Business Process as a Service

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Abstract— **The pursuit of adaptive and efficient operational strategies in contemporary corporate settings resonates with the inherent flexibility and transformative potential offered by cloud computing. The integration of cloud technology has emerged as a cornerstone for addressing modern business requirements and demands. In this context, the introduction of Business Process as a Service (BPaaS) has emerged as a critical link between the intricate landscape of business operations and the complexities of IT administration. This paradigm shift represents a forward-thinking and constructive development that has garnered increasing attention within academic and corporate circles.**

The central focus of this research paper revolves around the intricate transition from traditional, often rigid, business process models to the dynamic and agile realm of cloud-based execution. This transition is marked by the adoption of a multi-tiered BPaaS architecture, meticulously designed to ensure that it aligns with cloud-centric features, underlying theoretical principles, and the latest technological frameworks.

The multi-tiered BPaaS architecture described herein offers a comprehensive classification system, providing a well-defined path for the prospective conversion of traditional business processes into a cloud-based service model. By meticulously examining each tier, this research paper seeks to unravel the nuanced intricacies, nuances, and practicalities of BPaaS. It serves as a foundational first step, offering a compelling starting point for future endeavors in the burgeoning field of BPaaS, both within academic discourse and corporate implementation.

Furthermore, this research paper anticipates that as BPaaS gains prominence and recognition in both academic and corporate spheres, it will catalyze the development of novel industry standards, thus contributing to the ongoing evolution of business processes in the digital age. The path laid out in this paper not only serves as a roadmap but also as a springboard for future growth, innovation, and adaptation in the ever-evolving landscape of business and technology.

Keywords- Business Process as a Service; BPaaS; Cloud Computing; Cloud; NIST; Business Process Management; Business Process Automation; Business Proces Utility

I. INTRODUCTION

This research paper delves deep into the fascinating evolution of cloud computing services, tracing their growth from their initial compute-oriented models to the development of increasingly sophisticated, multidimensional structures. The impact of this evolution on various aspects, particularly on business models and innovation, is explored in detail [1].

The landscape of cloud adoption has undergone significant transformations over the years. Initially, cloud computing was primarily embraced by IT-oriented firms, who recognized the potential of this technology in optimizing their operations. However, the game-changer came with the introduction of Software as a Service (SaaS) [1]. SaaS expanded the horizons of cloud computing by making it more accessible to a broader spectrum of enterprises, including those that are not inherently technical in nature. This pivotal shift opened new possibilities and challenges.

Despite the newfound accessibility that SaaS brought to the table, it was not without its limitations. SaaS offerings often came with rigid structures and were sometimes incompatible with the existing traditional procedures of companies [24]. This incongruity gave rise to a pressing demand for innovative cloud service models that could seamlessly align with and prioritize the unique business objectives of different organizations.

One such innovative model that has been gaining attention in recent years is the Business Process as a Service (BPaaS). This cloud-based approach offers a novel way of presenting business processes as services [25]. Companies can leverage BPaaS to remotely access, modify, and execute these processes, tailoring them to meet their specific business requirements. The versatility and adaptability of BPaaS make it a promising solution for organizations looking to bridge the gap between cloud technology and their operational workflows [23].

One notable aspect of this research paper is its effort to address the lack of a clear and comprehensive description of BPaaS and its capabilities, which is a common issue found in the existing literature. This article aims to fill this gap by meticulously examining traditional definitions of cloud computing and delving into the essential stages required to seamlessly align IT with the intricacies of business operations.

The study also introduces a five-level business process hierarchy with varying degrees of technological complexity. This hierarchy provides a structured framework for understanding the layers of BPaaS and their functionalities, shedding light on how they can be harnessed to enhance business processes.

BPaaS, as a model, relies on a distributed, multi-tenant workflow engine that empowers users to upload their unique

business processes. Some of these processes may have the capability to interact with and access other services, further enhancing the flexibility and scope of BPaaS applications. The study underscores the importance of BPaaS systems that support multiple layers, as this enables a seamless transition between distinct activities within an organization, ensuring a harmonious flow of operations and maximizing efficiency [1].

