Susan J. Eggers

BIOGRAPHY

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Introduction

Susan J. Eggers is an American world-renowned software engineer, with a particular expertise in the field of computer architecture and back-end compiler optimisation. She is a prolific academic having published a multitude of papers and conducted studies on the benefits of simultaneous multi-threaded processors (SMT) for improving CPU performance. The IEEE Computer Society called her work "one of the most important advancements in computer architecture in the past 30 years" when she was presented with the Eckert-Mauchly award in 2018, being the first woman to achieve such an honour.[1] Now retired, she is Professor Emerita at the University of Washington, yet her legacy is an important one that has inspired and continues to inspire young prospective software engineers – particularly women who are underrepresented in the field.[2]

In this biography, I will explore Eggers' background, her journey to becoming a specialist in her discipline beginning late in her thirties, well after she had established an almost 20-year career, the important contribution her research has made and finally give an insight as to why I personally chose her to focus my biography on.

Early Life: Career and Education

Meeting the Hurdles

Susan Eggers was born in 1943 in Cincinnati, a major US city located in the state of Ohio. Naturally, growing up in the 40s and 50s was a different experience for Eggers, relative to her male counterparts, in many ways. Of these, the most prominent lesson she was typically faced with involved the age-old maxim: "Little girls should be seen and not heard."[2]

This limiting belief, however, did not stop Eggers from achieving her BA in Economics from Connecticut College (which was primarily an all-female college at the time) although it severely hampered her efforts when trying to land work in her preferred role as an economist. One particular incident with Merrill Lynch, a wealth management and investment firm (which agreed to be acquired by a large multinational bank in 2008), dashed her hopes of becoming a stock broker after being told that this job wasn't for women, but she could become a secretary if she wished. Despite being an incredibly demoralising and unfair event, it wasn't something incongruous for the time.[2]

Yale University, a Tale of Two Decades:

In 1965, Eggers started her career as a secretary at the Yale Economic Growth Center (EGC) working under Lloyd Reynolds, the founder and director of the EGC and ultimately for Howard Pack, an Assistant Professor who was involved with the Country Studies programme there.[2] She had a variety of different responsibilities and tasks in this particular centre, and she worked in related roles for almost two decades – 18 years to be exact. After 20 years, you'd be hard pressed to picture yourself switching careers and discovering an innate passion, yet remarkably, this is where Eggers' journey to becoming a renowned computer scientist began.[3]

While working with Pack, as part of the research programme looking into lower income-economies, Eggers was tasked by him to write up a programme that would multiply matrices – something that she had initially been doing herself manually using a calculator. Perhaps where others who were unfamiliar with programming may have struggled, Eggers buckled down and focused her efforts over the weekend learning Fortran (a programming language developed in the 1950s by John Backus who worked for IBM) from a book she had bought. [3]

To convey it very simply, she was hooked. This task had allowed her to discover a natural aptitude and love for programming, and as she herself put it: [3]

> *"Computer programming, as it turns out, is intellectually very much the same as devising the offensive strategy in bridge. So, I stopped playing bridge, stopped being a secretary, and became a programmer."*

Path to a PhD:

From then onwards, Eggers found herself working as a research associate at the EGC and in other areas of Yale University including the medical school. It was here that she involved herself with the development of a medical records system that allowed the database to try and link specific symptoms to a certain diagnosis and flag any drug conflicts. In addition to this, while seeking a fairer salary, she became involved in the Non-Faculty Action Committee and also with the Women's Movement where she oversaw a speaker's bureau to promote their message around various institutions including schools and churches.[2]

These movements helped Eggers to realise the opportunities available to her and that she was not to let herself be restricted. With this strong sense of proactivity and a desire for a professionally recognised programming qualification in spite of her extensive experience, she decided to enrol in the University of California, Berkeley's graduate programme with the Department of Electrical Engineering and Computer Science in 1983.[2]

Before commencing her research there, she had already released two publications as a lead author with a focus on saving data storage when working with statistical datasets – a very early prelude to her UC Berkeley research. At Lawrence Berkeley Labs, she worked with a research group where she was told to "Look around, pick a problem, and work on it", which encouraged her to create an algorithm that compressed the excess zeros in the datasets but left, what she refers to as "hooks" so that they could later be brought back when needed. It was the aforementioned project and articles published in the VLDB, that she believes were her "ticket to graduate school".[4]

At UC Berkeley, she developed a method that revolved around ensuring a multitude of processors were able to update their local cache in line with others, establishing a system where all processors had access to the most up-to-date data. After this, in 1989, now in her late forties she received her PhD and took up a teaching position at the University of Washington, where she is currently a Professor Emerita, having previously held the Microsoft Professorship in Computer Science.[5]

