Artificial Intelligence and Cloud Migration: Unlocking the Future of Business Infrastructure

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ABSTRACT

Fannie Mae, the mortgage financing company, is making substantial technical strides to improve the efficiency of its business infrastructure through cloud migration of on-prem applications and artificial intelligence (AI) chatbots serving Application Programming Interface (API), and functionalities. To aid Fannie Mae in its migration, I utilized AWS services to develop a file drop website to migrate on-prem assets and coded the UI with JavaScript, HTML, and jQuery. For the AI application, Amelia - Intelligent Assistant, I utilized BPNs, business process networks, and regression testing to train the model with new responses and questions. The projects showcased the future of business applications, in which cloud migration allows for improved efficiency, reduced costs, and greater scalability. These benefits are further increased through the newly discovered use of AI to perform API calls in business application tasks. Future steps for such projects include fully migrating all Fannie Mae applications to the cloud and more widely applying Amelia to improve its training and other capabilities.

1. INTRODUCTION

In today's world of ever-evolving technology, businesses need to keep up with trends or catch up to the competition that takes advantage of new technologies to improve their infrastructure and application abilities. New technological cloud migration trends and AI are all the rave in the news. However, they are not merely tools to play with or side projects but monumental innovations that will forever change the landscape of businesses and applications. If implemented correctly within a business, such strides can revolutionize its infrastructure and increase its efficiency, scalability, and abilities.

Cloud migration started in the 2000s but only recently has received more notice as more data centers have been constructed and the rise of cloud services has become more available. The ability to migrate to the cloud has been made easier and more accessible, with services such as AWS able to handle many different applications on the cloud. AI has been a hot topic recently, and the potential is limitless in its application, whether writing stories or solving math problems. My internship highlighted how AI can be applied to business functionalities handling external application calls. Such revolutionary technologies have burst onto the scene and have yet to reach their full potential, and as they evolve, so will businesses.

2. RELATED WORKS

Hamdan (2021) discusses the importance of businesses utilizing new technologies to produce more innovative solutions and applications. He highlights Toyota as a pioneer in the technology field, especially for their incorporation of AI, where they have used the

technology to improve car safety. Toyota utilizes intelligent transport systems that connect vehicles to build a safer community, emphasizing a network effect where AI improves with more users. My project borrowed the inspiration of Hamdan to utilize AI to innovate current systems where companies like Fannie Mae strive to incorporate AI to reach new feats and deliver services with newfound capabilities.

Additionally, Garrison (2018) emphasizes the abundant benefits of cloud migration, advocating for a revolutionary shift in infrastructure. Garrison references how the benefits of cloud migration allow for systems and architectures to be rebuilt on the cloud and provide greater flexibility and capabilities. However, within this newfound cloud freedom, the business infrastructure must accommodate such changes to succeed, innovate with the cloud, and reap all the benefits. Like Garrison, my project shares the motivation to advance technology by comprehensively understanding AWS components for effective application migration. Although it may seem like moving data to the virtual cloud, the applications it enables are boundless and improve companies' services, enabling them to be more efficient and innovative.

3. PROJECT DESIGN

The main projects for my internship centered around developing and incorporating new technological services into the business infrastructure with cloud migration and AI. The goal was to advance Fannie Mae's system in innovative ways that would improve their applications and data in ways unimaginable a few years ago. Incorporating and developing technologies needed for my project was not simple; such technologies are new and need more rigid tests and documentation. However, this sparked creativity in restructuring current systems to fit the technologies into the company best and reap all its potential.

3.1 **Review of System Architecture**

The projects I was responsible for were the on-prem migration of my team's assets to the cloud and the development of an AI chatbot with API functionalities. A few years ago, Fannie Mae started the fully on-cloud initiative, which is nearly complete, with a handful of applications and assets still on-prem, including the company's servers and data. Moving my team's final asset required understanding the code and applying many services for cloud deployment. Fannie Mae has also been trying to develop an AI chatbot not merely for questions but a more advanced model serving intent recognition and the ability to call API functions. The projects aim to improve the company's applications with cloud benefits such as scalability and accessibility but are also more innovative and easier to use with AI.

3.2 Cloud Migration Requirements

The cloud migration project involved migrating business applications and assets from their on-site physical servers (on-prem) to public cloud data centers such as AWS. The transition's main benefits were reducing operational and IT costs, dynamic scalability, and faster deployment. The application we migrated transfers bank and mortgage files for our team. The system was one of the last on-prem applications of my department to be migrated, raising the urgency for successful deployment. The asset on-prem system only supported flat files and needed to be more flexible to accept varying files from more sources more efficiently.

3.3 Cloud Migration Key Components

A successful cloud deployment required implementing various services such as FMSSO (Fannie Mae sign-on for employees), CDX, Apache, and AWS. The existing bank file transfer application’s code had to be broken down and reconfigured for the deployment and integration of such services.

The goal was to migrate the application to the cloud fully and still accept all kinds of bank files and on-prem ones. To start the migration, my team utilized documentation on previous standard migrations; however, due to the age of the code and system, many exceptions arose within the steps and needed workarounds.

To transition the application to the cloud, it needed a new website to drive it. Utilizing a standard Fannie Mae HTML template, I designed a website to host the application with an easy, user-friendly UI and user interface to simplify the functionality. I connected it to the sign-on services of the company for only internal users. Configuring the website ran into issues with the old code, causing errors accessing the internal database, requiring legacy alterations and JavaScript to run the website correctly.

