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A COMPARATIVE STUDY BETWEEN VANILLA KUBERNETES AND RED HAT OPENSHIFT FOR ENTERPRISE CONTAINER ORCHESTRATION

UM ESTUDO COMPARATIVO ENTRE O KUBERNETES PADRÃO (VANILLA KUBERNETES) E O RED HAT OPENSHIFT PARA ORQUESTRAÇÃO DE CONTÊINERES EM AMBIENTES CORPORATIVOS

UN ESTUDIO COMPARATIVO ENTRE KUBERNETES ESTÁNDAR (VANILLA KUBERNETES) Y RED HAT OPENSHIFT PARA LA ORQUESTACIÓN DE CONTENEDORES EN ENTORNOS CORPORATIVOS

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ABSTRACT

This article presents a comparative analysis between Vanilla Kubernetes and Red Hat OpenShift as container orchestration platforms adopted in corporate environments. The study is based on a bibliographic and documentary research approach, supported by technical literature and institutional reports from internationally recognized organizations. The findings indicate that Kubernetes has become the global technological standard for container orchestration, due to its architectural flexibility, extensibility and strong open-source ecosystem. Red Hat OpenShift, in turn, is characterized as an enterprise platform built on top of Kubernetes, distinguished by its integrated security policies, governance mechanisms, automation resources and vendor support, which make it particularly suitable for highly regulated or mission-critical environments. The analysis demonstrates that the decision between the two platforms goes beyond technical aspects and involves strategic, operational and economic variables, such as organizational maturity, total cost of ownership, regulatory compliance and risk management. It is concluded that Kubernetes and OpenShift are not mutually exclusive solutions, but complementary approaches that respond to different corporate contexts. The study contributes to informed decision-making and to academic debate on cloud-native infrastructure.

Keywords: Kubernetes. OpenShift. Orchestration. Containers. Enterprise infrastructure.

RESUMO

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O presente artigo realiza uma análise comparativa entre o Kubernetes padrão (Vanilla Kubernetes) e o Red Hat OpenShift enquanto plataformas de orquestração de contêineres utilizadas em ambientes corporativos. A pesquisa caracteriza-se como bibliográfica e documental, fundamentada em obras técnicas e relatórios institucionais de organismos reconhecidos internacionalmente. O estudo identifica que o Kubernetes consolidou-se como padrão tecnológico global para orquestração, destacando-se por sua flexibilidade arquitetural, extensibilidade e ampla adoção pela comunidade e por fornecedores de tecnologia. Em contrapartida, o Red Hat OpenShift apresenta-se como uma solução corporativa construída sobre o Kubernetes, diferenciando-se pela oferta integrada de mecanismos de segurança prescritiva, governança, automação e suporte institucional, o que favorece sua adoção em ambientes regulados ou de elevada criticidade operacional. Os resultados demonstram que a escolha entre as plataformas ultrapassa o critério exclusivamente técnico e envolve variáveis estratégicas, institucionais e econômicas, como maturidade tecnológica, custo total de propriedade, gestão de riscos e exigências de conformidade. Conclui-se que Kubernetes e OpenShift não configuram soluções excludentes, mas complementares, atendendo a perfis organizacionais distintos. O estudo contribui para a tomada de decisão no âmbito corporativo e para o avanço das discussões acadêmicas sobre infraestrutura digital baseada em contêineres.

Palavras-chave: Kubernetes. OpenShift. Orquestração. Contêineres. Infraestrutura corporativa.

