A Practical Training Report on

Modernizing Trade Screening Service from IaaS to PaaS

undergone at

Microsoft

under the guidance of

Shashank Madiraju, Principal SWE Manager
Vijay Sharma, Software Engineer - II

Submitted by

Suyash Satish Chintawar
191IT109
VII Sem B.Tech. (IT)

in partial fulfillment for the award of the degree of

BACHELOR OF TECHNOLOGY

in

INFORMATION TECHNOLOGY

Department of Information Technology
National Institute of Technology Karnataka, Surathkal.
October 2022

Microsoft India (R&D) Pvt. Ltd.
Microsoft Campus,
Gachibowli, Hyderabad- 500032

Tel: +91-40-66930000
Fax: +91-40-66935593
http://www.microsoft.com/india

Microsoft

8-Jul-22

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Suyash Chintawar** from the National Institute of Technology, Surathkal has successfully completed his Internship in the **"Cloud & Artificial Intelligence"** team under **Microsoft India (R&D) Pvt. Ltd, Hyderabad** from 16-May-22 to 8-Jul-22. He has completed the internship under the guidance of Shashank Madiraju (Sansam) and Vijay Sharma (Vijaysharma)**.**

We wish him all the best in his future endeavors.

Yours Sincerely,
For Microsoft India (R&D) Pvt. Ltd

Ira Gupta
SR GEO HR DIRECTOR

Signature of Candidate

Microsoft India (R&D) Pvt. Ltd.

Microsoft India (R&D) Pvt. Ltd.
Microsoft Campus,
Gachibowli, Hyderabad- 500032

Tel: +91-40-66930000
Fax: +91-40-66935593
http://www.microsoft.com/india

Microsoft

INTERN NON-DISCLOSURE AGREEMENT
(STANDARD)

1. **General.** As an intern of Microsoft India (R&D) Pvt. Ltd. ('MICROSOFT'), a company incorporated in New Delhi, India, under the Companies Act, 1956, and in consideration of the stipend now and hereafter paid to me, I will devote my best efforts to furthering the best interests of MICROSOFT. During my internship, I will not engage in any activity or investment (other than an investment of less than .01% of the shares of a company traded on a registered stock exchange), that (a) conflicts with MICROSOFT's business interests, including without limitation, any business activities not contemplated by this Agreement, (b) occupies my attention so as to interfere with the proper and efficient performance of my duties at MICROSOFT, or (c) interferes with the independent exercise of my judgment in MICROSOFT's best interests. As used herein, MICROSOFT's business means the development, marketing and support of software for business and professional use, including operating systems, languages and application programs as well as books and hardware for the microcomputer marketplace.

2. **Recognition of Absolute Ownership.** That I do hereby recognise and admit that MICROSOFT is the absolute, unrestricted and exclusive owner of the confidential or proprietary technical, financial, marketing, manufacturing, distribution or other technical or business information or trade secrets of MICROSOFT, including without limitation, concepts, techniques, processes, methods, systems, designs, clients, cost data, computer programs, formulae, development or experimental work, work in progress, customers and suppliers as well as software for business and professional use, languages and applications programs, operating systems, books, hardware and information for the microcomputer market place used by me in the course of my internship with MICROSOFT.

I agree that I shall not in any manner whatsoever, represent and/ or claim that I have any interest by way of ownership, assignment or otherwise in the same.

In this Agreement, all confidential and/ or proprietary information belonging to and/ or in possession of MICROSOFT, which is received, accessed, and/ or used by me, during the course of my internship with MICROSOFT, shall include without limitation, such information received from Microsoft Corporation, USA (the holding company of MICROSOFT) and/ or any entity in which Microsoft Corporation, USA holds or controls more than fifty percent of the stock thereof and/ or is entitled to vote for the election of directors.

3. **Non-Disclosure.** At all times, during my internship and thereafter, I will not disclose to anyone outside MICROSOFT nor use for any purpose other than my work for MICROSOFT a) any confidential or proprietary technical, financial, marketing, manufacturing, distribution or other technical or business information or trade secrets of MICROSOFT, including without limitation, concepts, techniques, processes, methods, systems, designs, circuits, cost data, computer programs, formulae, development or experimental work, work in progress, customers and suppliers, b) any information MICROSOFT has received from others which MICROSOFT is

Sayash

Signature of Candidate

Microsoft India (R&D) Pvt. Ltd.