Migrating the code required using an AWS lambda function to run and manage the code. To verify successful deployments, we used Jenkins pipelines verify each stage. The last piece was to utilize an AWS S3 bucket storage service to store the data. The lambda must be connected to the S3 bucket. The bucket is where the website will be hosted to process all file requests. The S3 bucket would be the new data source for the files, with the website being the bridge, allowing for the successful deployment of my team's last asset to the cloud with improvements and new capabilities for future growth.

3.4 AI Requirements

Fannie Mae has been developing an AI chatbot called Amelia Intelligent Assistant, equipped with API capabilities to aid the software development process and business infrastructure. The chatbot does not simply look for patterns but intent recognition, where requests are broken down to find their true intent and then further classified by entities. Illustratively, the phrase “It is toasty outside” triggers comprehension of weather-related intent, specifically hot temperatures with the entity of toasty.

My role in the project involved enhancing the model's capabilities through diverse task training, focusing on specific departments as the chatbot transitioned from beta. This departmental segmentation ensures tailored responses and limited power-to-call functions based on user roles by having them sign in first to grab their information. I was tasked with understanding the model to aid the training and create automatic regression tests. The goal was to be functional for specific departments first and then be a full-fledged assistant for the whole company.

3.5 AI Key Components

The AI processes requests through coded business process networks and BPNs. The networks are complex logical flowcharts with nodes with HTML and JavaScript code to execute scripts and functions. I was tasked with training my department's models, where I updated the codes of the nodes within the network to direct towards newer responses and add more functionalities to responses. The new responses for training were derived from familiar company, and Stack overflow questions and ideas for new functionality from the business department. I upgraded the user interface with dropdown menu responses and simplified the menu to have frequently asked questions and requests as a menu segment. I inputted creative misspelled phrases and wording to ensure user ease and increase the model's ability to understand.

I aided in developing more API functionalities where users can request to create, delete, and modify users for applications. I also generated automatic Eddie regression tests to ensure consistency in the chatbot; the tests would automatically run in the background and ensure that older requests were still correct as we updated new responses. The model ran into issues with users with overlapping roles needing to get certain

privileges or correct responses. To debug the issues and correct them, I had to break down specific networks into two or more, which helped by simplifying the complex groupings and being more specific based on topics and departments.

4. RESULTS

By the end of my internship, I had accomplished the projects I was tasked with and improved my team's application abilities. The successful migration of my team's application to the cloud, allowing for acceptance of diverse banking files, has enhanced operational efficiency, security, and scalability. Hosting the application's website on S3 buckets leverages AWS services like CloudWatch, enabling efficient analytical metric management. All the uploaded files can be easily accessed from the S3 bucket to be easily exported and audited. To combat aid with other deployments, I collaborated with my team to document our migration process and shared the source code to facilitate a smoother company-wide transition.

On the Amelia AI front, I enhanced the model's capabilities by implementing new batches of questions, requests, and functionalities for my department. These additions have enabled our department to leverage Amelia in various applications, ultimately improving efficiency and accuracy in user interactions across the company. I also deployed automatic regression tests to ensure the reliability of my code on the model and among my colleagues. These improvements have positively impacted our department's operations and the broader user base, with Amelia becoming a more intelligent and valuable asset to the company.

5. CONCLUSION

The pinnacle of the cloud migration and AI projects undertaken at Fannie Mae signifies a pivotal stride for the future of business applications. These advancements are not fleeting trends or mere conveniences; they are potent tools revolutionizing their systems to compete effectively in our rapidly changing digital age. The successful transition of on-prem assets to the cloud enhances operational efficiency and empowers companies to shift their focus toward innovating their applications.

The cloud migration for my team's assets has achieved greater scalability, analytical capabilities, and accessibility, enabling us to reach a broader user base and offer more dynamic services. The integration of the Amelia Intelligent Assistant exemplifies a paradigm shift in business functionalities, showcasing the transformative power of AI in handling intricate tasks like API calls. Fannie Mae's use of AI underscores the customizable potential, illustrating that the more extensively AI is implemented within business systems, the more it empowers applications and provides limitless features to users.

This experience has honed my technical skills as a software engineer and provided profound insights into the yet-untapped potential of cloud migration and AI. To non-software engineers, the current impact is just the tip of the iceberg, as both technologies hold the key to unlocking unprecedented innovation and evolution in modern business applications.

6. FUTURE WORK

The future focus for cloud migration is to achieve full deployment across the company, establishing a cohesive and optimized digital infrastructure. After successfully migrating my team's last asset, the following steps involve assisting other teams and departments in transitioning their lingering on-premises assets. Additionally, we aim to continually innovate the now-cloud-hosted applications by leveraging the tools and metrics available in the new system. Future efforts regarding the Amelia Intelligent Assistant include expanding integration across departments through increasing user awareness, aiming to

transform it into a comprehensive company-wide assistant for all business applications. A key priority for my manager is integrating it into the software ticket creation process to streamline functionality and enhance efficiency in software development. The ongoing journey at Fannie Mae and in the broader business landscape marks the commitment to continuous improvement, innovation, and unlocking the full transformative potential of these technological advancements when genuinely integrated into business applications.

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