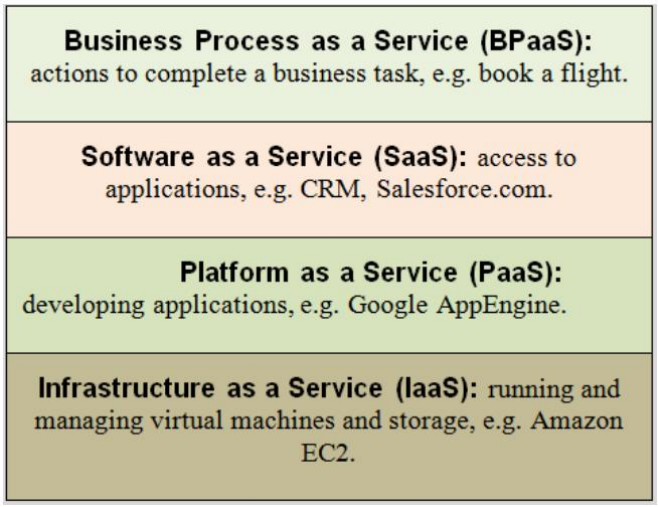

Figure 1. The Cloud Service Model Stack [4].

This research paper looks at the changing environment of Business Process Outsourcing (BPO) and the growing usage of cloud computing, especially Cloud Computing as defined by the National Institute of Standards and Technology (NIST).

The authors address the possible environmental benefits of cloud computing, specifically energy savings and lower carbon emissions [24]. A substantial market area has been identified as BPaaS, a cloud-based business process paradigm. BPaaS, on the other hand, lacks a clear definition, and its incorporation into cloud service models varies. The article underlines the necessity of flexible, energy-efficient, service-based business processes in the cloud, as well as the interoperability problems, particularly at the BPaaS level [2].

II. Business Process as a Service (BPaaS)

A. *Business Process as a Service vs Software as a Service*

In the context of software delivery, the basic delivery paradigm remains unchanged, with cloud technology serving as the underlying infrastructure for providing various functions over the internet. The primary distinction between Software as a Service (SaaS) and Business Process as a Service (BPaaS) is *the nature of the service delivered*. While SaaS refers to the distribution of software applications via internet channels, BPaaS is a broader concept that includes not only software but also the complete lifecycle management of business processes.

This broad scope encompasses operations such as *design*, *implementation*, *delivery*, *optimization*, and *transformation*, providing a comprehensive solution for controlling and improving business processes. This difference represents the academic background of comprehending how BPaaS expands beyond software provision to embrace a larger spectrum of process management inside the framework of cloud-based services [16].

BPaaS is the ideal solution for enterprises seeking process automation. In contrast to SaaS, which is limited to software solutions, BPaaS allows firms to outsource a wide range of business operations, making it a more adaptable alternative.

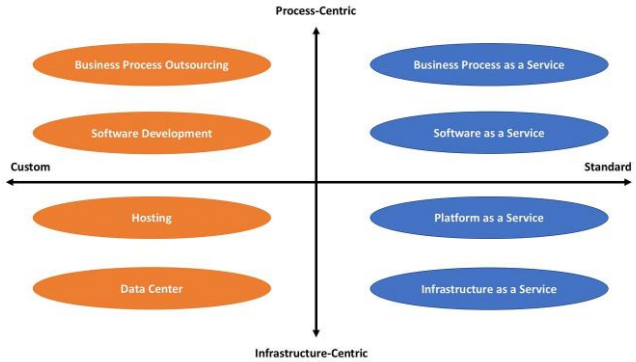

Figure 2. BPaaS vs SaaS [16].

When specific knowledge is required, such as for social media management services, BPaaS is an excellent choice [16]. It bridges the gap between software and trained individuals, making it appropriate for jobs such as regulatory compliance management, customer support, and marketing

Because of developments in enabling technologies such as Web services, service-oriented architecture (SOA), and the adoption of creative techniques such as Ajax, the prevalence of SaaS as a delivery model is increasing. Simultaneously, the expanding availability of broadband services has increased worldwide user access.