Scanned with CamScanner

Microsoft India (R&D) Pvt. Ltd.
Microsoft Campus,
Gachibowli, Hyderabad- 500032

Tel: +91-40-66930000
Fax: +91-40-66935593
http://www.microsoft.com/india

Microsoft

obligated to treat as confidential or proprietary or c) any confidential or proprietary information which is circulated within MICROSOFT via its internal electronic mail system or otherwise. I will also not disclose any confidential or proprietary information to anyone inside MICROSOFT except on a "need-to-know" basis. If I have any questions as to what comprises such confidential or proprietary information or trade secrets, or to whom, if anyone, inside MICROSOFT, it may be disclosed, I will consult with my manager/ CELA/HR at MICROSOFT.

4. **Assignment of Inventions.** I hereby assign exclusively to MICROSOFT all my right, title, and interest in and to any all inventions, discoveries, designs, developments, improvements, copyrightable material, and trade secrets (collectively herein "Inventions") that I, solely or jointly, may conceive, write, encode, develop, or reduce to practice during the period of time I am an intern of MICROSOFT. I will make prompt and full disclosure to MICROSOFT of any inventions, and if for any reason the assignment pursuant to this clause is not effective, I will hold all such inventions in trust for the sole benefit of MICROSOFT. If I wish to use any copyrightable material as described in the previous sentence in connection with my thesis, I will request from Microsoft a license for such use. Microsoft may, in its sole discretion, grant me a royalty free license to use such copyrightable material in connection with my thesis, provided that all protection required by Microsoft for the ideas and inventions in such copyrightable material has been obtained (which may include a requirement that such copyrightable material be put in the public domain and all patents related to such copyrightable material have been applied for).

I hereby waive and quitclaim to MICROSOFT, any and all claims of any nature whatsoever that I now or hereafter may have for infringement of any patent resulting from any patent applications for any Inventions so assigned to MICROSOFT.

My obligation to assign shall not apply to any Invention about which I can prove that:

a) It was developed entirely on my own time; and
b) No equipment, supplies, facility, services, or trade secret information of MICROSOFT was used in its development; and
c) It does not relate (i) directly to the business of MICROSOFT or (ii) to the actual or demonstrably anticipated research or development of MICROSOFT; and
d) It does not result from any work performed by me for MICROSOFT.

I will assign to MICROSOFT or its designee all my right, title, and interest in and to any and all Inventions full title to which may be required to be in the United States by any contract between MICROSOFT and the United States or any of its agencies.

5. **Excluded and Licensed Inventions.** I have attached hereto, a list describing all Inventions belonging to me and made by me prior to my internship with MICROSOFT that I wish to have excluded from this Agreement. If no such list is attached, I represent that there are no such Inventions. If in the course of my internship at MICROSOFT, I use in or incorporate into a MICROSOFT product, program, process, or machine, an Invention owned by me or which I have an interest, MICROSOFT is hereby granted and shall have an exclusive royalty-free, irrevocable,

Signature of Candidate

Microsoft India (R&D) Pvt. Ltd.

Scanned with CamScanner

Microsoft India (R&D) Pvt. Ltd.
Microsoft Campus,
Gachibowli, Hyderabad- 500032

Tel: +91-40-66930000
Fax: +91-40-66935593
http://www.microsoft.com/india

Microsoft

worldwide license to make, have made, use, and sell that Invention without restriction as to the extent of my ownership or interest.

6. **Application for Copyright and Patents.** I will execute any proper oath or verify any proper document in connection with carrying out the terms of this Agreement. If, because of my mental or physical incapacity or for any other reason whatsoever, MICROSOFT is unable to secure my signature to apply for or to pursue any application for any United States, Indian or foreign patent or copyright covering Inventions assigned to MICROSOFT as stated above, I hereby irrevocably designate and appoint MICROSOFT and its duly authorised officers and agents as my agent and attorney in fact, to act for me and in my behalf and stead, to execute and file any such applications and to do all other lawfully permitted acts to further the prosecution and issuance of U.S., Indian and foreign patents and copyrights thereon with the same legal force and effect as if executed by me. I will testify at MICROSOFT's request and expense in any interference, litigation, or other legal proceeding that may arise during or after my internship.

