picoseconds".

Grace Hopper passed away on January 1st 1992 at the age of 85, in her home in Arlington Virginia. She was laid to rest with full military honour in the Arlington National Cemetery.

[References]

1. "Grace Murray Hopper" Grace Murray Hopper-Computer Science- Yale University, Accessed 28 October 2018, <http://www.cs.yale.edu/homes/tap/Files/hopper-story.html>
2. "Named for Rear Admiral "Amazing" Grace Hopper" US Navy COMDERSON NINE, Accessed 28 October 2018, <http://www.public.navy.mil/surfor/ddg70/Pages/namesake.aspx#.WNmCa2jys2w>
3. "Grace Hopper Biography" Biography.com Editors, Accessed 28 October 2018, <https://www.biography.com/people/grace-hopper-21406809>
4. Norwood, Arlisha, "Grace Hopper" National Women's History Museum, Accessed 28 October 2018, www.womenshistory.org/education-resources/biographies/grace-hopper
5. Transcript, Grace Hopper, Oral History Interview by Angeline Pantages, Computer History Museum, Accessed 28 October 2018, <http://archive.computerhistory.org/resources/access/text/2015/06/102702026-05-01-ac.c.pdf>
6. Harford, Tim, "Grace Hopper's compiler: Computing's hidden hero", BBC News, Accessed 28 October 2018, <https://www.bbc.com/news/business-38677721>
7. Markoff, John, "Rear Adm. Grace M. Hopper Dies; Innovator in Computers Was 85," New York Times, January 3 1992, Accessed 28 October 2018, <https://www.nytimes.com/1992/01/03/us/rear-adm-grace-m-hopper-dies-innovator-in-computers-was-85.html>
8. "Biography of Grace Murray Hopper" Yale University, Accessed 28 October 2018, <https://president.yale.edu/biography-grace-murray-hopper>
9. Television Interview with David Letterman, "Grace Hopper on Letterman", Accessed 28 October 2018, <https://www.youtube.com/watch?v=1-vcErOPofQ>