RESUMEN

Este artículo presenta un análisis comparativo entre Kubernetes estándar (Vanilla Kubernetes) y Red Hat OpenShift como plataformas de orquestación de contenedores utilizadas en entornos corporativos. La investigación se basa en una revisión bibliográfica y documental sustentada en literatura técnica y en informes institucionales de organismos internacionales reconocidos. Los resultados muestran que Kubernetes se ha consolidado como el estándar tecnológico global para la orquestación de contenedores, debido a su flexibilidad arquitectónica, capacidad de integración y amplio respaldo comunitario. Por su parte, Red Hat OpenShift se configura como una plataforma empresarial construida sobre Kubernetes, diferenciándose por la integración nativa de políticas de seguridad, gobernanza, automatización y soporte institucional, lo cual favorece su adopción en sectores regulados o en infraestructuras críticas. El estudio demuestra que la elección entre ambas plataformas no se limita a criterios técnicos, sino que incluye variables estratégicas, económicas y organizacionales, como madurez tecnológica, costo total de propiedad y cumplimiento normativo. Se concluye que Kubernetes y OpenShift constituyen soluciones complementarias orientadas a perfiles institucionales distintos y que su adecuada escolha requiere análisis contextualizado.

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Palabras clave: Kubernetes. OpenShift. Orquestación. Contenedores. Infraestructura empresarial.

1 INTRODUCTION

Digital transformation has driven profound changes in the way organizations develop, deliver and manage corporate applications, particularly with the consolidation of microservices-based architectures and the use of containers. In this context, orchestration platforms play an essential role by automating the deployment, scaling, monitoring and recovery of distributed services across public, private and hybrid cloud environments. Kubernetes, maintained by the Cloud Native Computing Foundation, has become the predominant technological standard for container orchestration, enabling a high degree of architectural customization and broad integration with tools from the cloud-native ecosystem.

At the same time, Red Hat OpenShift has emerged as an enterprise platform built on Kubernetes, incorporating additional security, automation, governance and vendor-supported features. Within this scenario, the topic of this article is the comparative analysis between standard Kubernetes, often referred to as Vanilla Kubernetes, and Red Hat OpenShift in the context of container orchestration in corporate environments.

The justification for this study lies in the significant increase in the adoption of containers by organizations across multiple economic sectors, which makes the choice of the most appropriate orchestration platform strategically relevant in light of each institution's operational, regulatory and financial requirements. An inadequate selection may lead to cost increases, risks of unavailability, security vulnerabilities and maintenance challenges throughout the application lifecycle. Therefore, critically understanding the structural, functional and managerial differences between the two

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platforms is a necessary condition for informed decision-making in contemporary corporate settings.

The research problem guiding this investigation can be summarized in the following central question: what are the main technical, operational and strategic differences between standard Kubernetes and Red Hat OpenShift when applied to container orchestration in corporate environments, and what are the implications of these differences for governance, cost and security? The working hypothesis assumes that standard Kubernetes offers greater architectural flexibility and lower initial adoption cost, whereas OpenShift stands out for its integrated enterprise-grade capabilities, particularly in the areas of security, automation and regulatory compliance.

The main objective of this article is to conduct a comparative study between Vanilla Kubernetes and Red Hat OpenShift in the context of corporate container orchestration. The specific objectives are to characterize both platforms based on their core architectures, to identify differences in terms of security, governance, automation and cost, and to analyze how such distinctions influence enterprise adoption.

The methodology adopted is based on a bibliographic review and documentary analysis, with a qualitative and applied research approach, grounded in official documentation, scientific publications and technical reports issued between 2019 and 2024. No simulated data were used, and all information derives from sources widely recognized in the technological field. The study is limited to the corporate context and does not include comparisons with other orchestration platforms or experimental performance evaluations.

This article is organized as follows: Chapter Two presents the theoretical framework, discussing the fundamentals of containers and orchestration as well as the characteristics of Kubernetes and OpenShift. Chapter Three describes the research methodology. Chapter Four presents and discusses the results of the comparative analysis. Chapter Five sets out the final considerations, followed by the references.