7. **Third Party Information.** I recognise that MICROSOFT has received and will receive confidential or proprietary information from third parties subject to a duty on MICROSOFT's part, to maintain the confidentiality of such information and to use it only for certain limited purposes. During the term of my internship and thereafter, I will not disclose such confidential or proprietary information to anyone except as necessary in carrying out my work for MICROSOFT and consistent with MICROSOFT's agreement with such third party. I will not use such information for the benefit of anyone other than MICROSOFT or such third party, or in any manner inconsistent with any agreement between MICROSOFT and such third party of which I am made aware.

8. **Prior Employer Information.** During my internship at MICROSOFT, I will not use improperly or disclose any confidential or proprietary information or trade secrets of my former or current employers, principals, partners, co-ventures, clients, customers, or suppliers of the vendors or customers of such persons or entities or their vendor or customers and I will not bring onto the premises of MICROSOFT, any unpublished document or any property belonging to any such persons or entities or their vendors or customers unless such persons or entities have given their consent. I will not violate any non-disclosure or proprietary rights agreement I might have signed in connection with any such person or entity.

9. **Presumption of Breach.** In the event of the possession, access and or use of the confidential or proprietary technical, financial, marketing, manufacturing, distribution or other technical or business information or trade secrets of MICROSOFT, including without limitation, concepts, techniques, processes, methods, systems, designs, clients, cost data, computer programs, formulae, development or experimental work, work in progress, customers and suppliers as well as software for business and professional use, languages and applications programs, operating systems, books, hardware and information for the microcomputer market place by any other third party with whom I may have a nexus, it shall be presumed, unless proved to the contrary, that such information has so come to the possession of the third party on account of breach of this Agreement by me.

Signature of Candidate

Microsoft India (R&D) Pvt. Ltd.

Scanned with CamScanner

Microsoft India (R&D) Pvt. Ltd.
Microsoft Campus,
Gachibowli, Hyderabad- 500032

Tel: +91-40-66930000
Fax: +91-40-66935593
http://www.microsoft.com/india

Microsoft

10. **Term of Internship.** I acknowledge that my internship will be of a definite duration as specified in the offer letter, or as otherwise indicated to me. Either MICROSOFT or I will be free to terminate this internship relationship at any time during the above-mentioned period, with or without cause and in accordance with the Agreement signed by me with MICROSOFT. I also acknowledge that any representations to the contrary are unauthorised and void, unless contained in a separate agreement signed by an officer of MICROSOFT.

11. **Return of Materials.** At the time I end my internship with MICROSOFT, I will return to MICROSOFT all papers, drawings, notes, memoranda, manuals, specifications, designs, devices, documents, diskettes and tapes, and any other material on any media containing or disclosing any confidential or proprietary technical or business information. I will also return any keys, pass cards, identification cards or other property belonging to MICROSOFT.

12. **Non-Competition.** For a period of six months after termination of my internship, I will not accept employment or engage in activities directly or indirectly competitive with the products (including actual or demonstrably anticipated research or development) on which I worked or about which I learned, proprietary or confidential or trade secret information while interning at MICROSOFT.

13. **Non-Solicitation.** While an intern at MICROSOFT and for a period of one year from the termination of my internship, I will not induce or attempt to influence directly or indirectly, any employee or intern of MICROSOFT to terminate his/her employment or internship with MICROSOFT or to work for me or any other person or entity.

14. **Personal Property.** I agree that MICROSOFT will not be responsible for loss, disappearance, or damage to personal property on MICROSOFT premises, or if applicable, on residential premises subsidized by MICROSOFT (including apartments or temporary housing). I hereby release, discharge, and hold MICROSOFT harmless from any and all claims relating to loss of, disappearance, or damage to such personal property.

15. **Equitable Relief.** I acknowledge that any violation by me under this Agreement, and/or any obligation of like nature, will cause irreparable injury to MICROSOFT, and MICROSOFT shall be entitled to extraordinary relief in any court in India, including, but not limited to, temporary restraining orders, preliminary injunctions, and permanent injunctions, without the necessity of posting bond or security.

16. **Attorneys' Fees.** If court proceedings are required to enforce any provision of this Agreement, the prevailing party shall be entitled to an award of reasonable and necessary expenses of litigation, including reasonable attorneys' fees.

