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Review Protocol

Migration from On-Premises to Cloud: Challenges and Opportunities

Overview and Goal

Cloud computing has become an integral part of modern IT infrastructure, changing the way some organizations manage and deploy their systems [1]. The dynamic allocation of computing resources, such as storage, processing power, and applications, over the Internet has given rise to the cloud computing paradigm [2].

Furthermore, This technological evolution has not only transformed traditional IT landscapes, but has also significantly impacted system migration strategies. In this context, the field of cloud migration has gained considerable importance as organizations seek to harness the benefits of cloud computing. This field involves the processes of transferring existing systems, applications and data to cloud environments and their challenges . In this way, many organizations are seeking this transition with a view to greater scalability, cost efficiency and accessibility [3].

In light of the increasing relevance of cloud migration, numerous studies have been conducted to explore its intricacies, challenges, and opportunities. However, the existing literature suggests a potential gap in providing a comprehensive overview that systematically synthesizes the current state of knowledge on cloud migration and its implications for diverse systems.

Therefore, in this work, we conducted a systematic literature mapping to summarize the knowledge regarding the migration of legacy systems to the cloud. Additionally, we performed an exploratory analysis of discussions on Stack Overflow and other question-and-answer communities within the Stack Exchange network to gather professionals' perspectives on this topic and compare these perspectives with the knowledge found in the literature. The contributions of this study include identifying trends, patterns, advancements, gaps, challenges, and opportunities in the field of legacy system migration as reported in the literature. Most importantly, we developed a proof of concept for a decision support software tool using a Large

Language Model (LLM) that provides targeted responses to questions about migrating legacy systems to the cloud, enhanced by the Retrieval-Augmented Generation (RAG) method.

Research Questions

To elaborate research questions, there are several strategies. In this work, we decided on the PICO methodology. In Figure 1, we have the description of population, intervention, and outcome. As our study is a systematic literature mapping, we have not defined any criteria for comparing the results

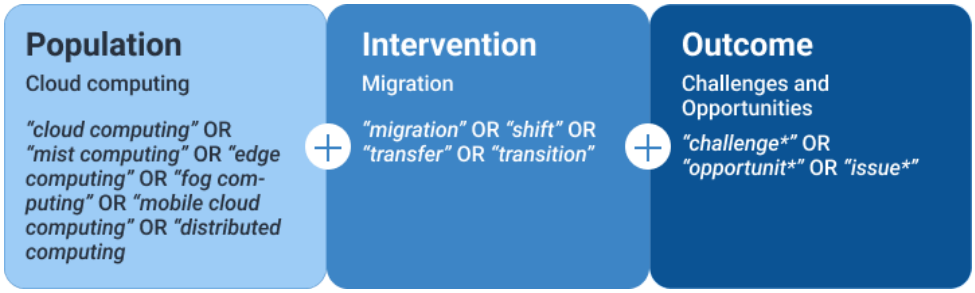

Figure 1. PICO strategy

Thus, we defined the following **Research Questions**:

1. What are the challenges in migrating traditional systems to the cloud?
2. What are the opportunities in migrating traditional systems to the cloud?
3. What is the developer's perspective about the migration process?

Sources Select

Databases: we chose three (3) databases considering the representativeness that they have regarding scientific research involving health and technology: Scopus, Web of Science (WoS), Compendex.

Search String:

- **Cloud**: cloud computing OR mist computing OR edge computing OR fog computing OR mobile cloud computing OR distributed computing
- **Migration**: migration OR shift OR transfer OR transition
- **On premise**: on premise OR legacy
- **Challenge**: challenge* OR opportunit* OR issue*

Table 1. Pilot analysis conducted on January 30, 2024.

Database	Search String	# of Papers
Scopus	(TITLE-ABS-KEY (“cloud computing” OR “mist computing” OR “edge computing” OR “fog computing” OR “mobile cloud computing” OR “distributed computing”) AND TITLE-ABS-KEY (migration OR shift OR transfer OR transition) AND TITLE-ABS-KEY (“on premise” OR “legacy”) AND TITLE-ABS-KEY (challenge* OR opportunit* OR issue*)) AND (EXCLUDE (DOCTYPE , “ch”) OR EXCLUDE (DOCTYPE , “re”) OR EXCLUDE (DOCTYPE , “cr”) OR EXCLUDE (DOCTYPE , “ed”) OR EXCLUDE (DOCTYPE , “le”) OR EXCLUDE (DOCTYPE , “sh”) OR EXCLUDE (DOCTYPE , “tb”) OR EXCLUDE (DOCTYPE , “bk”)) AND (LIMIT-TO (LANGUAGE , “English”))	143
WoS	(((((TS=("cloud computing" OR "mist computing" OR "edge computing" OR "fog computing" OR "mobile cloud computing" OR "distributed computing")) AND TS=(migration OR shift OR transfer OR transition)) AND TS=("on premise" OR "legacy")) AND TS=(challenge* OR opportunit* OR issue*))) AND ((LA==("ENGLISH")))	92
Compendex	(((((((("cloud computing" OR "mist computing" OR "edge computing" OR "fog computing" OR "mobile cloud computing" OR "distributed computing") WN KY) AND ((migration OR shift OR transfer OR transition) WN KY)) AND (("on premise" OR legacy) WN KY)) AND ((challenge* OR opportunit* OR issue*) WN KY))) NOT (({pp} OR {ch} OR {bk}) WN DT)) AND ({english} WN LA))	110
Total		**345**
Total without duplicates		**179**

