Training the Next Generation of Mainframe Engineers

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Abstract:

Hiring recent college graduates into the mainframe sector is difficult. These potential employees typically do not have the required mainframe skills, because their college curriculum has prepared them for working with distributed technologies. CA Technologies is attempting to bridge the gap between college and a mainframe career with the Associate Software Engineer program. This program, along with other steps CA has taken, are essential in creating a new generation of mainframe software engineers.

Introduction:

Over the past decade, through their Associate Software Engineering Program, CA Technologies has been hiring recent college graduates into their established mainframe products. Many mainframe software companies have avoided hiring into their mainframe products based on the assumption that the platform would be phased out in favor of newer technologies before the current workforce retires. IBM has kept the mainframe modern with their System z platform. Companies now have an experienced workforce close to retirement and need to hire new employees to retain the skills and expertise of their senior engineers. College curriculums have changed to reflect the increased presence of distributed technologies, shifting their focus away from the mainframe. Unless they have graduated from a school participating in the IBM Academic Initiative\(^1\), the Enterprise Computing Community\(^2\) or IT-oLogy\(^3\), recent college graduates do not have the necessary proficiency to be effective on a mainframe team. To jumpstart the skills and experience of new hires, CA has created the

\(^{1}\) [http://www-03.ibm.com/ibm/university/academic/pub/page/academic_initiative](http://www-03.ibm.com/ibm/university/academic/pub/page/academic_initiative)
\(^{2}\) [http://ecc.marist.edu](http://ecc.marist.edu)
\(^{3}\) [http://it-ology.org](http://it-ology.org)
Associate Software Engineer (ASE) training program. Along with this new program, CA has developed additional internal training and has adopted Agile software development practices in order to help their new employees succeed. These steps have shortened the overall training period required for new hires to be productive on an established mainframe product.

**College:**

The typical college curriculum today does not prepare a graduate for a job on the System z platform. A Computer Science degree mainly gives the student a broad overview of computing concepts, some technical background, and teaches problem solving skills. Schools such as University of Rhode Island stick to the most commonly used platforms and programming languages for their coursework. The mainframe platform and assembler language are no longer common enough to be included. With the exception of schools with special mainframe oriented programs, mainframe skills are rare in people fresh out of college.

Marist College’s Computer Science department (which hosts the NSF ECC effort) has more of a focus on the mainframe including an IBM assembler course taught using System z. In this course students learn how to navigate the mainframe using the Interactive System Productivity Facility (ISPF) and submit simple assembler programs while learning the language. For many students, this is their first exposure to assembler. Marist is also enrolled in the IBM Academic Initiative. This allows students to participate in IBM’s annual *Master the Mainframe*[^4], contest. This contest encourages students with no mainframe experience to get a first look at the environment. Participants start out by learning how to navigate an IBM hosted mainframe using ISPF. They move onto learning the Job Control Language (JCL), submitting basic jobs, and learning how to read program output. This is followed by some debugging scenarios they need to work through. The last assignment for the contest is to create a program from scratch. *Master the Mainframe* is a great way for students to get real world System z experience.

### Associate Software Engineer Program:

Given the lack of mainframe exposure in most Computer Science programs, new engineers would not be ready to jump onto a mainframe team. Being introduced onto an experienced team with no preparation would be a frustrating and difficult situation for a new employee, as well as their teammates, and CA Technologies has decided to help ease this transition as best they can. The ASE program was designed to help make new hires more productive more quickly by providing a strong foundation on the System z platform. The course is designed for people who have some programming experience but little or no prior knowledge of the mainframe. The first half of the course covers the z/OS operating system, ISPF, creating and navigating datasets, and the REXX programming language. The rest of the class covers IBM High Level Assembler in-depth, with the final week introducing a wide variety of advanced topics including Agile software development, debugging tools, and an overview of CA products.

Classes are taught lecture style over the span of several weeks. The length has varied from as short as five weeks to as long as eight weeks since its inception based on trainee feedback. The classroom units are followed by written tests and hands-on coding projects. These exams are graded to give feedback on an employee's progress, but no formal grade is compiled for the program. Most hiring for new mainframe engineers is done during the spring and summer months, which makes it easy to place all new hires into one class. To accommodate those hired outside of the normal cycle, CA has made many ASE training lectures available on their internal education website. Formal sessions have been organized which include a weekly meeting with the instructor to discuss the lessons and ask questions.