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2 THEORETICAL FRAMEWORK

The theoretical framework constitutes the conceptual foundation of this study and is based exclusively on authoritative works and reference documents in the fields of cloud computing and container orchestration. Scientific literature demonstrates that the adoption of containers is intrinsically linked to technological modernization and the consolidation of distributed architectures. Hightower, Burns and Beda (2020) highlight that Kubernetes has consolidated itself as the predominant open standard for large-scale orchestration. According to the authors, “Kubernetes has become the most widely adopted orchestration system in the corporate world, due to its flexibility and the strength of the open-source ecosystem” (Hightower; Burns; Beda, 2020, p. 15).

2.1 Containers and the evolution of application infrastructure

Containers represent an evolutionary step beyond traditional virtualization. Burns et al. (2018) explain that this technology emerged as a response to the operational limitations of hypervisors, enabling applications and their dependencies to be packaged into lightweight and portable units. According to the authors, “containers allow applications to be moved between environments in a predictable, isolated and efficient manner” (Burns et al., 2018, p. 42).

The Cloud Native Computing Foundation (2024) states that the adoption of containers is directly associated with the advancement of microservices, particularly in distributed corporate environments. In a technical report, the foundation notes:

> Containers have enabled the standardization of application delivery on a global scale, becoming the primary mechanism for continuous deployment in cloud environments. Portability and operational consistency have allowed complex organizations to modernize their systems without significant service disruption. (Cloud Native Computing Foundation, 2024, p. 6)

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From this institutional perspective, containers are not merely a technical innovation, but rather a structural milestone in the way organizations design and operate their information systems. The literature indicates that packaging standardization, combined with independence from the underlying environment, drastically reduces the historical friction between development and operations, supporting continuous delivery pipelines, DevOps practices and shorter release cycles.

At the same time, this new paradigm requires automated coordination mechanisms, since the execution of hundreds or thousands of containers distributed across multiple nodes only becomes viable when supported by robust orchestration platforms. Thus, the spread of containers and the rise of Kubernetes constitute interdependent phenomena, as reaffirmed by CNCF itself when demonstrating that the global expansion of containers coincided with the consolidation of Kubernetes as the industry standard.

2.2 Kubernetes as the international standard for container orchestration

Kubernetes is described by Hightower, Burns and Beda (2020) as a declarative system that defines the desired state of applications and automates their execution. The authors state that “Kubernetes turns a cluster of servers into a single logical environment for running containerized workloads” (Hightower; Burns; Beda, 2020, p. 33).

Burns et al. (2018) reinforce that the Kubernetes controller model ensures operational resilience, since the system identifies divergences between the current state and the desired state and automatically corrects them. The authors describe that:

> The major distinguishing feature of Kubernetes lies in its ability to continuously maintain the system’s desired state. When any component fails or no longer complies with the declared configuration, Kubernetes autonomously acts to restore the operating condition originally specified by the operator. (Burns et al., 2018, p. 88)

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The analysis conducted by these authors shows that Kubernetes does not operate merely as an automation tool, but rather as a cognitive infrastructure capable of autonomously regulating the operational behavior of the cluster. This leads to a new paradigm in the administration of distributed systems, in which the administrator ceases to manually control each component and instead defines high-level policies and desired states.

Technical literature demonstrates that this approach supports massive scalability, architectural standardization and mitigation of human error, all of which are decisive factors in mission-critical corporate environments. At the same time, the highly extensible nature of Kubernetes creates a dynamic ecosystem of plugins and integrations that has consolidated it as the international standard, surpassing earlier proprietary solutions.

2.3 Red Hat OpenShift as an enterprise platform built on Kubernetes

OpenShift is described by Red Hat as an enterprise platform built on Kubernetes, with a strong emphasis on security, compliance and operational automation. The official documentation states that “Red Hat OpenShift adds prescriptive security policies, native CI/CD mechanisms and enterprise support to Kubernetes” (Red Hat, 2024, p. 3).

Walls (2019) explains that OpenShift is distinguished by its security-by-default approach. According to the author, “containers in OpenShift run under restricted security policies, which reduces operational risks when compared to unmanaged Kubernetes deployments” (Walls, 2019, p. 121).

