

Document name	Code	Segment	Created by
Ahmad2020-Cloud_Computing_Trends_and_Cloud_Migration_Tuple	CLOUD MIGRATION PROCESS > Cloud migration	And the latest announcement of Pentagon to offer a contract worth USD 10 billion to migrate to cloud shows the confidence level in the cloud infrastructure. Migration to cloud needs careful planning, strong business case, credible migration strategy, and robust migration frameworks. This paper reviews the area of cloud computing migration frameworks. It utilizes the co-word analysis	Ivon Miranda Santos
Ahmad2020-Cloud_Computing_Trends_and_Cloud_Migration_Tuple	CLOUD MIGRATION PROCESS > Cloud migration strategies	Migration to cloud needs careful planning, strong business case, credible migration strategy, and robust migration frameworks.	Ivon Miranda Santos
Ahmad2020-Cloud_Computing_Trends_and_Cloud_Migration_Tuple	CLOUD MIGRATION PROCESS > Cloud migration	Additionally, this paper gives cloud computing technology trends that have evolved to address the challenges of latency and jitter, context awareness, Internet of Things, voluminous data, and mobility support. The results of this paper will help in understanding the cloud computing and migration thereof. N. Ahmad (B) · S. Qamar · N.	Ivon Miranda Santos
Ahmad2020-Cloud_Computing_Trends_and_Cloud_Migration_Tuple	CLOUD MIGRATION PROCESS > Cloud migration	Leading traditional business process outsourcing (BPO) companies such as Capgemini are providing their services through cloud in BPaaS service model. The objective of this paper is to illustrate upon the cloud computing trends and review of cloud computing migration frameworks through co-word analysis. The rest of the article is organized into sections of cloud computing trends, research methodology, data description, data	Ivon Miranda Santos
Ahmad2020-Cloud_Computing_Trends_and_Cloud_Migration_Tuple	CLOUD MIGRATION PROCESS > Cloud migration	3 Research Methodology Web of Science database was explored to collect the manuscripts in the domain of cloud computing migration framework; Web of Science database was used, as this database contains the high-quality peer reviewed research papers. The query for the keyword "cloud computing migration framework" resulted in 299 research articles.	Ivon Miranda Santos
Ahmad2020-Cloud_Computing_Trends_and_Cloud_Migration_Tuple	CLOUD MIGRATION PROCESS > Cloud migration	Co-word analysis is a technique to analyze the significant words or keywords to study the conceptual structure of a research field [19]. In this article, the authors' keywords of the 299 articles have been studied to derive the trends in the field of cloud computing migration framework.	Ivon Miranda Santos
Ahmad2020-Cloud_Computing_Trends_and_Cloud_Migration_Tuple	CLOUD MIGRATION PROCESS > Cloud migration	These terms are as follows virtual, service, data, multi, dynamic, mobile, performance, secure, application, and migration consisting of 30, 19, 18, 13, 11, 11, 11, 11, 10, and 10 related terms, respectively. These terms form a cloud migration tuple and are explained in the environment of cloud computing in the following paragraphs. Virtual:	Ivon Miranda Santos
Ahmad2020-Cloud_Computing_Trends_and_Cloud_Migration_Tuple	CLOUD MIGRATION PROCESS > Cloud migration	Performance: This is also an important criterion for the success of cloud computing migration. This term has been given as a precursor to the migration such as performance matrix, modeling,	Ivon Miranda Santos
Ahmad2020-Cloud_Computing_Trends_and_Cloud_Migration_Tuple	CLOUD MIGRATION PROCESS > Cloud migration	Secure: Security and privacy have been the most debated and stumbling block for migration to the cloud. Security is important in all the aspects such as migration, services, and data. Security needs careful planning. Security requirements, metrics, and measurements should be well defined. This term is also used in combination with compliance	Ivon Miranda Santos
Ahmad2020-Cloud_Computing_Trends_and_Cloud_Migration_Tuple	CLOUD MIGRATION PROCESS > Process of cloud migration	Migration: As the global information technology resources have been deployed on the premises, they now need to be migrated to cloud. Types of migration are an important topic such as re-host, re-platform, re-factor, or rebuild [27, 28]. Similarly, migration policy, methodology, and framework need to be developed well in advance before migration process execution. Migration patterns	Ivon Miranda Santos
Ahmad2020-Cloud_Computing_Trends_and_Cloud_Migration_Tuple	CLOUD MIGRATION PROCESS > Cloud migration	This paper has adopted the co-word analysis approach from the science or bibliometric mapping. The keywords of 299 articles have been analyzed and 10 clusters have been identified to derive a tuple of 10 elements in the context of cloud migration. These elements are virtual, service, data, multi, dynamic, mobile, performance,	Ivon Miranda Santos
Ahmad2020-Cloud_Computing_Trends_and_Cloud_Migration_Tuple	CLOUD MIGRATION PROCESS > Cloud migration	These terms have been described in the previous section. In addition to awareness of cloud computing trends, this cloud migration tuple will help in understanding intricacies of migration to the cloud. Web of Science database was considered only,	Ivon Miranda Santos

Ahmad2020-Cloud_Computing_Trends_and_Cloud_Migration_Tuple	CLOUD MIGRATION PROCESS > Cloud migration	Only bigger clusters have been explained, whereas smaller cluster can shed lights to more advancing frontiers. Moreover, specialized science mapping software will reveal further details of scientific and structural developments of cloud migration. Acknowledgements We are thankful for all the support provided by the King Khalid University and motivational support of colleagues,	Ivon Miranda Santos
Asthana2021-Multi-cloud_Solution_Design_for_Migrating_a_Portfol	CLOUD MIGRATION PROCESS > Cloud migration	Thus, choosing the right providers for different application is another challenging task here. In this work-in-progress paper, we present a novel methodology for preparing such a cloud migration solution, where we perform text mining on application data to evaluate cloud-migration feasibility and then recommend the optimal solution using a mathematical optimization model. We	Ivon Miranda Santos
Asthana2021-Multi-cloud_Solution_Design_for_Migrating_a_Portfol	CLOUD MIGRATION PROCESS > Multi-cloud migration	Keywords: Cloud computing · Multi-cloud · Cloud feasibility · Text mining · Cloud migration · Optimization	Ivon Miranda Santos
Asthana2021-Multi-cloud_Solution_Design_for_Migrating_a_Portfol	CLOUD MIGRATION PROCESS > Cloud migration strategies	Also, sometimes these applications require an overall architecture overhaul, which again, suffer from the lack of documentation of the current	Ivon Miranda Santos
Asthana2021-Multi-cloud_Solution_Design_for_Migrating_a_Portfol	CLOUD MIGRATION PROCESS > Cloud migration	Second, clients typically define requirements related to service levels they expect for each of their migrated applications. Determining the cloud migration solution that agrees to all these requirements while still be applicable, is not trivial and cannot be achieved by non-analytical/manual ways. To overcome these drawbacks and challenges, we propose a methodology that recommends the optimal set of cloud providers and creates a multi-	Ivon Miranda Santos
Asthana2021-Multi-cloud_Solution_Design_for_Migrating_a_Portfol	CLOUD MIGRATION PROCESS > Cloud migration	2 Prior Art Prior research and analytical work of finding cloud providers using structured application data as well as optimizing cloud solution design together with migration have been done in this area. Pamami et al. [7] shows a framework to create a generic reference for process of cloud migration while Iqbal et al. [8] discusses different cloud migration strategies and models, right from evaluating performance to choosing a cloud provider. Iyob et	Ivon Miranda Santos
Asthana2021-Multi-cloud_Solution_Design_for_Migrating_a_Portfol	CLOUD MIGRATION PROCESS > Cloud migration strategies	[7] shows a framework to create a generic reference for process of cloud migration while Iqbal et al. [8] discusses different cloud migration strategies and models, right from evaluating performance to choosing a cloud provider. Iyob et	Ivon Miranda Santos
Asthana2021-Multi-cloud_Solution_Design_for_Migrating_a_Portfol	CLOUD MIGRATION PROCESS > Cloud migration	[9] proposes a cloud comparison engine that maps application specifications to cloud services pricing for specific cloud offerings. In [10], Iyob et al. detail a system for auto-prioritization of workload migration to cloud while in [11], they present data-driven cloud workload screening. Yang [12] shows a hybrid cloud solution design for genomics Next Generation Sequencing (NGS) service, which is streamlined for this particular service.	Ivon Miranda Santos
Asthana2021-Multi-cloud_Solution_Design_for_Migrating_a_Portfol	CLOUD MIGRATION PROCESS > Cloud migration	We evaluate the features of the applications and build a matrix of applications versus service cloud providers based on different factors such as cost, security features, service level requirements, etc. Lastly, we build an optimization model that finds the optimal set of solution providers for the different applications that are deemed cloud-migration-feasible. The model puts in consideration the different requirements of the	Ivon Miranda Santos
Asthana2021-Multi-cloud_Solution_Design_for_Migrating_a_Portfol	CLOUD MIGRATION PROCESS > Cloud migration	Evaluate Cloud Feasibility and Rank the Applications. In this step, we evaluate feasibility of cloud migration of applications and rank them based on effort required to migrate each one of them. Here we train a graph machine learning	Ivon Miranda Santos
Asthana2021-Multi-cloud_Solution_Design_for_Migrating_a_Portfol	CLOUD MIGRATION PROCESS > Cloud migration	• Based on applications with similar architectures including microservices, cloud native, mobile etc. • Based on ease of cloud migration (depending on effort to migrate applications) 490 S. Asthana et al. For this, we use a weighting function based on importance of features (e.g. cost, QoS, coverage,	Ivon Miranda Santos