17. **Entire Agreement.** I agree that this Agreement shall be governed for all purposes by the laws of India and that venue for any action arising out of this Agreement shall be the courts of India. If any provision of this Agreement shall be declared excessively broad, it shall be construed so as to afford MICROSOFT the maximum protection permissible by law. If any provision of this Agreement

Signature of Candidate

Microsoft India (R&D) Pvt. Ltd.

Scanned with CamScanner

Microsoft India (R&D) Pvt. Ltd.
Microsoft Campus,
Gachibowli, Hyderabad- 500032

Tel: +91-40-66930000
Fax: +91-40-66935593
http://www.microsoft.com/india

Microsoft

is void or is so declared, such provision shall be severed from this Agreement, which shall otherwise remain in full force and effect. This Agreement sets forth the entire Agreement of the parties as to the subject matter hereof and any representations, promises, or conditions in connection therewith not in writing and signed by both parties shall not be binding upon either party. The terms and conditions of this Agreement shall survive termination of my internship.

18. **Effective Date.** I agree that the terms and grants contained in this Agreement shall apply from the first day that I effectively join or joined MICROSOFT, or as per the start date indicated in my offer letter, whichever is earlier.

HAVING READ AND FULLY UNDERSTOOD THIS AGREEMENT, I have signed my name on this day of , 02/04/2022

Suyash

(Signature)

Inventions listed on attached: ☐ Yes ☑ No

N/A

Witness

The following documents/information are required by us on the date of joining.

- Signed Offer Letter
- Signed NDA-signed on each page
- Copy of PAN Card
- Emergency Contact Details
  - o Emergency contact name, relationship, address, work and home phone
  - o Marital Status
  - o Date of Birth
  - o Current Address and home phone number

☑ By checking this box, you are acknowledging that you have received and read this document.

Suyash

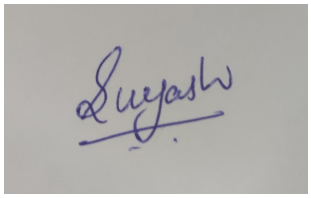
Signature of Candidate

Microsoft India (R&D) Pvt. Ltd.

Scanned with CamScanner

DECLARATION BY THE STUDENT

I, **Suyash Satish Chintawar (191IT109)**, hereby declare that the project entitled **"Modernizing Trade Screening Service from IaaS to PaaS"** was carried out by me during the **Summer** term of the academic year 2022 – 2023. I declare that this is my original work and has been completed successfully according to the direction of my guide **Mr. Shashank Madiraju (Microsoft)** and as per the specifications of NITK Surathkal.



Place: NITK Surathkal

Date: 21/9/2022

(Signature of the Student)

ABSTRACT

Microsoft Corporation is an American multinational technology corporation which produces computer software, consumer electronics, personal computers, and related services headquartered at the Microsoft Redmond campus located in Redmond, Washington, United States. Its best-known software products are the Windows line of operating systems, the Microsoft Office suite, and the then Internet Explorer and Microsoft Edge web browsers.

The project focuses on modernizing a service originally hosted in Infrastructure-as-a-service delivery model to a Platform-as-a-service cloud delivery model. To achieve a viable and optimized solution to solve the above problem, an azure function app was developed and tested thoroughly using durable functions which was deployed on azure cloud using Azure Resource Manager (ARM) templates.

The work was done for the Volume Licensing team in Microsoft India (R&D) Pvt. Ltd, Hyderabad. The document gives a detailed overview of the work done during the internship duration.

Contents

List of Figures

1. Introduction

In software licensing, a volume licensing is the practice of selling a license authorizing one computer program to be used on a large number of computers or by a large number of users. Microsoft offers softwares like Microsoft Windows, Microsoft Office, etc through its volume licensing programs.

Trade screening is the process in which the authenticity of the organizations is determined in carrying out business with the company. The organizations must follow the rules set up by the U.S. government for the same which determines their authenticity. It is a very crucial factor to be checked because the violation of these rules might lead to losses being faced by the company.