SaaS is closely related to the Application Service Provider (ASP) and on-demand computing software delivery paradigms. According to IDC, there are two main delivery models in the world of SaaS. The first option, called hosted application management (hosted AM), is quite similar to the ASP model. A provider hosts commercially accessible software and distributes it to consumers via the internet [16]. The second option, known as software on-demand, provides users with network-based access to a single instance of an application that is particularly intended for delivery via SaaS framework

B. *Benefits of BPaaS*

BPaaS provides enterprises with a new approach to improving the flexibility and efficiency of their business operations [11]. It is a low-cost solution that eliminates the need for costly in-house teams while simultaneously lowering operating expenses and human mistakes [12]. Small organizations can gain the most from BPaaS since it gives an easy and simplified method to enhance procedures without making large upfront expenses [14].

The cost advantage of BPaaS is substantial. It removes the need to purchase and maintain software, hardware, and infrastructure, lowering both upfront and continuing expenditures [13]. Because of its affordability, BPaaS is a viable option for small organizations, saving both *time* and *money* during the launch phase. Furthermore, outsourcing

international work might be less expensive than managing an in-house staff or dealing with language hurdles.

Another important benefit of BPaaS that is sometimes neglected is its *efficiency*. Small organizations, who may lack the capacity to handle abrupt surges in workload, might benefit from BPaaS suppliers' efficiency-focused products [12]. These service providers specialize on preserving efficiency while keeping under budget. As a consequence, procedures are simplified, and expenses are reduced.

BPaaS also distinguishes itself by its ability to eliminate interruption. It provides a unified experience through a managed service paradigm, assuring continuous operations [13]. Organizations may stay focused on their primary goals by avoiding distractions from IT chores that aren't critical to their business objectives.

Another advantage is the quick time to market. Companies may swiftly test their ideas by acquiring a business process as a service without making major capital investments [11]. BPaaS provides access to competent persons who can contribute to the project, reducing the time and effort required to identify and hire developers or designers. As a result, the time required to develop new apps is greatly decreased. BPaaS suppliers efficiently address security and privacy issues, with comprehensive rules in place to guarantee data confidentiality [12]. They adhere to the most stringent security requirements, providing consumers with a safe and dependable platform. Certification from reputable organizations adds to the legitimacy of BPaaS.

BPaaS's flexibility and scalability are critical advantages, allowing it to adapt to changing company demands and handle demand growth [13]. It may be adopted quickly and with minimum disturbance, allowing organizations to focus on their core capabilities while growing to meet changing needs. BPaaS prioritizes innovation, allowing firms to focus on their core business, customers, workers, and suppliers [11]. BPaaS enables firms to focus their resources on innovation, increasing overall efficiency.

C. Cloud-enabled Business Processes for BPaaS

BPaaS presents a cloud service paradigm for business processes (BPs), mandating support for the National Institute of Standards and Technology's (NIST) five key features [1]. To satisfy the "broad network access" criteria, BPaaS must provide a web-based interface and sufficient network bandwidth on its hosting servers. The "on-demand self-service" function requires complete automation of all user actions. Similarly, "rapid elasticity" requires a high level of automation, notably in BPaaS platform software component scalability and elasticity [1].

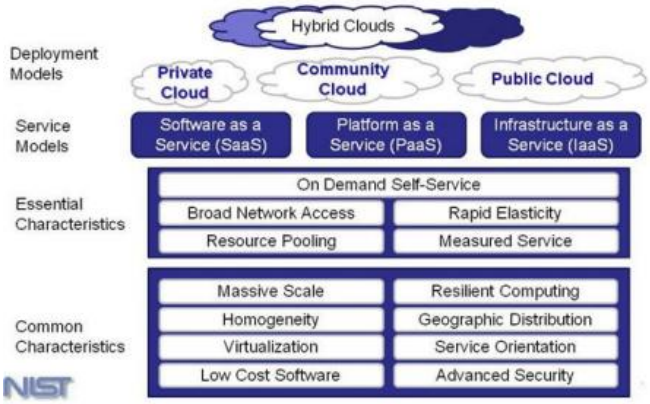

Figure 3. The NIST Cloud Definition Framework [4].

Based on a provider position, "resource pooling" is critical for functioning, allowing the aggregation of all BPs' resources over one or more resource pools while ensuring user isolation. As a result, BPaaS must offer multi-tenancy. Finally, "measured services" are critical for resource optimization and offering pay-per-use invoicing methods. Monitoring, fine-grained accounting, and adaptable billing models are therefore critical [30].