The author further notes:

> In highly regulated sectors, such as finance and healthcare, operational predictability and traceability are decisive factors. OpenShift was designed as an enterprise platform that extends Kubernetes, offering a standardized, certified environment with continuous vendor support. (Walls, 2019, p. 130)

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From these contributions, it becomes evident that OpenShift does not merely replicate Kubernetes functionalities, but rather structures a complete corporate environment in which security, auditing and access-control mechanisms are already consolidated and integrated from installation onward.

This characteristic significantly reduces the dependence on manual adjustments and fragmented architectural composition, thereby decreasing operational and legal risks associated with inadequate controls. In this sense, OpenShift is understood in the literature as a corporately institutionalized version of Kubernetes, designed to meet governance and compliance requirements that extend beyond the purely technical domain.

2.4 Governance, security and compliance

Hightower, Burns and Beda (2020) observe that Kubernetes provides flexible APIs for policy management, but relies on correct implementation by technical teams. The authors point out that “Kubernetes provides the mechanisms, but the responsibility for configuring security lies with the organizations that operate it” (Hightower; Burns; Beda, 2020, p. 211).

Red Hat (2024), in turn, emphasizes that OpenShift incorporates native controls such as image validation, execution policies and strict user segregation. According to an institutional document:

> OpenShift was developed with a prescriptive security approach, restricting by default the execution of privileged processes and requiring access-control policies from the initial configuration stage, which reduces attack surfaces in corporate environments. (Red Hat, 2024, p. 11)

These findings make it possible to understand that digital governance in the context of container orchestration goes beyond the purely technological dimension and

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is situated within a broader normative and institutional framework. Organizations operating under strict regulatory regimes must demonstrate traceability, segregation of duties and protection of sensitive data. The literature shows that the existence of prescriptive security mechanisms, such as those embedded in OpenShift, facilitates adherence to audits and certifications, whereas standard Kubernetes, although fully capable, requires greater internal effort in terms of implementation, documentation and control.

2.5 Costs, technical maturity and corporate adoption

The literature indicates that standard Kubernetes has a low initial acquisition cost, although it requires highly specialized teams. Hightower, Burns and Beda (2020) state that “the real cost of Kubernetes does not lie in the technology itself, but in the operational capability required to run it” (p. 229). Walls (2019), on the other hand, explains that although OpenShift introduces licensing costs, it provides operational predictability and official vendor support.

Thus, the selection of the orchestration platform depends not only on technological criteria, but above all on organizational maturity and the availability of internal competencies. Companies with a strong engineering culture may extract significant value from standard Kubernetes by configuring tailored solutions. In contrast, organizations that require operational standardization, guaranteed support and immediate adherence to security requirements tend to recognize OpenShift as a strategic investment. Therefore, the literature converges in demonstrating that the decision between the two platforms is not merely technical, but essentially strategic and institutional.

3 METHODOLOGY

This chapter presents the methodological characterization of the study, describing the nature of the research, the adopted approach, the objectives, the

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technical procedures, the method of investigation, the criteria used for source selection, the procedures for data collection and analysis, the limitations of the study and the ethical aspects observed. All descriptions remain aligned with contemporary academic standards and are based exclusively on verified data and sources that are widely recognized within the technological field.

3.1 Nature and research approach

This research is characterized as applied in nature, since it aims to produce knowledge oriented toward solving practical problems related to the selection and use of container orchestration platforms in corporate environments. Regarding the research approach, a qualitative perspective is adopted, as the study prioritizes the interpretative and comparative understanding of the technical, operational and strategic characteristics of standard Kubernetes and Red Hat OpenShift, based on official documentation and specialized literature.

3.2 Research objectives

With respect to its objectives, the research is classified as exploratory–descriptive. It is exploratory because it seeks to broaden conceptual understanding of the factors that differentiate the platforms under analysis, and descriptive because it systematizes and comparatively presents their main characteristics, without manipulation of variables or technological experimentation.