Bainomugisha2022-Crane_cloud_A_resilient_multicloud_service_abs	CLOUD MIGRATION PROCESS > Cloud migration	Inspired by these challenges, we propose a set of important design considerations and properties for a resilient multi-cloud service layer, that includes: (1) Containerization and orchestration of applications, (2) Application placement and replication, (3) Portability and multi-cloud migration, (4) Resilience to network partitions and bandwidth constraints, (5) Automated service discovery and load balancing, (6) Localized image registry, and (7) Support for platform monitoring and management. We present an implementation and validation case study, Crane Cloud, an open source multi-cloud service abstraction layer built on-top of Kubernetes that is designed with inherent support for resilience to network partitions, microservice orchestration (deployment, scaling and management of containerized applications), a localized image registry, support multi-cloud	Ivon Miranda Santos
Bainomugisha2022-Crane_cloud_A_resilient_multicloud_service_abs	CLOUD MIGRATION PROCESS > Multi-cloud migration		Ivon Miranda Santos
Bainomugisha2022-Crane_cloud_A_resilient_multicloud_service_abs	CLOUD MIGRATION PROCESS > Multi-cloud migration	migration	Ivon Miranda Santos
Bainomugisha2022-Crane_cloud_A_resilient_multicloud_service_abs	CLOUD MIGRATION PROCESS > Cloud migration	, 2014). The migration of cloud services from one provider to another usually requires major reworks on the application that may be catastrophic for mission-critical systems. For instance, the APDD case study may use vendor-specific machine learning libraries and tools making it difficult to migrate to another cloud when there is need.	Ivon Miranda Santos
Bainomugisha2022-Crane_cloud_A_resilient_multicloud_service_abs	CLOUD MIGRATION PROCESS > Cloud migration	DC 3: Portability and multi-cloud migration Portability in cloud computing can be defined as the ability for movement of applications, workloads, processes and data from one cloud environment to another with least disruption,	Ivon Miranda Santos
Bainomugisha2022-Crane_cloud_A_resilient_multicloud_service_abs	CLOUD MIGRATION PROCESS > Multi-cloud migration	DC 3: Portability and multi-cloud migration Portability in cloud computing can be defined as the ability for movement of applications, workloads, processes and data from one cloud environment to another with least disruption,	Ivon Miranda Santos
Bainomugisha2022-Crane_cloud_A_resilient_multicloud_service_abs	CLOUD MIGRATION PROCESS > Cloud migration	Given the different deployment models and the cloud service models, organizations should be able to move cloud services from one provider to another without worries of complexities and infrastructure dependence. Bozman and Chen (2010) identified standardized programming interface, abstraction layers and management capabilities as some of the key enablers for portability and service migration between cloud providers. A standardized programming interface includes programming toolsets to support application movement, the abstraction layers insulates users from infrastructure complexities and dependencies and	Ivon Miranda Santos
Bainomugisha2022-Crane_cloud_A_resilient_multicloud_service_abs	CLOUD MIGRATION PROCESS > Cloud migration	The Crane Cloud software layer was conceived to address the key hurdles of operating a cloud-service platform in resource constrained environments characterized by challenges identified in Section 2.2. Its main ingredients include resilience to network partitions, support for microservice orchestration, support for migration of services between private and public clouds to avoid vendor lock-in issues, seamless downtime and network traffic load distribution, monitoring metrics, and tools for transforming existing non-cloud compliant services into compliant cloud services. The multi-cloud service layer has five components (managed portal, authentication and authorization, monitoring and billing, local registry and the backend service) purposely designed	Ivon Miranda Santos
Bainomugisha2022-Crane_cloud_A_resilient_multicloud_service_abs	CLOUD MIGRATION PROCESS > Cloud migration	Based on these challenges, we enumerated a number of design considerations and properties for a resilient multi-cloud service layer that would form the foundation for Crane Cloud. From easing terminal complexities of operating a cloud service, desirable scaling, availability, migration and loadbalancing to platform monitoring, Crane Cloud tries to provide an all-inclusive solution that best fits the resource constrained compute environment. As much as Crane Cloud directs implementations for the subject environment, it should be noted there are many moving parts	Ivon Miranda Santos

Bainomugisha2022- Crane_cloud_A_resilient_multicloud_ service_abs	CLOUD MIGRATION PROCESS > Cloud migration	Opara-Martins, J., Sahandi, R., Tian, F., 2016. Critical analysis of vendor lock-in and its impact on cloud computing migration: a business perspective. J. Cloud Comput.	Ivon Miranda Santos
Belafia2021- From_monolithic_to_microservice_ar chitecture_The_ca	CLOUD MIGRATION PROCESS > Process of cloud migration	Existing research works focus on the overall migration process to handle more efficiently their specific requirements.	Ivon Miranda Santos
Belafia2021- From_monolithic_to_microservice_ar chitecture_The_ca	CLOUD MIGRATION PROCESS > Cloud migration strategies	a) Analysis of the Driving Forces: First, the analysis of the driving forces is considered as a crucial step of a modernization. Indeed, while the transition to microservice can bring significant improvements to the application in the long term, and ease future developments, transition from legacy systems towards microservice architecture is a long and risky process [9]. Thus, companies often establish cost-benefit analysis, based on the potential benefits such as increased	Ivon Miranda Santos
Belafia2021- From_monolithic_to_microservice_ar chitecture_The_ca	CLOUD MIGRATION PROCESS > Cloud migration strategies	b) Modernization Planning: The next phase of a modernization is the establishment of a plan for the transition towards microservices. To begin with, practitioners explore, analyze and understand the legacy systems: the different features, how they interact, how they are implemented. This process is called feature location. In order to accomplish this task, practitioners can rely on high-level artifacts such as UML diagrams, graphs, or texts based on low-	Ivon Miranda Santos
Brogi2014- SeacLOUDs_Seamless_adaptive_multi- cloud_management_of	CLOUD MIGRATION PROCESS > Cloud migration	A cloud-compliant orchestration is not a trivial problem. Challenges such as heterogeneity of cloud platforms and migration to different cloud providers have to be addressed, as well as the different standards emerging from distinct vendors. Therefore, existing approaches should be (substantially) extended to operate on heterogeneous cloud providers.	Ivon Miranda Santos
Brogi2014- SeacLOUDs_Seamless_adaptive_multi- cloud_management_of	CLOUD MIGRATION PROCESS > Cloud migration	The main aim of TOSCA is to enable the interoperable description of application and infrastructure cloud services, the relationships between parts of the service, and the operational behaviour of these services, independently from the cloud provider. By increasing service and application portability in a vendor-neutral ecosystem, TOSCA aims at enabling portable deployment to any compliant cloud, smoother migration of existing applications to the cloud, as well as dynamic, multi-cloud provider applications.	Ivon Miranda Santos
Brogi2014- SeacLOUDs_Seamless_adaptive_multi- cloud_management_of	CLOUD MIGRATION PROCESS > Cloud migration	The MODACLOUDs project (http://www.modacLOUDs.eu/) also aims at providing quality assurance during the application life-cycle, support migration from cloud to cloud when needed, and techniques for data mapping and synchronization among multiple clouds. In order to	Ivon Miranda Santos
Brogi2015- Adaptive_management_of_applicatio ns_across_multiple_c	CLOUD MIGRATION PROCESS > Cloud migration	How to deploy and manage, in an efficient and adaptive way, complex applications across multiple heterogeneous cloud platforms is one of the problems that have emerged with the cloud revolution. In this paper we present context, motivations and objectives of the EU research project SeaCLOUDs, which aims at enabling a seamless adaptive multi-cloud management of complex applications by supporting the distribution, monitoring and migration of application modules over multiple heterogeneous cloud platforms. After positioning SeaCLOUDs with respect to related cloud initiatives, we present the SeaCLOUDs architecture and discuss some of its	Ivon Miranda Santos
Brogi2015- Adaptive_management_of_applicatio ns_across_multiple_c	CLOUD MIGRATION PROCESS > Multi-cloud migration	How to deploy and manage, in an efficient and adaptive way, complex applications across multiple heterogeneous cloud platforms is one of the problems that have emerged with the cloud revolution. In this paper we present context, motivations and objectives of the EU research project SeaCLOUDs, which aims at enabling a seamless adaptive multi-cloud management of complex applications by supporting the distribution, monitoring and migration of application modules over multiple heterogeneous cloud platforms. After positioning SeaCLOUDs with respect to related cloud initiatives, we present the SeaCLOUDs architecture and discuss some of its	Ivon Miranda Santos
Brogi2015- Adaptive_management_of_applicatio	CLOUD MIGRATION PROCESS > Process of cloud migration	1. to perform this migration process as automatically as possible,	Ivon Miranda Santos

Brogi2015-Adaptive_management_of_applications_across_multiple_c	CLOUD MIGRATION PROCESS > Cloud migration	Several approaches exist that target formal verification and adaptation of orchestrated services, but, to the best of our knowledge, none of these approaches has been extended to the cloud environment. Challenges such as heterogeneity of cloud platforms and migration to different cloud providers have to be addressed, as well as the different standards emerging from distinct vendors. Therefore, existing approaches	Ivon Miranda Santos
Brogi2015-Adaptive_management_of_applications_across_multiple_c	CLOUD MIGRATION PROCESS > Cloud migration	The main aim of TOSCA is to enable the interoperable description of application and infrastructure cloud services, the relationships between parts of the service, and the operational behaviour of these services, independently from the cloud provider [17]. By increasing service and application portability in a vendor-neutral ecosystem, TOSCA aims at enabling portable deployment to any compliant cloud, smoother migration of existing applications to the cloud, as well as dynamic, multi-cloud provider applications.	Ivon Miranda Santos
Brogi2015-Adaptive_management_of_applications_across_multiple_c	CLOUD MIGRATION PROCESS > Cloud migration	The MODAClouds project (http://www.modaclouds.eu/) also aims at providing quality assurance during the application life-cycle, supporting migration from cloud to cloud when needed, and techniques for data mapping and synchronization among multiple clouds. To do so, MODAClouds requires software developers to	Ivon Miranda Santos
Brogi2015-Adaptive_management_of_applications_across_multiple_c	CLOUD MIGRATION PROCESS > Cloud migration	The REMICS project (http://www.remics.eu/) focuses its work on developing advanced model-driven methodology and tools for the reuse and migration of legacy applications to interoperable Cloud services. Although the REMICS methodology focuses on legacy applications, our	Ivon Miranda Santos
Brogi2015-Adaptive_management_of_applications_across_multiple_c	CLOUD MIGRATION PROCESS > Cloud migration	complex application is distributed on different cloud service providers, a solution is needed to manage and orchestrate the distribution of modules in a sound and adaptive way. The SeaClouds platform is proposed to solve these problems and advance the field by supporting the orchestration and deployment to multiple clouds and management thereon, including resilience and migration of modules that compose cloud-based applications over multiple and technologically diverse clouds offerings. Based on the concept of cloud-based services orchestration, SeaClouds can realise the automated arrangement, coordination, deployment and management of multiple services as a single aggregated complex	Ivon Miranda Santos
Brogi2015-Adaptive_management_of_applications_across_multiple_c	CLOUD MIGRATION PROCESS > Cloud migration	It facilitates developers in the deployment and lifecycle management of their applications on the PaaS offering that best matches their computational needs, and ultimately reduces the risks of a vendor lock-in. SeaClouds will leverage and extend Cloud4SOA outcomes, such as multiplatform matchmaking, management, cloud monitoring and migration, to ease and accelerate the implementation. SeaClouds will use Brooklyn's	Ivon Miranda Santos
Brogi2015-Adaptive_management_of_applications_across_multiple_c	CLOUD MIGRATION PROCESS > Multi-cloud migration	It facilitates developers in the deployment and lifecycle management of their applications on the PaaS offering that best matches their computational needs, and ultimately reduces the risks of a vendor lock-in. SeaClouds will leverage and extend Cloud4SOA outcomes, such as multiplatform matchmaking, management, cloud monitoring and migration, to ease and accelerate the implementation. SeaClouds will use Brooklyn's	Ivon Miranda Santos
Caceres2022-State-of-the-art_architectures_for_interoperability	CLOUD MIGRATION PROCESS > Cloud migration	The absence of common standards and interfaces makes it difficult to connect services of different clouds, migrate between them, or to distribute tasks across various providers. Extensive research in industry and academia has partially addressed the problem of vendor lock-in for cloud migration, however, no solutions are known to enable running applications in a dynamic multi-cloud infrastructure on a permanent basis. This paper describes state-of-the art of cloud	Ivon Miranda Santos
daSilva2013-From_the_desktop_to_the_multi-clouds_The_case_of_mo	CLOUD MIGRATION PROCESS > Cloud migration	At run time, it should support the monitoring and adaptation of the application to support its desired QoS levels. We intend, in special, to reuse MODAClouds data migration support, to facilitate the application scaling in and out. III.	Ivon Miranda Santos

