

# Modernizing Middleware Platforms: Strategies, Challenges and Opportunities

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**Abstract:** Middleware platforms are key components that bridge the gap between heterogeneous information systems and enable the flow of real time data between applications within and across organizations in order to achieve seamless and efficient business processes and data integrity. In the modern IT world, enterprises are adapting to digital transformation, and they are moving away from traditional on-premise services to cloud based services allowing them to outsource IT infrastructure, software and platforms via the Internet. This shift in businesses today results in an increasing demand to modernize middleware platforms, especially knowing that on-premise middleware platforms are not designed to address the need of such hybrid IT environments. In this paper, we provide a review of middleware modernization approaches and address the challenges and future opportunities of modernizing middleware platforms.

**Keywords:** Cloud Computing, Middleware, Integration platform as a service (iPaaS).

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## I. INTRODUCTION

Digital transformation is reshaping the landscape of the business world; and companies are trying to find their ways to adapt to this change. As enterprises move forward with digital transformation, they tend to move more IT services to cloud platforms and consequently, they encounter an increasing demand to have a powerful tool that can integrate their on-premise information systems with cloud-based services. Integration has been always a challenge for organizations; and as technology advances, integration platforms are evolving to address the new challenges to adapt to the new IT technologies like mobile computing, data analytics, cloud, and the Internet of Things (IOT). Today with the rapid change in IT industry, enterprises have realized the criticality of having a resilient and scalable integration platform; and they realized the need to scale up their integration platform to address the gap between legacy, modern and hybrid IT environments. To address this need, a specialized form of cloud-based integration services is being introduced which is commonly known as integration platform as a service (iPaaS) to replace the on-premise Enterprise Application Integration (EAI) Platforms. iPaaS is defined by Garner as “a suite of cloud services enabling development, execution and governance of integration flows connecting any combination of on premises and cloud-based processes, services, applications and data within individual or across multiple organizations”.

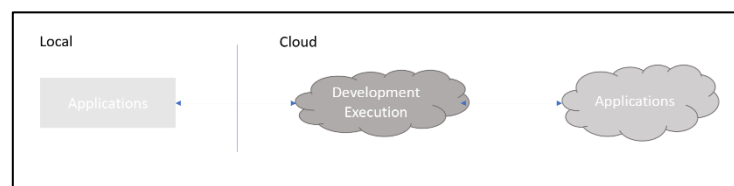
## II. APPROACHES OF MODERNIZING INTEGRATION PLATFORM

A cloud integration platform provides fundamental integration features that focus on core integration infrastructure including data mapping, transformation, communication channels, adapters and message routing. In addition to development features such as integrated modelling, testing tools and operation features that cover system administration, management and monitoring. Furthermore, a consolidated integration technology offers more governance capabilities like repositories, lifecycle management, auditing, policy tools and message tracking. Besides fundamental integration features, Modern cloud integration platform adds more provisioning features to facilitate the cloud integration setup between two cloud partners by offering pre-built integration packages and self-service capabilities and they offer cloud enabling features to support cloud computing capabilities like multi-tenancy and elastic scalability and provide runtime containers and services for application on-demand and as a service integration over network. Cloud integration platforms do not have to be fully cloud-based but instead, there are three architectural designs, two of which are partially cloud-based.

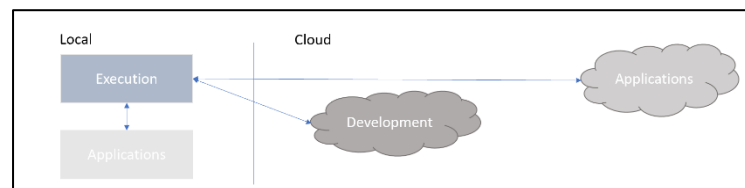
A- **Cloud and development execution:** in this architecture, development is supported through web-based design tools and metadata e.g., data mapping and process definition are stored in the cloud. Business data is transferred over iPaaS cloud during integration process execution. In this design, enterprise does not manage any integration infrastructure. Compared to other designs, this design requires less time from development to integration process execution. See Fig 1.