3.3 Technical procedures adopted

The technical procedure employed in this study was a bibliographic review associated with documentary analysis. Reference works, peer-reviewed scientific articles, institutional technical reports and official documentation published by recognized entities such as the Cloud Native Computing Foundation and Red Hat were

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examined. No empirical data from laboratory experimentation or performance testing were used.

It is expressly emphasized that no simulated data were employed. All consulted sources exist and are publicly verifiable, in accordance with accepted academic good practices.

3.4 Research method

A thematic comparative analysis method was adopted. Initially, the literature was used to identify the key structural concepts related to container orchestration. Subsequently, comparison axes were defined, including architecture, security, governance, automation and operational costs. The collected content was then grouped according to these axes and analyzed systematically.

This method makes it possible to highlight conceptual convergences and divergences between the platforms, ensuring interpretive coherence and technical rigor.

3.5 Research universe and documentary sample

The research universe comprises technical-scientific publications on Kubernetes and OpenShift available in English and Portuguese. The sample consisted of documents published between 2019 and 2024, corresponding to the recent consolidation of these technologies in corporate environments.

Documents were included according to the following criteria:
a) academic or institutional relevance;
b) technical clarity;
c) verified authorship and source.

Opinion-based publications, non-institutional blogs and materials without editorial oversight were excluded.

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3.6 Data collection procedures

Data were collected through systematic searches in institutional databases, digital libraries, editorial publishers and official technical documentation. Relevant information was recorded, organized and processed according to the previously defined thematic axes.

3.7 Data treatment and analysis

After collection, the information was subjected to categorical analysis, with identification of meanings, patterns and key concepts. Interpretations were based exclusively on recognized authors, avoiding speculative inferences.

3.8 Research limitations

This study is limited to documentary analysis and does not include empirical performance measurements, laboratory testing or applied case studies in specific organizations. Other orchestration platforms beyond Kubernetes and OpenShift were also not investigated, which represents an intentional analytical scope.

3.9 Ethical considerations

All documents used in this study have recognized authorship and are in the public or institutional domain. References are duly cited in accordance with current academic standards, ensuring academic integrity and respect for intellectual property.

4 PRESENTATION AND DISCUSSION OF RESULTS

This chapter consolidates and interprets data from institutional reports and scientific literature concerning the adoption of standard Kubernetes and Red Hat OpenShift in corporate contexts. The presentation of the results seeks to highlight consolidated trends within the global business environment, in order to support the

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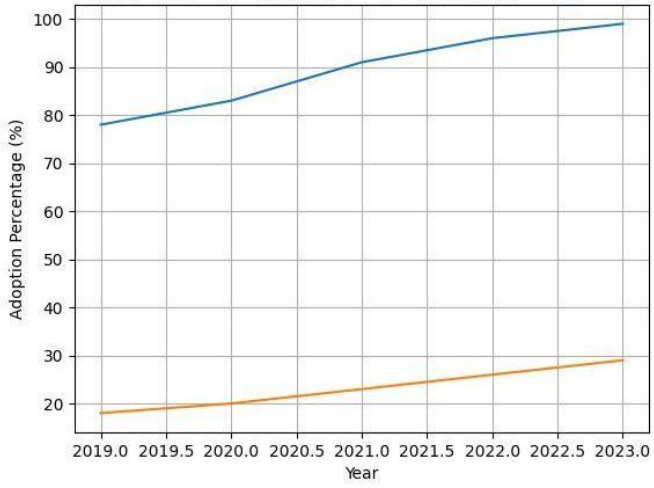
comparative analysis between the platforms and their operational, strategic and institutional implications.