Infrastructure as a service (IaaS) is a cloud computing offering in which a vendor provides users access to computing resources such as storage, networking, and servers. Organizations use their own platforms and applications within a service provider's infrastructure. On the other hand, in Platform as a service (PaaS) delivery model, the service providers also manage the runtime, OS and middlewares along with the resources in IaaS. Maintaining these IaaS services is costlier and hence PaaS delivery models are preferred depending on the use case. In this project, a PaaS solution has been used to modernize the existing service.

1.1 Scope of the work

The major milestones of my project during the 8-week internship duration were,

- Understood the existing framework and related concepts.

- Built an azure function app which replicates the functionality of the existing service.
- Deployed the developed function app on azure cloud and create a CI/CD pipeline.
- Did performance and load testing of the deployed function app.

The above milestones are discussed in detail in chapter 4.

1.2 Product Scenarios

The azure function app is triggered by azure itself based on a specific event. All possible exception that the function app might go into have been successfully handled. Retry polling mechanism has been integrated in case of timeouts or failures occur for some of the functions due to any reason. All the logs are stored in the Application Insights azure resource in the cloud including errors, exceptions and normal traces.

2. Requirement Analysis

2.1 Functional Requirements

- The main function of the azure function app is similar to the existing service which is to fetch records from a source database, process the records one at a time by updating information in a destination database and marking the processed record again in the source database.
- The traces of every function invocation should be logged. Application insights is to be used to serve this purpose.
- Error and exception handling is an important aspect which must be implemented by taking into consideration all the scenarios the system might face.
- In case any failure of function execution or timeouts, retry polling mechanism is must to give extra chances for the function to execute.

2.2 Non-Functional Requirement

The basic non functional requirements for developing the solution were,

- Completeness - To ensure that the function app has all the functionality of the original service.
- Correctness - To ensure that the code is error free and all the edge cases are covered.
- Flexibility - The code was written in such a way that new features could be easily built on top of it.
- Maintainability - It was made sure that the design is simple enough to be understood by other developers. Documentation for the

whole project consisting of the information of all features was compiled.

2.3 Use Case Scenarios

The service is a timer trigger which runs on a schedule and has been specially designed for this particular use case. Hence, it does not have any other use cases.

3. System Design

3.1 Design Goals

- To build an azure function app which is modular, scalable and easily maintainable.
- Build fault tolerant service with different custom exception handling
- Integrate telemetry logging with the function app to keep track of all events.
- To ensure that the resources required to run the function app are used efficiently.

3.2 System Architecture

Azure Functions is a serverless solution that allows us to write less code, maintain less infrastructure, and save on costs. Instead of worrying about deploying and maintaining servers, the cloud infrastructure provides all the up-to-date resources needed to keep our applications running. Azure function app consists of one or more azure functions.

Fig. 3.1 shows the basic outline of the implemented azure function app. The developed azure function app consisted of 5 different azure functions with their unique but interdependent functionalities. A timer trigger azure function was created to satisfy the requirements of the existing feature. Timer triggered azure function are function which run on a specified schedule. The schedule is specified in a NCRONTAB expression format. Durable Functions is an extension of Azure Functions that lets us write stateful functions in a serverless compute environment. These type of functions were used to better design the function app and to orchestrate the workflow. A function chaining pattern was

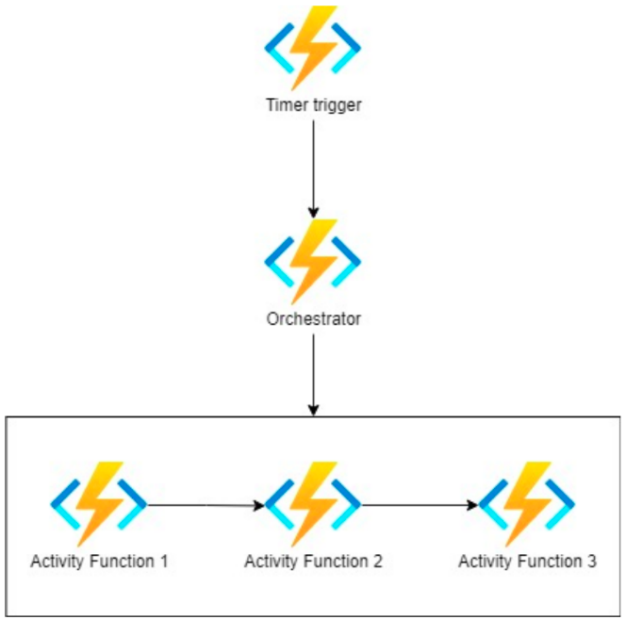


Figure 3.1: Outline of System Architecture

followed where a sequence of functions executes in a specific order. In this pattern, the output of one function is applied to the input of another function. Three azure functions were involved in this particular scenario in the function chaining pattern. Finally, to define a workflow amongst these function, an orchestrator function was employed. between the timer trigger and the function chain.