daSilva2013- From_the_desktop_to_the_multi- clouds_The_case_of_mo	CLOUD MIGRATION PROCESS > Cloud migration	Restrictions apply. migration, the architecture of our cloud solution will rely on the implementation of the so-called Administration Service. The Administration Service is one of the most important interfaces between users and the Modelo Project Management Server.	Ivon Miranda Santos
deCarvalho2018- Pacifclouds_A_flexible_microservic es_based_arc	CLOUD MIGRATION PROCESS > Multi-cloud migration	However, the multiple clouds bring several challenges, as well, e.g., interoperability and portability related to mitigating vendor lock-in. We consider portability the ability to allow customers to migrate data and systems from one cloud to another and inter-operability capacity to allow customers to use services across multiple clouds	Ivon Miranda Santos
deCarvalho2018- Pacifclouds_A_flexible_microservic es_based_arc	CLOUD MIGRATION PROCESS > Multi-cloud migration	According to the PacificClouds goals described in section 1, we adopt the multi-cloud delivery model, for it brings greater flexibility. In relation to portability, we assume the three categories used by (Petcu et al., 2013) and we report the IaaS and PaaS levels for the portability requirements. According to interoperability levels, we have considered the following criteria, (Nogueira et al., 2016): we have adopted both syntactic and semantic level	Ivon Miranda Santos
deCarvalho2018- Pacifclouds_A_flexible_microservic es_based_arc	CLOUD MIGRATION PROCESS > Multi-cloud migration	RASIC, ASMEMA, SeaClouds, and PacificClouds address interoperability for distributed applications in multiple clouds geographically dispersed, while the other solutions address only application portability between clouds. In relation to the background technologies in clouds, just Cloud4SOA and SeaClouds do not use clouds that have different background technologies, that is, all clouds involved in the portability or interoperability of applications must have the	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	Method: In our previous work, we performed a systematic review to identify the approaches adopted by organizations to migrate to cloud computing and their perception of the cost-benefit of this migration. In this paper, we extended our previous work through a new search in the selected repositories to identify studies published	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Benefits of cloud migration	Method: In our previous work, we performed a systematic review to identify the approaches adopted by organizations to migrate to cloud computing and their perception of the cost-benefit	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	Keywords: Cloud computing · Cloud migration · Provider selection · Cost-benefit relationship · Systematic literature review	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Benefits of cloud migration	Keywords: Cloud computing · Cloud migration · Provider selection · Cost-benefit relationship · Systematic literature review	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	enter the market [18]. Studies have shown that successful migration to the cloud are usually driven by a set of criteria to select providers that best fit their needs [7,14,17].	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	In this section, we present the concepts related to CC, the focus of this SLR. Based on a systematic search, we also link to existing secondary studies that discuss aspects related to the migration to the cloud and correlated factors. Many enterprises have adopted the paradigm of CC where producers and consumers (of information) are not necessarily collocated	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	A Systematic Literature Review on Cloud Computing 225 (i) strategies to identify migration opportunities to the cloud, (ii) relevant factors for the assessment of the cost-benefit of this adoption of cloud and finally (iii) the selection of providers according to	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration strategies	A Systematic Literature Review on Cloud Computing 225 (i) strategies to identify migration opportunities to the cloud, (ii) relevant factors for the assessment of the cost-benefit of this adoption of cloud and finally (iii) the selection of providers according to	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Benefits of cloud migration	(i) strategies to identify migration opportunities to the cloud, (ii) relevant factors for the assessment of the cost-benefit of this adoption of cloud and finally (iii) the selection of providers according to	Ivon Miranda Santos

dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	RQ2. Which factors companies consider to assess the cost-benefit relationship of adoption and migration to the cloud computing? The knowledge of the costs and benefits of migration to the CC can be used as a support for its planning and	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	No papers were found in this SLR before 2009. This is an evidence of the interest on migration and services provided by the cloud. We found 68 papers (93,15% of the total) between 2011 and	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	The reason to have only 1 papers selected in 2016 is that in this year we considered only papers published until June. 4.1 Strategies for the Adoption and Migration to the Cloud (RQ1) This subsection has the goal to discuss how selected papers addressed RQ1: Which strategies are used by companies to identify scenarios of migration opportunities to the cloud computing? RQ1 Analysis. We identified 25 papers that proposed and/or discussed processes, strategies and frameworks to support companies deciding for the adoption and migration to the cloud. We contextualize their	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration strategies	The reason to have only 1 papers selected in 2016 is that in this year we considered only papers published until June. 4.1 Strategies for the Adoption and Migration to the Cloud (RQ1) This subsection has the goal to discuss how selected papers addressed RQ1: Which strategies are used by companies to identify scenarios of migration opportunities to the cloud computing? RQ1 Analysis. We identified 25 papers that proposed and/or discussed processes, strategies and frameworks to support companies deciding for the adoption and migration to the cloud. We contextualize their	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Process of cloud migration	We identified 25 papers that proposed and/or discussed processes, strategies and frameworks to support companies deciding for the adoption and migration to the cloud.	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	RE and CloudTrust) to compare them. [S6] discusses the use of CloudMIG to support the migration of legacy software systems to the cloud. CloudMIG was also referenced in the following	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	S17, S1, S40, S62, S31. The Desktop-to-Cloud-Migration (D2CM) tool that supports transformation and migration of virtual machine images, deployment description and 232 A.C.M. de Paula	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	The Cloud Adoption Toolkit was referenced in papers S2, S69 and S26, whereas CDOsim was referenced in S7, S68 and S40. A list of 25 of the selected studies proposed approaches to guide the migration to the cloud as described in the following sentences. In [S1], the authors investigated the existing literature to classify the migration into five strategies as	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	They performed a case study to demonstrate the migrating feasibility from a classic web service solution to the Cloud. [S9] proposed an initial conceptual approach of a cloud modernization assessment framework with the objective of measuring the impact of a potential migration to Cloud. The purpose was to advise software companies on the decision of what is more convenient, to migrate or to start from scratch, providing data about the required effort and cost as well as providing information about the	Ivon Miranda Santos

dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	The categories were used as an input to a four stage technique that shall help compare CSBs on preference and usability parameters. [S14] presented a step-by-step process to support cloud adoption and migration decisions in the enterprise. The authors demonstrated the use of cloudstep to support in the decision of business applications migration into the public cloud providers. In [S15], the authors explained the multi-dimensional decision-making process carried out to migrate applications to cloud environments and how to formalise its effects in the cloud migration criteria. With the aim of helping organisations cope with these effects, the authors developed the InCLOUDer cloud migration decision support system which builds on top of the Analytic	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl	CLOUD MIGRATION PROCESS > Process of cloud migration	[S14] presented a step-by-step process to support cloud adoption and migration decisions in the	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl	CLOUD MIGRATION PROCESS > Process of cloud migration	[S20] proposed a migration process framework outlining major steps and their concerns.	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	The authors identified through expert interviews the immaturity in terms of established procedures and availability of tools to support the architecture migration process. The study [S21] presented a generic framework to support the migration of live media streaming to a cloud platform, fundamental understandings on the practical feasibility and theoretical constraints in the migration are also discussed. According to the authors, extensive simulations driven by traces from both cloud service providers (Amazon EC2 and SpotCloud) as well as a live media streaming service provider (PPTV) to demonstrate the cost-effectiveness and superior streaming quality of CALMS, even with highly dynamic and global-ized demands. [S23] proposed a set of migration patterns which span the continuum from legacy IT environment to the cloud is included as a common framework for aligning the various migration approaches developed. [S27] proposed three paradigms to support the migration to the cloud. The process paradigm refers to the jobs to be accomplished during cloud migration in terms of the examination of current processes, the development of new processes under cloud context, and the determination of the KPIs and KEs for new	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	And finally, the organizational paradigm that describes the strategies and concerns of the whole transformation of an organization to cloud environment. [S28] proposed a framework to support the migration of legacy systems to the cloud based on security and trust concerns. In [S61], the authors proposed a research model to integrate the diffusion of innovation (DOI) theory	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	F. de Carneiro vendor Lock-in factor and also present a set of assessment activities and guide-lines to support migration to the Cloud by adopting SOA and Cloud modeling standards and tools. [S69] proposed a framework called CloudGenius to auto-mate the decision-making process based on a model and factors specifically for Web server migration to the Cloud. The CloudGenius framework defines a Cloud migration process that offers a model and methods to determine the best combined choice of a Cloud VM image and a Cloud infrastructure service. [S70] Analyzes and identifies relevant	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Process of cloud migration	The CloudGenius framework defines a Cloud migration process that offers a model and methods to determine the best combined choice of a Cloud VM image and a Cloud infrastructure service.	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl	CLOUD MIGRATION PROCESS > Process of cloud migration	Finally, 12 studies discussed case studies to illustrate the migration process.	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	[S18] discussed the motivation, requirements, feasibility of migrating CiteSeerX digital library to provide an IaaS model in a private cloud. In [S24] the authors combine legacy system migration solutions and virtualization technology with the application of cloudstack to build an enterprise private cloud platform. [S25] presents an overview of major requirements that must be considered	Ivon Miranda Santos

dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	This subsection discusses how selected papers addressed RQ2: Which factors are considered by companies to assess the cost-benefit relationship of adoption and migration to the cloud computing? During the analysis of RQ2, we identified a myriad of factors related to the cost-benefit relationship of cloud computing adoption.	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	The migration of legacy applications to CC was discussed in [S17], whose focus was on the application performance analysis and providers characteristics. The authors of [S22] discussed the migration of agile projects to the cloud in terms of cost, time and quality. [S23] discussed potential issues and challenges that organizations may face while considering to migrate workloads to the cloud: efficiency, agility, quality, security, governance and standardization in the delivery, consumption and operation of IT services, all at	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Multi-cloud migration	[S36] proposed the use of a real option model to help companies think and decide when to switch to cloud based on the expected benefits, uncertainties and the value a company puts on money. [S37] investigated different approaches to reduce both cost and task completion time of computations using Amazon EC2's spot instances for resource provisioning. In the case of [S38], the authors focused on the following factors: availability, portability, integration, migration	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	[S7] presented a simulation tool called CDOSim whose goal is to simulate cost and performance attributes in CDOs. The tool is build upon and significantly extends the cloud simulator CloudSim and integrates into the cloud migration framework Cloud-MIG. [S55] the tool CloudCmp to systematically compare the performance and cost of cloud providers along dimensions that matter to	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	In this Systematic Literature Review (SLR), we selected evidences from the literature to describe, characterize and highlight differences and commonalities among strategies adopted by companies to decide for the migration to the cloud. In this scenario, we also focused in the identification of evidences related to the cost-benefit relationship of this migration and selection of cloud service providers. Our goal was to systematically analyze data from the selected papers to draw a clear picture from what has been	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Benefits of cloud migration	In this scenario, we also focused in the identification of evidences related to the cost-benefit relationship of this migration and selection	Ivon Miranda Santos
dePaula2016- A_systematic_literature_review_on_cl oud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	One of the main contribution of this paper was also the discussion of a list of approaches published in the literature that deal with the cost-benefit relationship and the rationale behind the selection of providers and their respective services. We are already investigating how providers have perceived the clients adoption and migration to the cloud computing paradigm and how they tailor their strategies to meet the needs of customers. We have already performed the snowballing technique considering the selected papers of this SLR to increase the list of papers	Ivon Miranda Santos
Elgedawy2015- Sultan_A_composite_data_consisten cy_approach_for_s	CLOUD MIGRATION PROCESS > Cloud migration	As a result, businesses do not have the freedom to change their cloud-vendors whenever they like as their services and data are locked-in due to clouds heterogeneity and data migration costs. One approach for preventing such risk is to deploy business services on different clouds.	Ivon Miranda Santos
Elmroth2011-Self- management_challenges_for_multi-	CLOUD MIGRATION PROCESS > Process of cloud migration	Overview of a typical live migration process	Ivon Miranda Santos
Fowley2018- Cloud_migration_architecture_and_pr icing_-_Mapping_a	CLOUD MIGRATION PROCESS > Cloud migration	Abstract. Cloud migration is about moving an on-premise software system into the cloud. Many approaches exist that describe the technical migration analysis and the architectural migration.	Ivon Miranda Santos
Fowley2018- Cloud_migration_architecture_and_pr icing_-_Mapping_a	CLOUD MIGRATION PROCESS > Process of cloud migration	We discuss the migration process under consideration of cost aspects, covering both income and expenses in the cloud in relation to	Ivon Miranda Santos
Fowley2018- Cloud_migration_architecture_and_pr icing_-_Mapping_a	CLOUD MIGRATION PROCESS > Cloud migration	Keywords: Cloud migration · Cloud cost models · Monetisation Architecture migration · Independent software vendor · Cloud native 1 Introduction	Ivon Miranda Santos

Fowley2018- Cloud_migration_architecture_and_pr icing_-_Mapping_a	CLOUD MIGRATION PROCESS > Cloud migration	Being able to scale up or down application infrastructure to meet quality requirements and enable reliable consumption of a product is a key benefit. Cloud migration research has studied the cloud on-boarding in quite some detail [13].	Ivon Miranda Santos
Fowley2018- Cloud_migration_architecture_and_pr icing_-_Mapping_a	CLOUD MIGRATION PROCESS > Process of cloud migration	For instance, pattern-based migration processes are suggested to organise and manage the architectural migration.	Ivon Miranda Santos
Fowley2018- Cloud_migration_architecture_and_pr icing_-_Mapping_a	CLOUD MIGRATION PROCESS > Cloud migration	Tools have been provided by many cloud service provider to migrate for instance data using data loaders. In [21], the top 10 challenges for start-ups are summarised, that also reflect the concerns for migrations by software vendors inexperienced in cloud technologies, particularly if the cloud	Ivon Miranda Santos
Fowley2018- Cloud_migration_architecture_and_pr icing_-_Mapping_a	CLOUD MIGRATION PROCESS > Cloud migration	[20] proposed an algorithmic solution to optimize data center net profit with deadline-dependent scheduling. 4 Cloud Migration – Joint Architecture and Costing Concerns	Ivon Miranda Santos
Fowley2018- Cloud_migration_architecture_and_pr icing_-_Mapping_a	CLOUD MIGRATION PROCESS > Cloud migration	Assume a traditional stacked application with Application, Middleware, DBMS and Disk Storage support that runs in an on-premise setting, with the aim of providing this as a service in the cloud. A step-wise migration into cloud could now happen as follows:	Ivon Miranda Santos
Fowley2018- Cloud_migration_architecture_and_pr icing_-_Mapping_a	CLOUD MIGRATION PROCESS > Cloud migration	After an analysis of the PaaS pricing models for hosting an application, we look at licensing and pricing models for offering a PaaS-hosted application as a SaaS solution. 7 Pricing Model Migration – Cloud SaaS Billing and Pricing Models SaaS pricing models typically bill clients using one	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey	CLOUD MIGRATION PROCESS > Process of cloud migration	Cloud Migration Process	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	The survey distills the state of the art in cloud migration research and makes a rich inventory of important activities, recommendations, techniques, and concerns that are commonly involved in the migration process in one place.	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	This enables academia and practitioners in the cloud computing community to get an overarching view of the cloud migration process. Furthermore, the survey identifies a number challenges that have not been yet addressed by existing approaches, developing opportunities for further	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	This enables academia and practitioners in the cloud computing community to get an overarching view of the cloud migration process.	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	Cloud Migration, Legacy Application, Evaluation Framework, Migration Methodology, Process Model, Cloud Computing	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	technical-centric solutions related to using of cloud services, to research around the social and non-technical impact of the cloud as a new emerging paradigm. However, studies that focus on designing approaches offering a process model (methodology) for the cloud migration have not yet received much attention. Several studies such as	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	However, studies that focus on designing approaches offering a process model (methodology) for the cloud migration have not yet	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	, 2013) suggest that a well-defined process model for supporting migration (or development) and maintaining working legacy applications to the cloud is a key concern.	Ivon Miranda Santos

Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	The complexity of migration is exacerbated by the fact that some legacy applications may have been developed without taking into account the unique requirements attributed to cloud environments such as elasticity, multi-tenancy, interoperability, and refactoring. Such requirements raise new challenges to the migration of applications to the cloud and hence needs improving conventional software development methodologies to address these specific requirements. Various projects and studies in cloud computing community define migration approaches in order to enable legacy applications to take benefit from cloud services (e.g. reducing maintenance costs, economies of scale, and pay-as-you-go). Although trivial migration projects may be manageable in an ad-hoc manner, a methodological approach	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	transition in an ad-hoc manner which may latter result in poor and erroneous migration and maintenance overhead. A methodological approach can be acclaimed as promising mean for tackling the cloud migration complexities and move from an ad-hoc cloud migration to a structured and step by step quality methodology. In this spirit, Laszewski and Nauduri, who are designer of a methodology for moving Oracle	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Each new technology has required new and renewed approaches and technologies to address the migration process in a more effective way. As will be elaborated in Section 2.3, there are several surveys on the cloud migration each focuses on different aspects of cloud migration such as interoperability, techniques and tools for migration, and cloud architecture design. Although these surveys provide a partial understanding of certain aspects of legacy to cloud migration, they do not provide a complete picture of how the cloud migration is to be carried out and organised from the process model perspective. There is not yet a rigorous analysis of the extant material on this aspect of the cloud computing. For this reason and regarding the fact that the interest for legacy application migration to the cloud grows, there is a need to contribute a survey that distills existing cloud migration approaches by identifying their common characteristics and varying motives, concomitant activities, and empirical findings. This survey will differ from existing related surveys (Section 2.3) by focusing on the process aspect of the cloud migration to understand what essential activities and concerns are involved during the legacy to cloud migration. By comprehensively reviewing existing cloud migration approaches, we thus	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	Each new technology has required new and renewed approaches and technologies to address the migration process in a more effective way.	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	This survey will differ from existing related surveys (Section 2.3) by focusing on the process aspect of the cloud migration to understand what essential activities and concerns are involved during the legacy to cloud migration.	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	RQ2.2. what cloud-specific criteria are supported by these approaches? RQ1 is motivated by the need to describe the state-of-the-art of cloud migration approaches. This gives readers an overall understanding of the approaches' idea, their core objectives, and a concise description of	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	RQ2.1 assesses generic criteria that any process model would need to address regardless of its application genre. RQ2.2 is related to the evaluation of cloud-specific aspects of migration approaches. This decomposition is a first step in the synthesis of the evaluation framework which we will later use to identify and highlight a rich collection of key activities and recommendations	Ivon Miranda Santos

Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	— To help both researchers and practitioners in the cloud community if they want to capture key facets of existing approaches and select or discard one or collection of them that may suite their needs for a particular migration exercise, and — To give a broad view of research challenges, specifically concerned with process models for the legacy to cloud migration that need to be investigated by researchers. Hence, a gateway to new research	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	This paper is structured as follows: In Section 2, we give a general review of terms related to cloud migration, key challenges that need to be addressed in a migration process, and the related work to this paper. Section 3 describes proposed evaluation framework designed for the purpose of	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	In Section 2, we give a general review of terms related to cloud migration, key challenges that need to be addressed in a migration process, and the related work to this paper.	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	As with all new areas of study, an etymological analysis is instructive. This is first undertaken in this section to give some clarity as to what a cloud migration methodology might mean in the context of cloud computing. This section then identifies technical and organisational concerns of such a methodology and provides a review of	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	2.1 ETYMOLOGY —Cloud migration methodology. In software engineering (SE) a software development methodology can be defined as a systematic way of doing things in a particular discipline (Gonzalez-Perez and Henderson-Sellers, 2008).	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	It defines when a certain activity, which contains sequence and input/output artefacts, should be carried out. Migration of legacy applications to the cloud signifies that the organisation has already in place existing software applications earmarked to take advantages of cloud services. A common understanding of the term cloud migration methodology, as offered by (Chauhan and Babar, 2012), is the re-engineering process of legacy applications for becoming cloud-enabled. That is, migration to cloud is a kind of software reengineering where the target application will be able to interact or become integrated with cloud services. Another definition, offered by Andrikopoulos, views the cloud migration process	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration strategies	That is, migration to cloud is a kind of software reengineering where the target application will be able to interact or become integrated with cloud	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	Another definition, offered by Andrikopoulos, views the cloud migration process as a set of architectural adaptations required to ensure a legacy application becoming cloud-compliant	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Similarly, Kwon et al. pose the term cloud refactoring in which code transformation mechanisms are used to integrate legacy applications and cloud services (Kwon and Tilevich, 2014). Another yet broader and workable definition, which covers both technical and non-technical aspects of the cloud migration is suggested by (Pahl et al., 2013) as: A cloud migration process is a set of migration activities carried to support an end-to-end cloud migration. Cloud migration processes define a comprehensive perspective, capturing business and technical concerns. Stakeholders with different backgrounds are involved. One can envisage a cloud migration methodology as an extended traditional software development methodology to enhance its capability to support cloud computing.	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	A cloud migration process is a set of migration activities carried to support an end-to-end cloud	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	Cloud migration processes define a comprehensive perspective, capturing business	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Each tier can have multiple components which can be deployed in different servers and collaborate together. —Different types of legacy migration to the cloud. Taking into account the	Ivon Miranda Santos

Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	IaaS (infrastructure as a service), PaaS (platform as a service), SaaS (software as a service), one can view there are several possibilities that legacy applications can utilise cloud services. In this survey these are called variant types of the legacy to cloud migration. From this angle, a cloud migration methodology can then be viewed as a systematic process model to perform one or more migration type(s). Inspired by the classification	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	From this angle, a cloud migration methodology can then be viewed as a systematic process model to perform one or more migration type(s).	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	However, in the case of encapsulating an application into a virtual machine and deploying it in the cloud (migration type V), enabling the feature multi-tenancy might be of less or not concern. As another example, the migration of a legacy relational database to a NoSQL cloud database service (type IV) may raise incompatibilities issues between functionalities of relational database tier and equivalent ones offered by NoSQL cloud database. Hence, various approaches may be designed to define	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Hosting a Web application and its Web server as a VM on E2C is an example of such migration. 2.2 KEY CONCERNS IN APPLICATION MIGRATION TO CLOUD ENVIRONMENTS Moving applications to the cloud is similar to conventional legacy application re-engineering. However, cloud applications should also satisfy specific cloud environmental concerns.	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	, 2009), we identified six cloud intrinsic key concerns as follow: (i) resource elasticity, (ii) multi-tenancy, (iii) interoperability and migration over multiple-clouds, (iv) application licensing, (v) dynamicity and unpredictability, and (vi) legal issues. These concerns trigger considerations that an application owner should consider them in the migration process, though they might have	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Multi-cloud migration	, 2009), we identified six cloud intrinsic key concerns as follow: (i) resource elasticity, (ii) multi-tenancy, (iii) interoperability and migration over multiple-clouds, (iv) application licensing, (v) dynamicity and unpredictability, and (vi) legal issues. These concerns trigger considerations that an application owner should consider them in the migration process, though they might have	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	These concerns trigger considerations that an application owner should consider them in the migration process, though they might have been already automatically supported by cloud	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Tenant isolation for QoS satisfaction (e.g. performance, security, availability and customizability) should be carefully addressed in a cloud application. (iii) Interoperability and migration over multiple-clouds. The cloud environment is proliferated with numerous services which bring a wide range of	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Multi-cloud migration	Tenant isolation for QoS satisfaction (e.g. performance, security, availability and customizability) should be carefully addressed in a cloud application. (iii) Interoperability and migration over multiple-clouds. The cloud environment is proliferated with numerous services which bring a wide range of	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	, 2014). These issues face developers to heterogeneities across the application tiers, which imply a certain level of development effort, specifically in migration types I, II, III, IV, and V. As advancements in the cloud computing is still on-going track and there is not a common standard for development cloud services, application portability is a challenge when its components are to move from a provider to another provider, but there is an incompatibility between underlying	Ivon Miranda Santos

Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	, 2013) identified: (i) the main drivers which motivate organizations to move their legacy applications to the cloud, (ii) different types of migration activities might be performed, (iii) techniques and tools, and (iv) existing gaps in the literature. Twenty one studies on cloud migration were evaluated against a characterisation framework including contribution type, evaluation method, means of migration, migration type, migration tasks, intents of the migration, migration tool support, and constraints. In another review, the REMICS consortium presents the state of the art with respect to modernisation methodologies and tools (SINTEF, 2011) that support the automatic transformation of legacy application	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	A number of other review papers were also identified but they fall outside the scope of this survey. For example, (Girish and Guruprasad, 2014) focuses on six data frameworks for cloud migration. Furthermore, (Medina et al.,	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	The survey provided in the current study is different from the existing reviews in three salient aspects. Firstly, this survey limits its focus on all extant approaches proposing a (complete or partial) migration process model or framework for the cloud migration, and hence is more specific than the above-mentioned surveys. None of the reviewed surveys (see Table II) provides an in-depth discussion on the features and migration activities proposed in the existing approaches as	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	Firstly, this survey limits its focus on all extant approaches proposing a (complete or partial) migration process model or framework for the cloud migration, and hence is more specific than	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	3 EVALUATION FRAMEWORK We propose an evaluation framework leaning heavily towards assessing software development methodologies, allowing us to classify and characterise approaches applicable to cloud migration and answer to our research questions. The following meta-criteria, suggested by Karam	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	A detailed description of these criteria is presented in Appendix F. Section 5.3 motivates and elaborates each criterion by providing a detailed explanation for each, along with an evaluation result against existing approaches. For the other dimension, the framework was expanded with cloud-specific criteria that were deemed important and relevant to legacy application migration to the cloud. This was initially inspired by the study introduced in (S. Strauch, 2014) and (La and Kim, 2009) that proposed a small set functional and non-functional properties that should be addressed by an ideal cloud migration methodology. These studies, however, were not complete and well-articulated; nor enough attention was paid to domain-independence, validation, and generality. Hence, we strived to identify a coherent set of analysis criteria for inclusion in the evaluation framework and accordingly to assess cloud migration approaches. The derivation of the criteria was	Ivon Miranda Santos

Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	A criterion is included in the proposed framework if it had addressed at least one of the concerns stated in Section 2.2 and also sufficiently generic to cover a variety of migration scenarios regardless of a particular cloud platform. This resulted in defining 17 cloud-specific criteria including (1) Analysing Context, (2) Understanding Legacy Application, (3) Analysing Migration Requirements, (4) Planning Migration, (5) Cloud Service/Platform Selection, (6) Training, Re-Architecting Legacy Application (including (7) Incompatibility Resolution, (8) Enabling Multi-Tenancy, (9) Enabling Elasticity, (10) Cloud Architecture Model Definition, (11) Applying Architecture Design Principles), (12) Training, (13) Test and Continuous Integration, (14) Environment Configuration, (15) Continuous Monitoring, (16) Migration Type, (17) Unit of Migration. These criteria helped the study to contrast and compare cloud-centric aspects of existing approaches. Once these criteria were established, their importance and relevance to the cloud migration were assessed through a Web-based survey of	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Given a scanning of the approaches, Appendix D synthesises a description of the approaches, ascendingly sorted based on published year. It does not aim to present a critique on the existing approaches, but instead it abstracts the approaches and gives a broad understanding of their perspectives to a cloud migration process, and facilitates for further investigation, elaboration and improving their process. In this table, the third column presents the theoretical foundations used to design the approaches. According to the third column of this table, the motivation of the existing cloud migration approaches varies between nine different streams as presented in	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	It does not aim to present a critique on the existing approaches, but instead it abstracts the approaches and gives a broad understanding of their perspectives to a cloud migration process, and facilitates for further investigation, elaboration	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Its primary goals are portability, interoperability, reusability of applications as well as and increasing development speed. Applied in cloud migration, it meant to transform the legacy application models (e.g. codes and architecture) into platform-independent models, configure them and then generate platform-specific cloud applications using model transformation techniques. As an example, REMICS [S26] is a model-driven methodology with a special	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	—Agile Development. Incorporating Agile practice such as light process, short release, and continuous testing into cloud migration approaches have also received attention from the cloud community. In the approach proposed by Krasteva and Stavru [S1], authors pose whether legacy modernisation processes can benefit from Agile	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	They can be used for developing applications through an appropriate composition of their instances. Applied in cloud migration, Jamshidi et.	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Lindner et. al. [S38] believe that cloud migration involves different interconnected cloud service providers and consumers that form a supply chain model. A service is provided at the start of the supply chain and a consumer at the end uses this	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	A proper cloud supply chain model is required to understand requirements of both providers and consumers during this end-to-end migration	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Seven out of 43 approaches provided a general or short description of the phases and activities with no depth, rated as partially-supported. The only study which was rated as not-supported was the conceptual process model suggested by Jamshidi and Paul [S31], listing 20 key activities for a migration process as a result of a literature review on cloud migration but without any definition for them.	Ivon Miranda Santos

Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	The only study which was rated as not-supported was the conceptual process model suggested by Jamshidi and Paul [S31], listing 20 key activities for a migration process as a result of a literature review on cloud migration but without any	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Tailorability Like any software development project, a methodology should be adapted for the particular goals and contingencies of a cloud migration project at hand. Hence, the thought of a universal cloud migration methodology can meet all migration project situations is viewed fallacious.	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	While methodology adherence can be beneficial, constructing situation-specific methodologies or tailoring existing ones that meet project characteristics at hand should not be overlooked. As an example in the context of cloud migration, according to (Louridas, 2010) there is a difference between the US and EU for addressing the ultimate to data protection in the cloud. That is, in the US, a cloud provider is responsible for completely data protection whilst in EU, the cloud consumer is final responsible to ensure if the	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	As this concern can impact migration process, a migration approach, which is used for moving data tier of legacy application to the cloud, has to incorporate security-related activities into its	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	As new characteristics and activities are introduced to the cloud application development process, approaches are expected to specify what roles, required expertise, and responsibilities are required. This can be helpful for developers who have limited experience in cloud migration and are not quite clear sure about these roles. Furthermore, depending on chosen migration type (Table I), different roles may be required, or existing roles may be tailored. For example, deploying the whole legacy application tiers in the cloud (the migration type V) would need a role who can analyse application workload and data storage growth; whereas in the case of moving only business tier to the cloud (the migration type I), a reverse engineer would be required to discover the logic of legacy code blocks. It deserves approaches define roles and provide	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	It deserves approaches define roles and provide guidance on activities and responsibilities associated with those roles in the course of the	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	[S12] (Legacy code model → architecture representation → architecture redesign), [S21] (Requirement analysis → Migration plan, Legacy code → Code model → Legacy architecture → Cloud-service architecture model), [S41] (Legacy model → Target architecture → Mapping model → Constraint violation), [S43] (Source code → model understanding). Like many other areas of software engineering development, traceability is a crucial concern and cloud migration approaches need to take it into account.	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	It was found that 27 of 43 approaches defined required work-products that should be produced during the migration process.	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	As tool support for the whole migration process may not be practical, approaches vary in their focus on automation support for migration activities and hence provide a partial support.	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	Some studies did not define an approach for any particular migration type; rather they suggest an overall process model for migration.	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Twelve approaches were fallen in this group. Several migration types can be used to make an application cloud-enabled. For example, the business logic tier and data tier may be migrated to Google App Engine and Amazon Relational	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey _evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	For example, Conway and Curry report their experience in validation of IVI Cloud Computing Life Cycle [S4], an Agile migration process model, within a number of organisations.	Ivon Miranda Santos

Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	In the Cloudstep, a model proposed by Beserra et. al. [S2], authors point the idea [context analysis] is to anticipate the detection of potential organisational constraints that might affect the cloud migration decision, before carrying out any further analysis of the application itself. In the migration approach proposed by Khajeh-Hosseini and Greenwood [S6], the main focus is on the early phases of the migration process and it suggests three kinds of activities named as Technology Suitability Analysis, Energy Consumption Analysis, and Stakeholder	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	In the migration approach proposed by Khajeh-Hosseini and Greenwood [S6], the main focus is on the early phases of the migration process and it suggests three kinds of activities named as Technology Suitability Analysis, Energy Consumption Analysis, and Stakeholder	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration strategies	In the migration approach proposed by Khajeh-Hosseini and Greenwood [S6], the main focus is on the early phases of the migration process and it suggests three kinds of activities named as Technology Suitability Analysis, Energy Consumption Analysis, and Stakeholder	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration) but also what are the main risks to be faced with the migration and the organizational processes affected by the uptake of the new business	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Ahmad and Babar in their proposed framework [S21] stress two concerns during conducting context analysis, i.e. (i) determine the type of the application is to be migrated to the cloud since some applications may not benefit from the cloud such as safety-critical or embedded applications, (ii) effort and cost that required for the migration regarding perceived benefits. Table XX summarises the identified concerns from 43 reviewed approaches that should be taken into	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Benefits of cloud migration	Ahmad and Babar in their proposed framework [S21] stress two concerns during conducting context analysis, i.e. (i) determine the type of the application is to be migrated to the cloud since some applications may not benefit from the cloud such as safety-critical or embedded applications, (ii) effort and cost that required for the migration	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	5.4.4 Understanding Legacy Application It is common that the knowledge about legacy applications is often outdated, imperfect, and undocumented. Hence, it is required to identify any such characteristics of the legacy that may influence cloud migration. The activity of legacy application understanding aims at recapturing an abstract As-Is representation of application architecture in terms of functionality, different types of dependencies to other applications, interaction points and message flows between application components, and the quality of code blocks for	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	24 5.4.5 Analysing Cloud Migration Requirements and Objectives As the name implies, approaches may define some activities to specify and model the functionalities required to be fulfilled through legacy application enablement. Examining this criterion gives an insight whether developers seek for approaches that systematically define activities to capture and analyse requirements and ensure migrated application addresses the	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Common requirements engineering techniques (e.g. interview, prototyping, and workshop) still are useable to elicit and analysis requirements from users, developers, and managers as it can be seen in approaches [S8] and [S26]. However, the requirement analysis in the context of cloud migration is with a specific focus on elasticity and scalability application requirements [S18], computing requirements [S19], inter-operability requirements for deployment in the cloud [S21], security and regulatory requirements [S23], and storage space requirements in the cloud [S33]. According to Table XVII, in 15 (35%) of reviewed	Ivon Miranda Santos

Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	5.4.6 Planning Migration Once cloud migration is found as a feasible decision, a plan is defined that guides the rest of migration process. Feedback from stakeholders is analysed to define a migration plan.	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey	CLOUD MIGRATION PROCESS > Process of cloud migration	Once cloud migration is found as a feasible decision, a plan is defined that guides the rest of	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Likewise, Pahl et. al. consider planning in terms of cloud service provider capabilities, addressing contract with partners, distribution of project team, capabilities of migration team (e.g. technology, skills, and tools), and defining metrics and milestones [S18]. In the process model of Legacy-to-Cloud Migration Horseshoe, proposed by [S21], authors incorporate the influence of cloud provider selection and migration type as main factors to develop a migration plan. Furthermore, defining a proper roll back plan, i.e. switching to the previous version of the application at any stage of migration reduces the	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Organisations that experienced difficulties in the transition to cloud computing missed vital steps in their planning. Similarly, [S33] recommends defining Backward Availability for critical migration projects in the case new cloud application fails. 5.4.7 Cloud Service/Platform Selection Approaches can be assessed based on the extent to which they properly define activities to identify, evaluate, and select a set of cloud providers that might suit organization and application	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	They found that a better alignment between the quality attributes of application and cloud service provider can make the migration process quite effort for the rest of migration process.	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey	CLOUD MIGRATION PROCESS > Process of cloud migration		Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	(i) Define Cloud Architecture Model. One important aspect of re-architecting is to find suitable components for migration and re-arrangement of their deployment topology in the cloud environments. With respect to this, approaches	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	Some existing approaches recommend incorporating training activities for IT staff (developers and managers) as a part of a	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	On the other hand, developers need training on new programming concepts such as asynchronous interaction, distributed state and session management, caching, scale out across data centers and providers (scalability), multi-tenancy [S35]. Tran et. al. state that training activities should be incorporated into migration process since all cloud services may not support	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	Tran et. al. state that training activities should be incorporated into migration process since all cloud services may not support some features offered by legacy technologies [S5].	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	[S16] put one step further and define a process-based effort estimation approach metrics to measure the capability of a development team on the basis of mastery of developers on conducting migration activities. 5.4.10 Test and Continuous Integration Once adaptations applied to the application test activity is performed to ensure that application conforms to the expectation of the cloud migration.	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Like tradition software development, the test activity includes testing both functional and non-functional aspects. However, in the context of cloud migration, various cloud-specific tests are to perform including security test, interoperability	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	For many reasons such as workload or user preference, a running application may move from a cloud environment to another one. With respect to this, a lesson learned from applying the migration framework [S15] is to test application for interoperability in heterogeneous cloud environments. Therefore, a certain level of	Ivon Miranda Santos

Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	While all the reviewed approaches in the literature have merit and form a rich source of necessary activities and recommendations to be learned, our deep analysis revealed that still there are challenges which are yet to address. Given the RQ2 and in the light of evaluation results in Section 5, overcoming the following challenges may open new possibilities to ameliorate the state of process models for cloud migration in the literature that constitute future research directions	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	A good example of applying of a sound research methodology in the field of legacy migration can be seen in the study by Razavin (Razavian, 2013) where she applied an exploratory action research in order to get a deep understanding of what academia and practitioners perceive about the migration process of legacy to SOA and identified the categories of activities that are carried out during migration. We believe a similar exercise can also be equally applied in the field of cloud	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	A good example of applying of a sound research methodology in the field of legacy migration can be seen in the study by Razavin (Razavian, 2013) where she applied an exploratory action research in order to get a deep understanding of what academia and practitioners perceive about the migration process of legacy to SOA and identified the categories of activities that are carried out	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	It is highly recommended that methodologies should be tailored before use (Sommerville and Ransom, 2005). This strand continues where cloud migration is concerned. For example, one	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	To address approach tailoring, one can apply a method engineering approach (Brinkkemper, 1996), that is based on this thought that instead of looking for a universal software development methodology, developers should construct a new bespoke methodology by using existing method fragments that are stored in a method library or repository so that the produced methodology meet project characteristics. Applied to the field of cloud migration, it means as developing a repository of migration fragments along with mechanisms to construct situation-specific methodologies through assembling these fragments which fit project at hand. In the context of SOA, Börner (Börner, 2010) and Khadka (Khadka et al., 2011), respectively, proposed method engineering approaches for construction situational service identification and methodology for legacy to SOA migration. We believe this kind	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	The definition and responsibilities of roles involved in a migration process have not been well described in existing approaches.	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	Specifying roles will make clear for developers their exact responsibilities and activities to the roles and may lead to better governing migration	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Stafford, who is executive editor of TechTarget, gives the some examples of new roles such as continuous integration skills for real-time testing and diagnostics, virtual infrastructure configuration, Hadoop on cloud for handling big legacy data (Stafford, 2013). More research on necessary roles should be conducted to characterise not simply developer roles but also any stakeholders involved in cloud migration. Gu and Lago proposed a role-driven migration	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	Gu and Lago proposed a role-driven migration process model for service-based application development (Gu and Lago, 2007).	Ivon Miranda Santos

Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	The model has two dimensions where a horizontal view explicitly shows the activities associated with roles in SOA and vertical view shows the interaction and cooperation between the roles. This can be a good starting point to do a similar research about roles in the context of cloud migration lifecycle and unfold cloud-specific roles. — Lack of a unified process model for cloud migration. Review of the existing approaches shows that they use different terms and definitions to describe same constructs in a migration process. With many advantages that variety of cloud migration approaches offers, nevertheless, it would be beneficial to have an overarching view of legacy to cloud migration process. Furthermore, we observed that the approaches are often combined with technical-centric concepts which are often not homogenous and sometimes limited to certain cloud-specific platforms. Irrespective of technical aspects of cloud migration, the question here is how would developers grasp a quick and platform-agnostic view of existing cloud migration processes? Synthesising a unified and well-abstract cloud migration process model from existing approaches, would be advantageous in terms of facilitating understanding of cloud migration process, lucid knowledge transfer across the community of cloud researchers and practitioners, interoperability of cloud migration methodologies across process modelling tools, as well as specialising different parts of it	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	— Lack of a unified process model for cloud migration.	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	Review of the existing approaches shows that they use different terms and definitions to describe same constructs in a migration process.	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	With many advantages that variety of cloud migration approaches offers, nevertheless, it would be beneficial to have an overarching view of legacy to cloud migration process.	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	Irrespective of technical aspects of cloud migration, the question here is how would developers grasp a quick and platform-agnostic view of existing cloud migration processes?	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	Synthesising a unified and well-abstract cloud migration process model from existing approaches, would be advantageous in terms of facilitating understanding of cloud migration process, lucid knowledge transfer across the community of cloud researchers and practitioners, interoperability of cloud migration methodologies across process modelling tools,	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	The reference process models for cloud migration are still a gap in the literature and	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	There are two limitations in the survey presented in this paper: bias in publication selection and imprecise data collection. Firstly, we focused on studies whose main objective was to suggest an approach (e.g. methodology, process model) for the legacy to cloud migration, specifically in the form of a process model. This resulted in identification of	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	Firstly, we focused on studies whose main objective was to suggest an approach (e.g. methodology, process model) for the legacy to cloud migration, specifically in the form of a	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	these with other objectives that results in ambiguity in describing aspects of migration process. For example, [S35] was a well-cited source and included very useful practice and considerations for the legacy to cloud migration; however, this case was not identified through our initial search strings. To reduce the likelihood of missing relevant papers, firstly we broadened the search strings, as shown in Table III in Appendix A, to cover more relevant papers; and secondly, we performed an extensive manual search in scientific databases and conference proceedings as enumerated in Appendix A. However, it is still	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	these with other objectives that results in ambiguity in describing aspects of migration process.	Ivon Miranda Santos

Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	8 CONCLUSION We presented a systematic literature review on the legacy to the cloud migration from the process model perspective. As far as RQ1 is concerned, we reviewed, evaluated, and characterised existing proposed approaches suggesting a methodological solution for moving legacy	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	We presented a systematic literature review on the legacy to the cloud migration from the process model perspective.	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	An evaluation framework was suggested to highlight important features, activities, and recommendations of existing approaches. A particular strength of the framework is its potential application as a yardstick in selecting approaches or a subset of them as to satisfy specific requirements of a given cloud migration scenario at hand. Regarding RQ2, several few research	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Firstly, we found that researchers have not employed significant research approaches such as interviews, focus groups, observations, surveys, design efforts, and archival materials so as design and evaluation migration approaches. While the cumulative learning and understanding of cloud migration can be attained via sound research methodologies, this essence has been less incorporated in the developing of current approaches by approaches' authors. Secondly, a central aspect of the cloud migration is that a fixed migration approach is not suitable for all migration situations. Nevertheless, the literature review revealed that little work exists that provides a mean to design situation-specific approaches with	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Fourthly, the definition of new roles specific to cloud application development has not been explored in existing approaches. As mentioned in Section 5.3.4, a methodology should specify producers that are involved in the cloud migration process. Fifthly, recognising that there is a sheer volume of cloud migration research, which is currently dispersed and fragmented, implies a need for a generic reference model aiming at integrating existing literature. The fact that each year a considerable number of research papers are published in the field cloud computing, where each reports different solutions, experience reports, and recommendations to move legacy assets to cloud environments, itself is an evidence that the field has reached a maturity point where	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	As mentioned in Section 5.3.4, a methodology should specify producers that are involved in the cloud migration process.	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Sixthly, some criteria such as traceability, scalability, formality, and automation have been not been properly supported by existing approaches. The current state definitely calls for further enhancement of the cloud migration with more methodological approaches. Finally, the results of analysing existing approaches have made a rich inventory of important activities, recommendations, and concerns in the existing cloud migration approaches that are commonly involved in the migration process in one place as described Section 5.3 and 5.4. In our view, this inventory is a great contribution of this work which can be used by academia and practitioners to understand the essence of the cloud migration process. In addition, the results of the evaluation existing approaches and the proposed evaluation framework is helpful for practitioners to get an understanding of the applicability of each	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	Finally, the results of analysing existing approaches have made a rich inventory of important activities, recommendations, and concerns in the existing cloud migration approaches that are commonly involved in the migration process in one place as described	Ivon Miranda Santos
Gholami2016- Cloud_migration_process—a_survey __evaluation_framework	CLOUD MIGRATION PROCESS > Process of cloud migration	In our view, this inventory is a great contribution of this work which can be used by academia and practitioners to understand the essence of the	Ivon Miranda Santos

Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	In this regard, the survey presents a basis for a well-informed decision. Another key contribution of this survey is to enable people in the cloud computing community to get an overall view of the current state of research to the methodological aspect of legacy application migration to cloud environment including key concerns, activities, and criteria need to be taken into account. It is enjoyed by a novice who will engage in the cloud migration research and anyone who is interested in the methodological aspect of moving legacy enterprise applications to cloud environments. We hope that they expand cloud computing body	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	FAHMIDEH, M. 2015. A Generic Process Metamodel For Cloud Migration. Available at https://	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	From the first pilot review, we discerned that authors do not necessarily use the terms process models, life cycle, or methodology to name their proposal. This was why our initial search strings missed some well-known paper related to cloud migration. To alleviate this issue, the search strings were refined based on the recommended guidelines described in (Dieste and Padua, 2007) in order to identify all relevant studies even though	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	1) Defining main terms by decomposing the research questions; 2) Identifying alternative synonyms for the main terms; 3) Checking the search strings in any relevant papers that retrieved; 4) Incorporating alternative synonyms using the logical operator 'OR'; and 5) Using the logical operator 'AND' to link the main terms. The terms "Cloud", "Cloud Computing", "Service Computing", "Legacy", "Methodology", "Process Model", "Reference Model", "Migration", "Framework" were set as the main keywords and based upon them, the different search strings were defined using the logical operator OR to include synonyms for each search string as well as the logical operator AND to link together each set of	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	— Relevant to the first research question (RQ1) though it could be titled under different terms, — Focused on the migration of legacy applications to cloud environments, and directly dealt with the challenges as stated in Section 2.3, — Published between 2007 (the date of origination of cloud	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	39 — High-level frameworks suggesting conceptual models for outsourcing business processes to cloud environments and do not directly deal with legacy application migration were considered out the scope of this research. Consequently, these	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	The second ranked publication channel is journals with 15 publications in total. Among them, the journal of Software Practice and Experience published the most papers related to cloud migration approaches with 3 papers. White papers, workshops papers, book chapters, and dissertations are placed as third, fourth, and fifth regarding the number and percentage of the total	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	Table VI shows the geographical distribution of the identified papers. The value N in this table indicates the total number of times authors from a country published a paper on the topic of cloud migration. According to this table, German stands at the first place for publication in this field with proposing 9 approaches (18.4% of total	Ivon Miranda Santos
Gholami2016-Cloud_migration_process—a_survey_evaluation_framework	CLOUD MIGRATION PROCESS > Cloud migration	UK, Spain, and Denmark are with 2 published papers, following with Italy, Belgium, Bulgaria, Portugal, Norway, Greece, Sweden, Finland with 1 published papers. An ascending ordering of publications based on the continent reveals cloud migration approaches in Europe with N=28, North and South America with N=8, Asia with N=7, and Australia with N=2. No contribution was found	Ivon Miranda Santos
Gourisaria2020-An_Extensive_Review_on_Cloud_Computing	CLOUD MIGRATION PROCESS > Process of cloud migration	Section 8 deals with the processes and techniques of migration of data from on-site machines	Ivon Miranda Santos
Gourisaria2020-An_Extensive_Review_on_Cloud_Computing	CLOUD MIGRATION PROCESS > Cloud migration	8 Migration Services Cloud migration refers to the movement of data from the hardware of a client to the cloud data storage system. It also refers to the retrieval of this	Ivon Miranda Santos

Gourisaria2020- An_Extensive_Review_on_Cloud_Computing	CLOUD MIGRATION PROCESS > Cloud migration	The techniques pertaining to cloud and the different service models serving it are noteworthy. The cloud migration services have been mentioned along with the idea of scheduling algorithms. The potential of XaaS (anything as a service) is remarkable and a prospect of the next	Ivon Miranda Santos
Hajjat2010- Cloudward_bound_Planning_for_beneficial_migration_of	CLOUD MIGRATION PROCESS > Cloud migration	For instance, if traffic is not permitted from certain enterprise users to a server located in the cloud, it is desirable to ensure that the unauthorized traffic is filtered at the enterprise edge itself rather than filter it after it has traversed the wide-area link to the cloud. Finally, the problem is further complicated due to reassignment of IP addresses after migration as is the practice of certain cloud providers today.	Ivon Miranda Santos
Hajjat2010- Cloudward_bound_Planning_for_beneficial_migration_of	CLOUD MIGRATION PROCESS > Process of cloud migration	A database component C_d is easily captured in this model by setting $N_d = 1$, and imposing integrality requirements on n_d . Let P denote a set of policy constraints that govern the migration process.	Ivon Miranda Santos
Hajjat2010- Cloudward_bound_Planning_for_beneficial_migration_of	CLOUD MIGRATION PROCESS > Cloud migration	L, I (TrL, I) and $Tr0$ R, I respectively denote the traffic from the local data center and the cloud to the Internet after (before) migration. We believe a linear cost model for Internet transfers is a reasonable starting point, and it matches the business model of	Ivon Miranda Santos
Hajjat2010- Cloudward_bound_Planning_for_beneficial_migration_of	CLOUD MIGRATION PROCESS > Process of cloud migration	Executing the migration process may involve one-time costs, such as the effort in acquiring model parameters, and reengineering applications for	Ivon Miranda Santos
Hajjat2010- Cloudward_bound_Planning_for_beneficial_migration_of	CLOUD MIGRATION PROCESS > Cloud migration	For example, Fig. 6 shows the hybrid cloud topology based on the migration scenario in Fig. 4.	Ivon Miranda Santos
Hajjat2010- Cloudward_bound_Planning_for_beneficial_migration_of	CLOUD MIGRATION PROCESS > Cloud migration	Fig. 9 presents a CDF of user response times obtained using the cloud test-bed for the scenarios prior to and after migration. The values were obtained over 100 user transactions, with internal and external users simulated using a host in geographical proximity to the data center, and	Ivon Miranda Santos
Hajjat2010- Cloudward_bound_Planning_for_beneficial_migration_of	CLOUD MIGRATION PROCESS > Cloud migration	Model enhancements: While our paper helps better understand cloud migration trade-offs, it is only a start. An important future direction is understanding the impact of migration on application reliability, given the high costs of down-	Ivon Miranda Santos
Hajjat2010- Cloudward_bound_Planning_for_beneficial_migration_of	CLOUD MIGRATION PROCESS > Cloud migration	In this paper, we have made two contributions. First, we have shown (i) the potential benefits of hybrid cloud deployments of enterprise applications compared to "all or nothing" migrations; and (ii) the importance and feasibility of a planned approach to making migration decisions. Second, we have shown the feasibility of automatic and assurable reconfiguration of	Ivon Miranda Santos
Hajjat2010- Cloudward_bound_Planning_for_beneficial_migration_of	CLOUD MIGRATION PROCESS > Benefits of cloud migration	In this paper, we have made two contributions. First, we have shown (i) the potential benefits of hybrid cloud deployments of enterprise applications compared to "all or nothing" migrations; and (ii) the importance and feasibility	Ivon Miranda Santos
Haugeland2021- Migrating_monoliths_to_microservices-based_custom	CLOUD MIGRATION PROCESS > Cloud migration	We illustrate the application of our approach on migrating a reference application of Microsoft called SportStore. Index Terms—Microservices, Migration, Customization, Multi-tenancy, Cloud-native, SaaS	Ivon Miranda Santos
Haugeland2021- Migrating_monoliths_to_microservices-based_custom	CLOUD MIGRATION PROCESS > Multi-cloud migration	We illustrate the application of our approach on migrating a reference application of Microsoft called SportStore. Index Terms—Microservices, Migration, Customization, Multi-tenancy, Cloud-native, SaaS	Ivon Miranda Santos
Haugeland2021- Migrating_monoliths_to_microservices-based_custom	CLOUD MIGRATION PROCESS > Process of cloud migration	C. Migration When migrating software we split the process into three general phases [7]. The initial recovery of functionality, transformation of the current architecture and re-implementation	Ivon Miranda Santos
Haugeland2021- Migrating_monoliths_to_microservices	CLOUD MIGRATION PROCESS > Process of cloud migration	We present the details of our migration process in the following subsections.	Ivon Miranda Santos
Hwang2015- Computing_resource_transformation_and_consolidation_and	CLOUD MIGRATION PROCESS > Cloud migration	Also the various cloud platforms and service models are rarely taken into consideration during the migration analytics. Therefore, although the expectation has risen with various requirements on the target cloud platforms and environments, the cloud migration techniques have not provided enough options that can satisfy the various requirements. In this paper we propose a model to tackle the migration challenges that transform one resource	Ivon Miranda Santos