Studies Selection

The study selection process uses the inclusion and exclusion criteria. These criteria were defined in accordance with the objectives and research questions. The eligibility criteria for studies and the selection procedure are detailed below:

Inclusion Criteria

The inclusion criteria for the study selection process in the context of cloud migration applied to on-premise and legacy systems are defined to ensure relevance and alignment with the research objectives and questions. The following criteria will be used:

- Papers that specifically address the challenges, solutions or open questions related to the integration of cloud migration methodologies into legacy systems.
- Publications that address a systematic way of choosing a cloud provider.
- In cases of partial agreement among the team whether an article should be included or not, we choose to include it and that article may be excluded in a detailed review

Exclusion Criteria

To maintain the focus and quality of the study selection, exclusion criteria are established based on factors that deviate from the primary objectives. The exclusion criteria for the research on cloud migration applied to on-premise and legacy systems are as follows:

- Do not discuss migration focused on legacy systems to the cloud
- Do not be written in English
- Do not be available on the web
- Be a secondary study
- Be a short paper (four pages or less)
- Be available only in the form of abstract or presentations or expanded summary without comprehensive details
- Do not be published in a workshop, conference, journal, magazine, or newspaper

Procedures for selection:

The selection process will follow a systematic approach to ensure consistency and rigor in study identification and evaluation. The steps for the selection procedure are outlined below:

1. Researchers will apply research strategies across various databases to identify primary studies related to cloud migration;
2. All Researchers will read title and abstract of all papers to select and the result will be defined by majority;
3. All Researchers will read title, abstract and introduction of all papers to verify agreement with the context established by the inclusion criteria;
4. The researchers will perform a full reading of the works to understand the knowledge they bring and assess their relevance to answering the research question
5. The researches will execute a final review of the works that generated doubts in the previous phase and then selected those included for extraction

Data Extraction

In the context of the research on cloud migration, the data extraction process aims to systematically collect and organize relevant information from the selected primary studies. The extracted data will be organized into a table with the following fields:

- Basic fields: identifier, title, keywords, authors, authors country, year, abstract, source of publication, venue type (conference, journal, workshop), publication source (academia, industry);
- Research type;

Research Type	Description
Evaluation Research	The research investigates a practical problem and provides an implemented solution. Usually case studies or field studies are performed.
Validation Research	The research investigates a solution proposal that has not been implemented in practice. Usually experiments, simulations, or prototyping are performed.
Solution Proposal	The research proposes a novel or an improved solution, though not fully validated. Usually a proof-of-concept or an example is provided.
Experience Paper	The research reports personal experiences and lessons learned from projects in practice.
Conceptual Proposal	The research proposes a new conceptual framework, ontology, or taxonomies, etc.
Opinion Paper	The research reports the author's personal opinion, though with no reasoning arguments, or any means to validate the statements.

- Major findings of study and contribution type (method, model, tool, formal study, experience, others);

Contribution Type	Description
Method	The contribution is a new or extended method, approach, process, procedure, technique, strategy or algorithm.
Model	The contribution is a software architecture, conceptual model or framework, system design.
Tool	The contribution is a software tool to support industry digitalization.
Formal Study	The contribution is a theory, or a formal analysis or measurement of some aspect of cloud computing or Internet-of-things aspects, such as performance, reliability and failure rates.
Experience	The contribution is a description of personal experience and lessons learned.
Others	The contribution does not belong to any of the types above. It can be general descriptions that cover various aspects, e.g., challenges of a specific cloud/Internet-of-things aspect.

- Empirical Validation (controlled experiment, case study, survey usability test, proof-of-concept, others)

- Challenges and Open Questions discussed in the paper;

Data Summarizing

- Topic Modeling with LDA;
- Tableau visualizations;
- Build a Q&A system POC with selected studies content.

References

[1] Durao F, Carvalho JFS, Fonseka A, Garcia VC. A systematic review on cloud computing. **Journal of Supercomputing**, v. 68, n. 3, p. 1321-1346, 2014.

[2] Sen Liu, Felix T.S. Chan, Junai Yang, Ben Niu, Understanding the effect of cloud computing on organizational agility: An empirical examination. **International Journal of Information Management**, v. 43, p. 98-111, 2014.

[3] Modor Intelligence, “Cloud Migration Market Size and Share Analysis – Growth Trends and Variations (2023 – 2028),” URL: https://www.mordorintelligence.com/pt/industry-reports/cloud-migration-services-market. Accessed by: 2024-01-07.