These criteria underline the importance of highly automated settings in order to accomplish BPaaS, which has a substantial influence on business-IT alignment. Cloud-based techniques let IT infrastructure to flexibly change to the desired scale, and third-party BP automation services are not statically constrained [1]. A Cloud-enabled Business Process (CeBP) is a business process or workflow that supports these qualities and is deployable in a BPaaS environment [27].

The need for flexibility within the realm of business-IT alignment becomes increasingly apparent as organizations embrace the dynamic pay-as-you-go model and leverage the inherent elasticity of cloud services, all in pursuit of the coveted goal of Business Process as a Service (BPaaS). This aspect of our exploration underscores the critical role of adaptability, agility, and responsiveness within the contemporary business landscape [30].

Business-IT alignment, a pivotal aspect of modern organizational strategy, takes on a multifaceted character as it grapples with the intricacies of cloud computing [26]. It must accommodate and harness the transformative capabilities of cloud services, which are inherently fluid and scalable. This adaptability is fundamental in unlocking the full potential of BPaaS [29].

To formalize the concept of business-IT alignment in the context of BPaaS, it is necessary to deconstruct it into a series of well-defined phases. These phases serve as a roadmap, guiding organizations as they embark on the journey of aligning their non-technical business processes (BPs) with the technical intricacies that underlie the world of cloud computing. The objective is to seamlessly fuse non-technical BPs with the requisite technical information, creating a harmonious fusion of the two realms [32].

One of the key contributions of this research is the introduction of a novel framework – the five-level Cloud-enhanced Business Process (CeBP) hierarchy. This hierarchy

serves as a comprehensive and structured model, designed to empower organizations with a clear and intuitive understanding of how to effectively integrate technical components into their non-technical business processes. Each level of the hierarchy represents a different degree of technical involvement, ranging from the most straightforward and non-invasive to the most complex and deeply integrated. The CeBP hierarchy thus provides a nuanced and flexible approach to accommodating the technical aspects of business-IT alignment, tailored to the specific needs and complexities of each organization [31].

At the foundational level of the CeBP hierarchy, we find processes that are primarily non-technical in nature. These processes require minimal technical intervention and serve as a starting point for organizations beginning their journey toward BPaaS adoption [28]. As organizations progress up the hierarchy, they encounter increasing levels of technical complexity, with each level building upon the previous one. This progressive approach allows businesses to implement changes gradually, minimizing disruptions to their existing operations [26].

In essence, the CeBP hierarchy offers organizations a structured pathway toward embracing BPaaS, allowing them to chart their course from less technical processes to more technologically integrated ones [1]. This structured approach ensures that the technological transformation aligns seamlessly with the unique needs and existing practices of each organization, fostering a harmonious fusion of non-technical and technical elements in pursuit of the full potential of BPaaS [32].

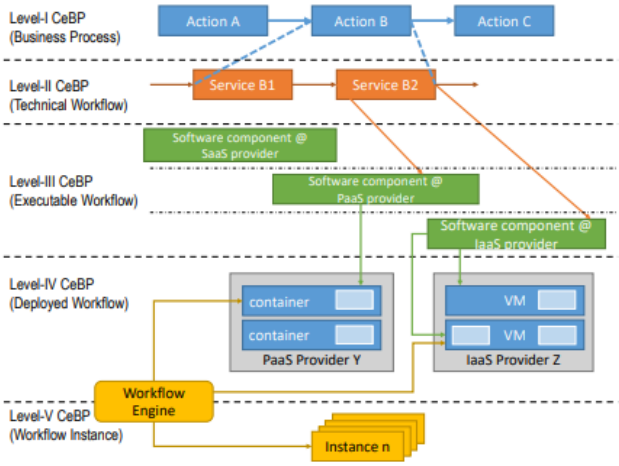

Figure 4. Levels of the BPaaS process [10].

Figure 3. presents a hierarchical structure that categorizes Business Processes as a Service (BPaaS) into five separate tiers. The following are the levels:

Level I: At this level, it describes worker tasks in a manner that workflow engines cannot directly execute.

Level II: Workflows are an intermediary layer that helps humans comprehend business operations. They communicate the designer's objectives, allowing for process creation and allocation to certain cloud services. Although they are not immediately executable, they lay the groundwork for prospective business process exploitation.