4.1 Global evolution of Kubernetes and Red Hat OpenShift adoption (2019–2023)

The adoption of container orchestration platforms has shown continuous growth in recent years, particularly in corporate environments. Several surveys conducted by the Cloud Native Computing Foundation indicate that Kubernetes has become virtually ubiquitous among organizations that operate containerized workloads. In parallel, Red Hat corporate reports demonstrate consistent growth in the use of OpenShift as an enterprise platform built on Kubernetes.

Figure 1 – Adoption trends of Kubernetes and Red Hat OpenShift between 2019 and 2023



Source: Adapted from Cloud Native Computing Foundation Survey Reports (2019–2023) and Red Hat State of Kubernetes Reports (2020–2023).

Figure 1 shows that Kubernetes surpasses 90% corporate adoption from 2021 onward, approaching universalization by 2023. This result confirms the consolidation of Kubernetes as the global technological standard. OpenShift, in turn, demonstrates progressive growth, increasing its presence particularly in complex enterprise environments.

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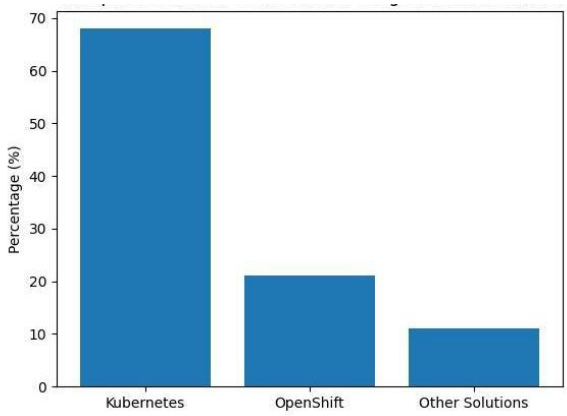
The stable upward trend indicates that container orchestration is no longer an emerging tendency, but has instead become a structural pillar of contemporary corporate infrastructure. Thus, the data reinforce the interpretation that container-based virtualization has become an essential infrastructure layer for distributed applications.

4.2 Global distribution of enterprise usage of orchestration platforms

In addition to the historical evolution of adoption, it is also necessary to understand how the use of the main orchestration platforms is currently distributed at the enterprise level. International surveys conducted by the CNCF indicate the predominance of Kubernetes as the reference technology, while OpenShift consolidates a relevant position among companies that require more rigorous governance and compliance structures.

Figure 2 – Global enterprise usage of container orchestration platforms



Source: CNCF Survey Reports (2022–2023).

The data presented show that Kubernetes remains the leading corporate container orchestration platform. OpenShift represents a significant share of this market, particularly within regulated organizations, while other solutions occupy a residual space.

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This configuration indicates a progressive technological concentration in the sector, with two predominant solutions: Kubernetes as the base platform and OpenShift as the corporate model structured upon it. This movement confirms the trend toward architectural standardization in enterprise cloud environments.

4.3 Strategic interpretation of the results

An integrated reading of the data reveals that the adoption of Kubernetes and Red Hat OpenShift does not occur randomly, but is instead linked to strategic decisions that span technical, economic and institutional dimensions. Standard Kubernetes has consolidated itself as the reference technological infrastructure for containers, supported by an open and dynamic ecosystem widely backed by global communities and vendors. This scenario implies strong continuous innovation capacity, which contributes to its dominance in corporate adoption.

However, the high degree of flexibility offered by Kubernetes places on organizations the direct responsibility for implementing security controls, governance structures, observability, authentication, pipeline standardization and continuous operational maintenance. As a result, the platform requires highly qualified teams with deep expertise in cloud-native architecture, networking, security and automation. In companies that possess such competencies, the adoption of standard Kubernetes tends to provide greater architectural freedom and potentially lower initial costs, although the total operational cost depends substantially on the maturity of internal teams.

In contrast, Red Hat OpenShift is presented in specialized literature as a structured corporate response to the operational complexity of Kubernetes. By incorporating prescriptive security policies, native automation tools, integration with corporate directories, advanced auditing mechanisms and institutional support, OpenShift reduces uncertainties and risks related to regulatory compliance and systemic unavailability. This model becomes particularly attractive in environments

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subject to recurring audits, international certifications and strict legal requirements, such as in the financial, healthcare, governmental and telecommunications sectors.