4. Work Done

4.1 Week-wise work done

4.1.1 Week 1 & 2

The first two weeks were spent into understanding the underlying architecture of the whole trade screening process. The first week was spent in setting up the local development environment on the machine along with the learning phase. The learning phase included in understanding the upstream and downstream dependencies and the purpose of each sub module present in the architecture. We were provided with resources to learn the required development tools and the languages and frameworks used. During this duration of two weeks I learnt C#, .NET framework, Transact-SQL and azure functions. We were also supposed to complete some online training programs to learn about how the .NET framework is used in building modular and durable applications efficiently.

4.1.2 Week 3

Once acquainted with the system architecture, the basic implementation of the of the azure function app was started. It included understanding the original services' implementation and its corresponding solution in azure functions.

4.1.3 Week 4 & 5

The next two weeks were spent in modifying the developed code to best replicate the functionality of the existing service. It mainly included in optimization of the code to make it modular and more scalable and re-usable. Application insights logging was integrated with the function app to replicate the logging functionality of the original service.

Application Insights is a feature of Azure Monitor that provides extensible application performance management (APM) and monitoring. Application Insights is used automatically detect performance anomalies, diagnose issues by using powerful analytics tools and continuously improve app performance and usability.

4.1.4 Week 6

This week was mainly spent in testing the developed function app locally under different scenarios and use cases. The process for deployment of the function app onto the azure cloud was also initiated. Azure Resource Manager (ARM) templates were created to define the infrastructure that needs to be deployed. Azure command line interface (CLI) was used to deploy these built ARM templates to be deployed onto azure portal.

4.1.5 Week 7 & 8

After the deployment, the created resource was thoroughly checked for all error prone conditions and necessary modifications were done to the code. An Azure DevOps pipeline was created to automate the process of git pushes onto the remote cloud server. Azure Pipelines combines continuous integration (CI) and continuous delivery (CD) to test and build the code and ship it to any target.

The last week was mainly spent on doing the performance testing of the created function app under different circumstances. Load testing was also performed to check the traffic or the number of requests the trigger was capable in handling. It was concluded that there was a significant performance boost after converting the original service to its corresponding PaaS solution.

4.2 Development Requirement

- Visual Studio 2022 - Visual Studio is an integrated development environment (IDE) from Microsoft. It has multiple features like code editor, debugger, and other important tools like server explorer, solution explorer. It supports multiple programming languages like C#, Visual Basic, C++, .NET, etc.
- Microsoft SQL Server Management Studio (SSMS) - This tool is used for configuring, managing, and administering all components within Microsoft SQL Server. A central feature of SSMS is the Object Explorer, which allows the user to browse, select, and act upon any of the objects within the server.
- Azure DevOps - It provides a platform to maintain version control in project management. It has multiple features like workboards, repositories, pipelines, etc. So basically it covers the entire application lifecycle, and enables DevOps capabilities.

5. Result and Discussion

The aim of the project was to build a scalable solution to modernize the trade screening service and to transfer the existing on-premise solution to its corresponding PaaS solution. I was able to achieve this by successfully building an azure function app which improved the performance over the original service. After performance analysis it was observed that a performance boost of approximately 20% was gained in terms of runtime.

6. Conclusion and Future Work

The project helped me understand a variety of tools, frameworks like Azure, .NET, DevOps, Transact-SQL, etc. It gave me clear insights about the complete software development life cycle (SDLC). Generic learnings included writing modular and reusable code and the importance of documentation for the clarity of the project.

The future work of the project mainly included performing load testing of the function app using azure load testing to better understand the working and durability of the developed function app. The project was completed within the stipulated time and satisfied all the requirements specified.

7. References

1. https://learn.microsoft.com/en-us/
2. https://portal.azure.com/
3. https://www.wikipedia.org/