Level III: Workflows at this level are in charge of arranging interactions between human tasks and software services. Depending on parameters such as automation levels, chosen services, and how failures, recoveries, and variations are managed, a single domain-specific business process might correlate to many executable workflows.

Level IV: These packages are ready for cloud deployment and include all essential settings. They may be launched automatically in the cloud based on demand. Depending on variables such as cloud providers, Service Level Agreements (SLAs), deployment tactics, and the intricacies of multi-cloud deployment, one executable process may translate to numerous cloud-deployable workflow packages.

Level V: Bundles that have been obtained and deployed in the cloud are encountered at this level. These bundles are ready for instantiation and execution by the user. One cloud-deployable workflow bundle can be linked to many deployed workflow bundles in production, each of which serves one or more BPaaS clients.

D. Business Process Automation (BPA)

Extensive study has been conducted in the management sector in recent decades, with a special emphasis on analyzing, modeling, and improving business processes. Notably, business process automation (BPA) has emerged as a critical breakthrough in both management and technology. BPA entails using technology to fulfill business goals, resulting in benefits such as simplified process execution, cost reduction, and improved process quality [4]. BPA is used by organizations to improve operational efficiency and reduce human mistakes. It is described as technology-driven automation of specified operations within a service to meet well-defined workflow tasks.

Figure 5. Business Process Automation features.

Dayal [9] highlights BPAs attempt to increase operational efficiency and eliminate mistakes, despite the fact that commercial business process management software lacks facilities for measuring key business KPIs statistically. BPA provides a cost-cutting strategy that combines systems and software applications [4]. This cyclical strategy includes business process analysis, documentation, optimization, and automation, creating value-added activities at each stage and eventually contributing to the end product or service. BPA enables managers to find and execute technical solutions to improve service efficiency in cross-functional areas of a workflow.

E. Business Process Management (BPM)

Business process management is an essential component of workflow infrastructure management that focuses on increasing efficiency and minimizing mistakes in basic business activities. Elzinga [6] define BPM as a systematic and organized method to assessing, improving, regulating, and managing processes in order to improve the quality of products and services. Zairi [7] presents a functional explanation of BPM, highlighting its systematic nature in assessing and continuously improving basic business tasks. Lee and Dale [8] emphasize the importance of business process management in monitoring, evaluating, and improving key processes, noting process discipline, improvement, and cross-process integration as essential success factors [4].

Value-driven processes are services inside a corporate network that execute processes to produce economic value while keeping cost, quality, and time restrictions in mind [25]. By encouraging operational excellence and process agility, BPM is a management discipline that regards processes as valuable assets that contribute directly to corporate performance [5][22]. Various methodologies, rules, measurements, management practices, and software tools for optimizing organizational performance, such as BPMN, BPEL, EPC, and xBML, are offered to enable BPM. BPM distinguishes itself from prior process management systems by emphasizing process agility and continual optimization [4].

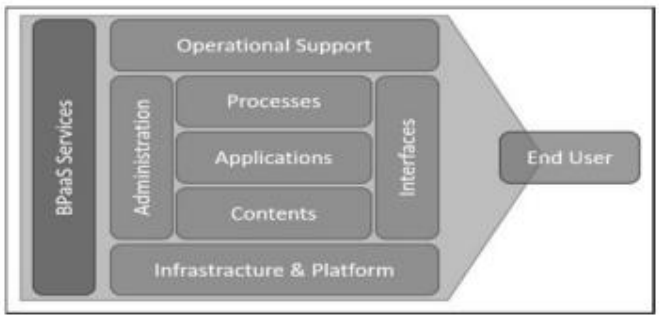

Figure 6. BPaaS Architecture [15].

F. Business Process Utility (BPU)

Business Process Utility is an original concept that aims to improve the alignment of people, processes, and IT in order to simplify transactional operations. Gartner [5] defines BPU as standardized, preconfigured, and scalable Business Process Outsourcing (BPO) services, with varying degrees of automation depending on the service. While providing increased configurability to meet varied user cases, BPU runs at the process level, which may pose standardization and interoperability difficulties in a cloud-centric corporate context.