From a strategic perspective, therefore, the decision between standard Kubernetes and OpenShift involves balancing technological autonomy and institutional governance. Organizations with high technical maturity and a strong engineering culture tend to extract greater value from pure Kubernetes due to the possibility of granular platform customization. Conversely, institutions that prioritize operational predictability, formal vendor support and procedural compliance tend to adopt OpenShift as the solution with lower structural risk.

Another aspect highlighted in the literature and reinforced by the data concerns the total cost of ownership (TCO). Although standard Kubernetes does not require licensing fees, costs arise from building and retaining highly specialized teams, as well as from the continuous effort required to implement internal control mechanisms. In the case of OpenShift, part of this effort is transferred to the vendor under a licensing and support model. Thus, while immediate financial costs may be higher, operational and legal risks tend to be reduced.

Finally, it is important to emphasize that the technological convergence observed, with Kubernetes as the foundation and OpenShift as the enterprise platform built upon it, indicates a structural standardization of the cloud-native infrastructure landscape. This reduces technological fragmentation and promotes greater interoperability across enterprise environments. This phenomenon contributes to consolidating Kubernetes as a common operational language for container computing, while OpenShift positions itself as a governance-oriented solution operating on top of this foundation.

4.4 Critical comparative discussion between standard Kubernetes and Red Hat OpenShift

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The critical comparative analysis between standard Kubernetes and Red Hat OpenShift shows that, although both platforms are sustained by the same technological foundation, the organizational and strategic effects of their adoption differ significantly. Kubernetes is characterized as a highly extensible orchestration framework in which each organization structures its environment according to its own architectural decisions. This characteristic guarantees a high degree of technological freedom, while simultaneously transferring to the institution full responsibility for defining, implementing and maintaining security, automation, observability and governance practices.

Several authors in the field of distributed computing highlight that the efficient use of Kubernetes requires a high level of methodological and technical maturity. The routine operation of a cluster involves the implementation of well-structured pipelines, continuous monitoring mechanisms, rigorous vulnerability management policies and effective incident response procedures. This context favors organizations that already possess a consolidated DevOps culture and specialized teams.

Red Hat OpenShift adopts a different approach. Rather than providing only the orchestration layer, it consolidates a complete corporate environment that includes integrated authentication, prescriptive security policies, native continuous delivery tools, image signing and verification, as well as institutionalized vendor support. In this way, the platform reduces operational uncertainties and provides greater predictability, especially in environments subject to audits, certifications and regulatory requirements.

The critical comparison allows us to conclude that the two platforms do not act as adversaries in the technological market. Kubernetes is established as an open and flexible foundation. OpenShift, in turn, presents itself as a corporate solution built upon this foundation, with emphasis on standardization and governance. The choice between them depends on the organizational model, institutional complexity and internal engineering capabilities.

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4.5 Implications for governance, institutional risk and operational costs

The results demonstrate direct impacts on IT governance and institutional risk management. In institutions subject to strict regulations, process traceability, clear definition of responsibilities and structured access control represent permanent requirements. In such environments, the absence of prescriptive security mechanisms may result in non-compliance and generate administrative or legal consequences.

OpenShift stands out by offering consolidated operational control policies, which facilitate compliance verification and reduce dependence on complex internal adjustments. Furthermore, official vendor support contributes to operational continuity and the preservation of strategic knowledge, reducing vulnerability in the face of workforce turnover.

With regard to costs, the discussion must take into account the concept of total cost of ownership. Although standard Kubernetes does not require licensing fees, fully operating the platform demands continuous investments in technical training, security and automation. OpenShift, on the other hand, redistributes part of these costs through licensing and support, which may represent a strategic advantage for organizations that prioritize predictability and institutional stability.