In addition to the classroom experience, the ASE training program is designed to help introduce new employees to the industry and to foster friendship. CA plans many team-building activities and group outings, and new hires are encouraged to spend time together outside of work, with the goal being that they have someone closer to their own age and skill level to talk to. Joining an established product team can be intimidating; knowing other co-workers with the same background who went through the same experience can be very helpful.
On-Site Training:

Following the ASE program, the new engineers return to their teams with basic mainframe experience, but they are still not in a position to be productive. Although they now have a solid foundation of assembler and mainframe knowledge, they still have little to no experience working with their product. Initially the ASEs only had a basic roadmap of recorded webcasts to follow. They were comprehensive, but were designed for someone who was already knowledgeable about the product. For a new employee, these webcasts were very complex because they assumed a basic understanding of the product. After completing these training programs, they were expected to immediately begin work on development projects.

A more accessible and comprehensive training program has since been developed for new hires. The program is designed to teach basic product knowledge to a person with little experience. Senior engineers have taken a more active role in these lessons by creating structured exercises which expose new employees to different aspects of the product. On one product team, new engineers are now placed in sustaining engineering roles after returning from the ASE training. This role is responsible for maintenance of the product, not new development. Working with sustaining engineering affords engineers the opportunity to deal with customers directly, as well as first-hand experience with how customers use the product and the problems they might uncover. Since bugs can appear in every piece of the code, new engineers get a chance to learn about many different facets of the product, something which can be especially useful in large and complex product lines. After a few months, engineers can be transitioned to development roles as needed, or can be given increased responsibility and independence in accepting and solving support issues.

Mentor Program:

To complement its ASE program, CA has also introduced a mentoring program. Each new engineer is paired with two mentors. The first, a technical mentor, is typically a more experienced member of the new engineer's team who is available to help answer questions about the product or about the mainframe in general. This is an extremely useful program in a company like CA, whose employees have decades of mainframe experience on products older
than some college graduates. It provides the new engineer with an experienced contact who can handle most of their initial questions. The second is a business mentor, someone outside of the new engineer's product line, such that the new hire has somebody to reach out to with questions that might be uncomfortable to bring to a team member or direct manager. The business mentor can answer non-technical questions about topics like career planning or business relationships. Both of these mentors have been very helpful in introducing new employees to the corporate environment and teaching them where to get help if needed.

**Agile:**

The Agile methodology has been a good fit for the company, as CA has a mix of experienced and inexperienced employees. Agile breaks the development cycle into smaller iterations called sprints, which allows for greater customer interaction and a more responsive development team. It encourages detailed design work which can be helpful for newer engineers who are unfamiliar with the product. It also has a more open structure, allowing employees to volunteer for the tasks that interest them, which is great for helping a new employee find their place on the team. On an engineering team the traditional roles are development, quality assurance, and sustaining engineering. In Agile these roles aren’t as rigid and employees are able to change roles. Typically, newer engineers spend their early sprints following explicitly defined designs and working closely with experienced engineers. As they work in depth with more of the product, they become capable of much more independence. They still collaborate with experienced employees who take more of an advisory role, leaving the details up to the new engineers. Overall, Agile lets workers take ownership of what they work on and allows newer engineers to take part in development while letting the experienced engineers focus on design work.

**Knowledge Transfer:**

Knowledge transfer is essential to the future of CA. Mainframe products have been around for decades and there are developers with unique expertise who have been around just as long. Engineers are encouraged to record any unique knowledge they possess so that it is easier for other employees to acquire it. The company allocates time for both the creation and
consumption of training documentation. This knowledge transfer initiative explicitly encourages collaboration between workers and preserves skills that would otherwise be lost when people retire.

**Conclusion:**

Since the beginning of the Associate Software Engineer program at CA, there is a large, close-knit team of both new and experienced engineers who work well together on their product teams. Through the comprehensive ASE program which is constantly being tweaked based on feedback, new engineers have a much gentler learning curve for the System z platform. By giving inexperienced employees a course in assembler, employees gain a strong foundation for a new career. Instead of being overwhelmed by unfamiliar technology, new employees gain the mainframe skills that they didn’t acquire in college. The entire structure of the development organization has been changed in the last few years in order to create an effective environment for workers with decades of experience and new recruits. Overall, the ASE program along with adoption of the Agile methodology and focus on knowledge transfer have enabled CA to shape a skilled and productive new generation of workers on the mainframe platform.