B- **Cloud and development local execution:** in architecture design B, development is supported by web-based tool in the cloud and integration processes are executed locally. In this design, enterprise is fully responsible for process execution environment. This design best fit enterprise with integration requirements for only on-premise applications where no application data need to send to an external cloud. The initial setup for execution environment in architecture design B can consume time and effort compared to other architecture designs. See Fig 2.

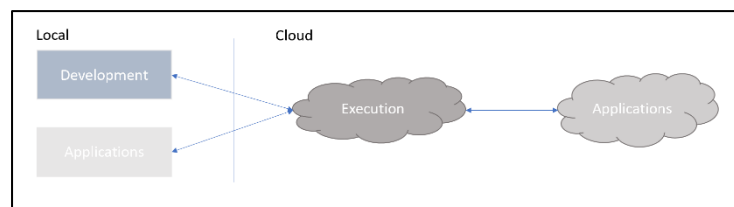
C- **Local and development cloud execution:** the development is local using on-premise tools E.g Eclipse and integration processes are executed in the cloud. In this design, user can benefit from more powerful on-premise development tools and by executing processes in the cloud, enterprises do not need to worry about setting up any execution environment. See Fig 3.



**Fig 1. Architecture Design A**



**Fig 2. Architecture Design B**



**Fig 3. Architecture Design C**

### III. STEPS TOWARD MODERNIZING INTEGRATION PLATFORM

Modernizing integration platform is a critical and challenging task for enterprise to cope with digital transformation. Therefore, it is important to have a well-established plan to overcome this challenge. Following are some important steps that an enterprise needs to consider when planning for integration modernization journey:

**A. Understand integration maturity level:** first step to modernize the integration platform is to assess the enterprise to understand their integration maturity level and where it stands in terms of integration capabilities and what benefits they are looking for from a cloud-based integration platform. Below is a sample of questions that enterprise needs to answer in the first place [4]:

- What is the level of integration and percentage of applications that leverage integration at your organization?
- What kind of integration solutions are used to connect with the other applications within the organization? (Point-to-Points, web services etc.)
- How do the legacy applications integrate with other applications (On-Premises and Cloud)? What kind of integration solution is used currently?
- Is there any process established to integrate SaaS based applications in real time?

- What is the capability of your organization to expose parameters to manage the configuration of processes without any impact?
- What is the ability of your organization to manage data from multiple systems in the same integration process through orchestration?

**B. Building efficient integration strategy:** with the rapid change in IT industry, companies need to build an efficient and long-term resilient strategy to handle their integrations scenarios. The first step in modernizing the integration platform is to assess current integrations and forecast the future integration requirements. Then look for the best cloud-based integration platform that matches those needs. This exercise will require deep thoughts and strategic planning to ensure a successful modernizing journey. Companies need to review and compare available iPaaS platforms from different aspects including capabilities, features, security, cost and select the best fit. An Efficient integration strategy can handle complex integration scenarios by considering both reusability and scalability and can achieve complex integration with less implementation cost.

**C. Establish integration governance team:** the enterprise needs to have a dedicated team to manage, governance and review all integration activities. The existence of this team will ensure the integration scenarios are aligned with the enterprise integration strategy and it will help to standardize integration process as well as building resilient integration strategy for enterprise. Some of roles that can be assigned to this team is to establish integration standards and guidelines for scattered integrations across enterprise, review integration designs to ensure that it follows the enterprise integration strategy. Another role that can be assigned to the team is to evaluate available integration platforms and decide on the best fit that satisfies enterprise integration scenarios requirements and foresees future integration requirements for enterprise.

**D. Develop reference architecture:** another essential point for enterprise is to build an integration reference model that will resemble the best practices and provide guidelines for different teams to follow when building integration scenarios. This will help to standardize the integration process and the execution. With scattered organization and numerous amounts of integrations required between on-premise and cloud applications, a reference architecture has become a must to ensure compliance with enterprise integration strategy.