Compelling Contributions

In 2018, Eggers became the first woman ever to be named the recipient of the Eckert-Mauchly Award for her ground-breaking contributions to advancing the field of computer architecture. Never in its over 40-year history had a female computer scientist been awarded this prestigious accolade, the most significant honour in the computer architecture field.[6]

Her works which gained her this recognition include her research into multiprocessor memory sharing and coherency as well as simultaneous multithreaded processor architectures.[6]

1). Multiprocessor Memory Sharing:

The research she conducted while pursuing her PhD at UC Berkeley focused on cache coherency. This is the name given to the aforementioned method of ensuring multiple processors were able to preserve a continuous state of accessing accurate data across all processors. Prior to this, despite cache memory not requiring too much space, nor being particularly difficult to retrieve, data was more susceptible to being overwritten or lost as it was stored in separate caches specific to individual processors.[7]

It is Eggers who is credited with conducting the first data-driven study on this topic and owing to her efforts, the understanding of both hardware and software coherency techniques in computer architecture were greatly developed.[7]

2). Simultaneous Multithreaded (SMT) Processors

Undoubtedly, Eggers' most famous contribution is that of her early stage research and development of commercially viable SMT processor technology which she carried out while at the University of Washington with her colleague Hank Levy. During the 1990s when Moore's Law saw an increase in logic and memory with the advancement of computer engineering, there were no longer any noteworthy performance gains.[3] New approaches were required, and it was Eggers who was one of the primary believers of the virtues of parallelism in achieving these gains. She was involved in testing this proposition from 1995 to 2003 and used SMT as the technique to improve CPU performance by up to four times.[7]

In brief, a "thread" refers to an "independent sequence of programmed instructions". These thread parallelisms were transformed to a much simpler instruction-level parallelism type and thus made more efficient use of a computer's resources. These findings were then showcased to the ISCA (International Symposium of Computer Architecture) and earned Eggers widespread acclaim in spite of initial scepticism.[7]

Nowadays, the processors from the likes of Intel, Sun and IBM still use this SMT design which is very much an integral component. It's no surprise, thus, that SMT processors are recognised in computer architecture as an immensely important development for the field within the last thirty years.[2]

Conclusion

Susan Eggers is now widely renowned as one of the prime computer architects and engineers of her discipline. Given her background in Economics and the obstacles placed on her path, the mere fact that at almost the age of

forty after establishing a near two-decade long career, she was able to not only switch professions but also to make revolutionary innovations in her new field of computer architecture, makes her an awe-inspiring figure.[7]

The research she conducted with her colleagues at Washington University, and the findings of those studies are still very relevant today with SMT techniques still being utilised by the leading tech companies in their processors. Despite the initial scepticism that her idea faced from early critics, she pressed ahead and developed a commercially viable solution to improve CPU performance. For her work, not including the prestigious Eckert-Mauchly award, Susan Eggers was named an ACM Fellow in 2002, an IEEE Fellow in 2003 and pronounced the ISCA Test-of-Time Awards winner in 2010 and 2011 for publications she had co-authored in 1995 and 1996.[5]

Throughout her life she has embodied the virtuous attributes of proactivity, a desire for knowledge and a determination worthy of high praise. In 2011, she retired from teaching but continues her activism by working with Common Power, an organisation whose purpose is to encourage voter registration.[2]

Personal Reflection

Out of the many profiles and articles of prominent software engineers that I came across, Susan Eggers' story is one that I was drawn to most. I was immediately intrigued by her description, most notably the mention that she had actually switched careers to become a programmer at a time that many would consider to be quite late in life. I found this turn in her personal trajectory striking because I, myself struggle with trying to identify what I would like to pursue in the future. I scrutinise every choice I make, and mull over every opportunity that comes my way desperate to avoid making a single mistake. The nagging thought "what if everything I've done up until now is wrong? What if everything I do afterwards is wrong?" worms its way into my mind more often than not and it really can become a blackhole of endless what ifs drawing you in deeper and deeper.

It's accounts like these which can be quite grounding and reassuring in the sense that they remind you to relax and to relieve the pressure you place on yourself. It reminds you that as people, we are capable of adaptation and can demonstrate a resilience over which we have control, so that we can try to alter our situations if we need to. Of course, the most important lesson of all is that it's never too late.

Susan Eggers is an incredible person who has done much to promote female participation and interest in computer science and recognises the leaps that have been made since her time which have opened up far more opportunities for women today to pursue their interests than would have been the case a few decades ago.

We would do good to try and display the same level of enthusiasm and courage that she had shown throughout her life during our own pursuits.

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