Implementing a BPU service model is a strategic choice that involves several stakeholders evaluating the possibilities for customization and competitive advantage [4]. BPU assists business operations by automating repetitive tasks, enabling a concentration on core processes and implementing cost-saving standardized procedures.

Nevertheless, organizations must assess whether standardization can confer a competitive edge, as recognizing the full benefits of BPU may be challenging, especially for critical and unique processes, with cost considerations influencing decisions [4].

Figure 7. BPaaS Adoption [5].

According to Gartner [5], more than 60% of organizations are currently using or considering using Business Process Utility (BPU) or Business Process as a Service (BPaaS) for Business Process Outsourcing (BPO), demonstrating a significant interest in these approaches (Figure 5). Gartner predicts that the BPaaS industry, which was worth $71.7 billion in 2011, would increase significantly, perhaps reaching $133.5 billion by 2015. This expansion highlights the considerable potential of BPaaS as a basic service model, giving a promising prospect in the next years, notably for Ireland.

G. Examples of BPaaS in Action

Human Resources (HR) Management: HR activities such as payroll administration, recruiting, and employee onboarding might benefit from BPaaS. ADP, a well-known human resources technology business, uses BPaaS to provide payroll and HR services to clients all over the world. This is an example of how BPaaS simplifies HR processes while also ensuring compliance with changing tax and employment legislation [17].

Customer Relationship Management (CRM): Salesforce, a well-known CRM software supplier, provides a BPaaS solution for customer relationship management. It offers a complete set of tools that allow organizations to manage their marketing, sales, and customer support activities on a one platform. Organizations may enhance their customer interaction strategies and increase overall productivity by adopting Salesforce's BPaaS solution [18].

Finance and Accounting: Accounting software business Xero provides BPaaS solutions to help small and medium-sized businesses (SMEs) manage their financial processes. Businesses may easily handle invoicing, financial reporting, and inventory management with the cloud-based platform. The BPaaS method developed by Xero streamlines financial processes and allows firms to focus on core business activities [19].

Supply Chain Management: Watson Supply Chain from IBM is an excellent example of BPaaS in supply chain

management. To optimize supply chain processes, it provides real-time insight, automation, and predictive analytics. Companies that use Watson Supply Chain may improve supply chain efficiency, save operating costs, and manage hazards [20].

These examples demonstrate flexibility and benefits of BPaaS, such as cost savings, scalability, and increased company agility. However, it is critical to recognize the risks associated with data security, compliance, and vendor lock-in when deploying BPaaS solutions [21].

CONCLUSION

This research paper reaches into the changing environment of cloud computing and its transformational influence on current company operations. It emphasizes the rise of BPaaS as a critical connection integrating the complexities of business operations with the possibilities of cloud technology. As firms seek more adaptive and efficient operational techniques, BPaaS has gained traction in academic and corporate circles.

The transition from old, often inflexible, business process models to the dynamic and agile domain of cloud-based execution is the central emphasis of this study. The multi-tiered BPaaS architecture described here provides a well-structured approach for transitioning traditional business activities to a cloud-based service paradigm. This research study gives insights into the complexities, ambiguities, and realities of BPaaS by methodically evaluating each layer.

In addition, the rising popularity of BPaaS in both academic and corporate arenas is expected to drive the establishment of new industry standards, contributing to the continued evolution of business processes in the digital era. The approach outlined in this paper serves not only as a blueprint, but also as a springboard for future development, innovation, and adaptability in the ever-changing business and technological ecosystem.

As BPaaS gains traction, it provides several benefits to organizations, including cost reductions, efficiency improvements, flexibility, scalability, and faster time-to-market. The article discusses the possible uses of BPaaS in a variety of disciplines, including human resources, customer relationship management, finance and accounting, and supply chain management, as well as real-world instances of its benefits. However, while using BPaaS solutions, enterprises must be wary of possible issues such as data security, compliance, and vendor lock-in.

In summary, the incorporation of cloud technology and the emergence of BPaaS reflect a substantial shift in how firms approach their operations. This article lays a solid basis for understanding the complexities of BPaaS and its potential to foster innovation and efficiency in today's business context. It is a timely investigation into an area with enormous promise, providing a look into the future of business process management and technology.

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