#### IV. CHALLENGES

Organizations may face technical, economical, organizational challenges in their way to migrate from on-premise integration platform to cloud based integration platform, the journey can be very expensive in terms of human hours especially for big organizations that have scattered integrations. Furthermore, internal regulations and laws can hinder the adoption of cloud integrations as well as technical challenges in sharing data externally such as firewall and network setup which can slow down the adoption process.

Today, one of the core issues of cloud-based integration platforms is data protection and privacy. The fact that application data is transferred over the Internet raises many concerns for organizations and fear of data being compromised and exposed. Hence, many organizations may not like to store their data outside their datacentres or have their data in a shared infrastructure which increases the risk of data being exposed. Data protection is a fundamental issue in cloud-based integration platforms including protecting identify information, transactions and integration components. Cloud platform providers need to investigate providing privacy assurance mechanisms and more mature security management solutions to provide a trustworthy cloud integration platform and achieve a high level of trust with their customers. Performance is another common concern of cloud-based integration platform. Performance can depend on the Internet connection or the cloud platform itself which is often unpredictable. Poor Performance can negatively impact data exchange and message flow between applicable and consequently impact business processes.

From research respective, the fact the cloud-based platforms are relatively new, there is a lack of research studies in many areas of cloud-based platforms including security, technical details and challenges. Also, business use cases of cloud integrations, technical issues and limitations have not been investigated in detail. Lack of research and successful stories of cloud platforms can impact enterprise decision to shift to iPaaS.

#### V. OPPORTUNITIES

Cloud based integration platform promises to tackle many challenges that organization are facing with traditional on-premise platforms, and it promises to provide more features and functions that will help organization meet their integration requirements and at the same time, reduce the integration effort and achieve overall cost saving in development, management and execution of integration scenarios. IPaaS provides friendly interface that is easy to use compared to on-

promise integration platforms. Many tasks can be easily achieved by drag and drop instead of writing codes and it provides a predefined template for adapters, integration processes and data mapping that can help reduce the integration deployment effort.

Due to the wide range of cloud integration scenarios, requirement of cloud integration platforms may vary depending on organization needs. Developing such an integration platform that delivers all integration solutions for all possible scenarios may result in a very complex solution. In this regard, cloud integration federation concept is suggested to benefit cloud integration industry and give organization flexibility to benefit from different complementary cloud integration solutions. Federation concept will allow to compose multiple cloud integration solutions into one holistic solution. This approach has its own challenges that will increase the integration complexity by introduce another layer to the design.

Another suggestion that is being discussed to tackle the lack of standardization, transparency and data protection in iPaaS industry is to establish an open-source cloud-based integration platform or build a standard that all iPaaS provider must adhere to. Open-source approach can help to define a common ground for iPaaS standards that will benefit organizations and help iPaaS vendor to have a well-established ground relevant to standard requirements for iPaaS platform to build their platform on top of it. Cloud integration platform standards can cover areas of security, fundamental integration features, operation management and governance. iPaaS standards will make iPaaS industry more mature and encourage organization to capitalize on it to have more resilient integration strategy.

## VI. CONCLUSION

In summary, shifting to cloud integration may become a must for organization to compete in the modern IT era to overcome challenges in integrating with cloud-based solutions that is heavily used nowadays. Cloud-based integration platforms can be a better alternative to the classic on-premise integration platforms when organizations have a well-established integration strategy that is efficient and scalable. Organizations need to identify their integration requirement and select cloud-based integration platform that matches their needs to effectively manage their business processes. It is essential for organizations to evaluate the challenges and the hidden opportunities of cloud-based integration in order to succeed in its modernization journey. Security, data privacy and performance are among the top challenges of modern integration platforms where on the other hand there is a potential opportunities of cloud integration platforms that promises to build resilience and scalable integrations.

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