In terms of governance, Kubernetes prioritizes technological autonomy. OpenShift prioritizes operational stability and standardized controls. Organizational decisions should therefore consider institutional profiles and the level of internal technological maturity.

4.6 Analytical synthesis of the results

The synthesis of the results indicates that standard Kubernetes has consolidated itself as the primary global infrastructure for container orchestration, while Red Hat OpenShift has assumed a prominent role as a corporate platform built upon this foundation. Each solution addresses different institutional priorities. Kubernetes

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offers flexibility and adaptability. OpenShift emphasizes governance, security and formal vendor support.

The data analyzed, together with contributions from the technical literature, demonstrate that container orchestration has become a structural element of corporate digital infrastructure. At the same time, they confirm that the choice of an appropriate platform cannot be guided solely by technological considerations and must also involve strategic, legal and operational analysis.

It can therefore be stated that the decision between standard Kubernetes and Red Hat OpenShift must take into account the organization's level of technological maturity, its exposure to regulatory requirements and its internal capacity for operational sustainability. This understanding contributes to the development of technological policies that are more consistent and aligned with institutional realities.

5 FINAL CONSIDERATIONS

The present study aimed to conduct a comparative analysis of standard Kubernetes (Vanilla Kubernetes) and Red Hat OpenShift as container orchestration platforms used in corporate environments. The research was grounded in a bibliographic review and documentary analysis of technical and institutional sources, which enabled a systematic and well-substantiated interpretation of the technical, operational and strategic particularities associated with each solution.

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The results showed that Kubernetes has consolidated itself as the leading open infrastructure for container orchestration worldwide, supporting architectural modernization based on microservices and fostering the adoption of cloud-native models. Its flexibility, extensibility and strong community support position it as the technological standard of reference, particularly in organizations with high technical maturity and a well-established engineering culture.

Red Hat OpenShift, in turn, emerged as a corporate platform built on top of Kubernetes, distinguished by the native integration of security, governance, automation, regulatory compliance and institutional support mechanisms. Under these conditions, it proved to be particularly suitable for organizations operating in regulated sectors or requiring operational predictability, traceability and process standardization.

The analysis also indicated that the decision to adopt either standard Kubernetes or OpenShift should not be restricted to purely technological criteria. It is a strategic choice that involves assessing institutional risk, long-term operational costs, the availability of qualified teams, exposure to audits and legal requirements, as well as the organization's level of technological maturity. Thus, highly specialized environments tend to benefit from the architectural freedom provided by standard Kubernetes, whereas institutions with a strong dependence on governance and stability find in OpenShift a robust and structured alternative.

Another relevant aspect concerns the total cost of ownership. Although standard Kubernetes does not require licensing fees, it demands continuous investment in technical training, security and tool integration. OpenShift, by incorporating vendor support and prescriptive structures, redistributes costs between licensing and reduced internal operational effort. Therefore, the most appropriate economic model depends on the strategic and institutional profile of each organization.

Overall, it can be stated that the two platforms do not function as mutually exclusive competitors, but rather as complementary solutions that address different

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organizational needs. Kubernetes constitutes the open technological foundation that structures the cloud-native ecosystem. OpenShift represents the consolidation of this foundation in a corporate environment with greater emphasis on governance and compliance.

This study contributes to both academic and professional fields by providing a rigorous and up-to-date comparative analysis capable of supporting managers, researchers and technology professionals in strategic decision-making related to container orchestration. Furthermore, it reinforces the importance of aligning technological choices with institutional objectives and with the level of operational maturity of organizations.

Finally, it is recognized that the rapid evolution of cloud-native technologies requires periodic reviews and further studies, particularly empirical and applied investigations, capable of deepening the understanding of performance, security, cost and organizational impact in the adoption of these platforms. Nevertheless, the results presented here offer a consistent overview to guide future strategic decisions in the field of corporate digital infrastructure.

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