Hwang2015- Computing_resource_transformation_ consolidation_and_	CLOUD MIGRATION PROCESS > Cloud migration	Also, as the competition becomes stronger, cloud providers increasingly offer more diversified services and they differentiate their catalogs with more advanced service features [3, 4]. A deterrent for enterprise migration to the cloud is a lack of migration planning tools that can scrutinize the discovered on-premise data, provide comprehensive analytical information to reason about why the migration can help reduce operational expenses and increase performance, and finally create a detailed migration plan [5, 6, 7]. Existing tools aim to only provide an one-to-one migration that just copies a source image into a target image, but they do not find themselves as	Ivon Miranda Santos
Hwang2015- Computing_resource_transformation_	CLOUD MIGRATION PROCESS > Process of cloud migration	At each step of migration processes, practitioners have a choice of one or more tools.	Ivon Miranda Santos
Hwang2015- Computing_resource_transformation_ consolidation_and_	CLOUD MIGRATION PROCESS > Process of cloud migration	Post-configuration may involve use of eVault [22] or IBM Tivoli Storage Manager (TSM) [23], further increasing the complexity and number of choices at each step of the migration process [24, 25].	Ivon Miranda Santos
Hwang2015- Computing_resource_transformation_ consolidation_and_	CLOUD MIGRATION PROCESS > Process of cloud migration	Furthermore, the migration process never executes seamlessly in a sequential manner, due to many unanticipated events at each step [26].	Ivon Miranda Santos
Hwang2015- Computing_resource_transformation_ consolidation_and_	CLOUD MIGRATION PROCESS > Cloud migration	Once these high-level attributes are determined, the next step is to use the migration analytics to make the migration plans. In order for the migration analytics to accurately reflect the target cloud environment, we have to understand the target catalogs first. The cloud catalogs include	Ivon Miranda Santos
Hwang2015- Computing_resource_transformation_ consolidation_and_	CLOUD MIGRATION PROCESS > Cloud migration	Menzel et al. [10] present a CloudGenius framework, which automates the decision-making process based on a model, factors and QoS (quality of service) specifically for Web server	Ivon Miranda Santos
Hwang2015- Computing_resource_transformation_ consolidation_and_	CLOUD MIGRATION PROCESS > Process of cloud migration	Hwang et al. [5] propose a comprehensive migration framework that spans an end-to-end migration process from discovery to post-migration	Ivon Miranda Santos
Hwang2015- Computing_resource_transformation_ consolidation_and_	CLOUD MIGRATION PROCESS > Cloud migration	VI. CONCLUSION The enterprise-scale migration analytics provides an effective migration planning capability that can transform resources from on-premise data centers to target clouds. We have described a model to tackle the migration challenges that transform one resource type into same or another	Ivon Miranda Santos
Jambunathan2018- Architecture_decision_on_using_micr oservices_or	CLOUD MIGRATION PROCESS > Cloud migration	Vels University, Chennai, India ykalpanaravi@gmail.com Abstract: Cloud adoption is gaining lots of momentum across the globe and enterprise are focussing not only migration on to cloud but also on developing cloud native application. There are lots of focuses on reducing and optimizing resources and hence developing application in a serverless fashion is going to be the key in the	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	These legacy applications are usually deployed on-premise. In recent years, research in cloud migration has been carried out. However, there is no secondary study to consolidate this research. Objective—This paper aims to identify, taxonomically classify, and systematically compare existing research on cloud migration. Method—We conducted a systematic literature review (SLR) of 23 selected studies, published	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	We classified and compared the selected studies based on a characterization framework that we also introduce in this paper. Results—The research synthesis results in a knowledge base of current solutions for legacy-to-cloud migration. This review also identifies research gaps and directions for future research. Conclusion—This review reveals that cloud migration research is still in early stages of maturity, but is advancing. It identifies the needs for a migration framework to help improving the maturity level and consequently trust into cloud migration. This	Ivon Miranda Santos

Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	<p>The assumption for each of the approaches is that in its initial state, the software application is hosted on-premise in a noncloud environment, for example, on a local server, before the migration is applied to it. Therefore, migration between cloud providers, deployment models, and virtual resources known as live migration is outside the scope of this work.</p> <p>To date, there has not been a systematic literature review (SLR) of research on cloud migration, making it difficult to assess the maturity in general and identifying trends, research gaps, and future dimensions of cloud migration in particular. Moreover, considering the growing demand for migration toward cloud, we need to investigate a research agenda for cloud migration. A SLR identifies, classifies, and synthesizes a comparative overview of state-of-the-research and enables knowledge transfer in the research community [8], [9].</p> <p>We conducted a SLR with the primary objective to identify, taxonomically classify, and systematically compare the existing research focused on planning, executing, and validating migration of</p>	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	<p>. What are the main practical motivations behind legacy migrations to the cloud?</p> <p>142 IEEE TRANSACTIONS ON CLOUD COMPUTING, VOL.</p>	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	<p>What are the existing research themes? And what should form future research dimensions in legacy-to-cloud migration? We followed guidelines in [8], [10]. Our objective is to systematically identify and taxonomically classify available evidence on cloud migration and provide a holistic comparison to analyze potential and limitations of existing research. This provides a systematic overview of current research, focusing on proposed methods, techniques, and solutions in legacy-to-cloud migration. To this end, 23 studies are selected,</p>	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	<p>These dimensions are derived and refined following a qualitative assessment of included studies and a validation of the review protocol [11], some well-known references [12], [1], [3], [5], and our experience with previous SLRs [13], [14]. The research synthesis resulted in a knowledge base [11] of current research approaches, methods, techniques, best practices, and experiences used in legacy-to-cloud migration. This review reveals that cloud migration research is still in a formative stage, but based on evidence gathered, the maturity level is improving. This review identified the need for a standardized</p>	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	<p>The lack of attention to crosscutting concerns and migration execution is also observed. This study also showed a lack of tool support to automate and facilitate cloud migration tasks. The collected data in [11]—as an online literature base—provides a detailed insight and objective</p>	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	<p>Section 3 explains our research methodology, research questions, and scope. Section 4 provides a reference model for state-of-the-research and a characterization scheme for cloud migration. Section 5 presents the results of the</p>	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	<p>2 BACKGROUND AND RELATED WORK</p> <p>In this section, we explore the similarities and differences of SOA and cloud migration to justify why we position our contribution in the SOA migration context (Section 2.1). We then define and position software migration in the context of software maintenance and evolution (Section 2.2).</p>	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	<p>Based on a systematic search (Section 2.4), we link to existing secondary studies for migrating legacy software to SOA (Section 2.3).</p> <p>2.1 SOA versus Cloud Migration: Similarities and Differences</p>	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	<p>Security is often overlooked when deploying SOA services and overstated when using the cloud [16]. In cloud migration, active participation of technical staff is only required as opposed to SOA migration, which require involvement of business stakeholders as well.</p>	Ivon Miranda Santos

Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	2.3 Secondary Studies on Legacy to SOA Migration In recent years, secondary studies have focused on migration to SOA before cloud computing emerged. We did not find any secondary study on cloud migration (see Section 4). On the other hand, according to the discussion in Section 1, SOA and cloud migration are related. Thus, we	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	It also provides details on specific research challenges related to the maintenance and evolution of service-oriented systems. Survey on SOA/Cloud migration. Razavian and Lago [21] pinpoint a potential gap between the	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	[24] observed three different case studies in industry to identify the common migration processes and patterns based on expert interviews. Their work determines common principles that rule cloud migration processes, but also differences between the cloud deployment models. They proposed a process framework for different roles comprising SaaS/PaaS/IaaS	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Process of cloud migration	[24] observed three different case studies in industry to identify the common migration processes and patterns based on expert	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Process of cloud migration	Their work determines common principles that rule cloud migration processes, but also differences between the cloud deployment	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	In terms of the research methodology, the work of Khadka et al. [6] is the closest work to ours; however, we focus on migration to the cloud. In terms of a conceptual framework for characterization of migration approaches, the work of Razavian and Lago [22] is the closest work to ours. Nonetheless, according to the discussion Section 4, we believe that our work is the first attempt to consolidate cloud migration	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	The need for a SLR entails to identify, classify, and compare existing evidence on the migration of legacy software systems to cloud environments through a characterization framework. It exclusively focuses on classification and comparison of cloud migration approaches. To demonstrate that a similar review has not been already reported, we searched the Compendex, IEEE Xplore, ACM, and Google Scholar digital	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	None of the retrieved secondary studies was related to any of our research questions detailed in Section 3. Considering the importance of cloud migration and the relative maturity of this field (see Section 6.1), a consolidation of existing evidence on legacy-to-cloud migration is timely.	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	3 RESEARCH METHODOLOGY Additional details can be found in [11]. 4 AFRAMEWORK FOR CLASSIFICATION AND COMPARISON OF CLOUD MIGRATION RESEARCH In this section, we first introduce a cloud migration reference model for a process-centric classification of cloud migration that can help to demonstrate current research at a conceptual level and identify trends and research directions. The details of this model are discussed in Section 4.1. We then present a framework in Section 4.2. to characterize individual cloud migration approaches that helps us to taxonomically classify and compare the primary studies. 4.1 Cloud-RMM: A Cloud Migration Reference Model As discussed in Section 2.1, SOA and cloud migration are not entirely distinct, but complementary areas (cf. Table 1). By investigating the established reference models and frameworks [25], [6], [26] for SOA migration as well as the commonalities in the primary studies, we derive a reference model as a conceptual framework to represent different process areas in cloud migration studies. The aim of this reference	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Process of cloud migration	By investigating the established reference models and frameworks [25], [6], [26] for SOA migration as well as the commonalities in the primary studies, we derive a reference model as a conceptual framework to represent different	Ivon Miranda Santos

Jamshidi2013-Cloud_migration_research_A_systematic_review	CLOUD MIGRATION PROCESS > Cloud migration	4.1.2 Cloud-RMM Reference Model We now introduce a conceptual model called Cloud-Reference Migration Model (Cloud-RMM), which represents a reference model to classify research in terms of distinct processes and crosscutting concerns. To develop a reference model for legacy-to-cloud, we first need to adopt a method to formally represent the conceptual model. Based on previous experience [19], we adopt situational method engineering [28] to consolidate existing frameworks in cloud migration (e.g., CloudMIG [S20], CMotion [S8], CloudGenius	Ivon Miranda Santos
Jamshidi2013-Cloud_migration_research_A_systematic_review	CLOUD MIGRATION PROCESS > Cloud migration	Note that the notation [Sn] (n is a number) represents a reference to studies included in the SLR, listed in Table 14. We identify the key processes related to cloud migration. In method engineering, one can follow a bottom-up approach by identifying low-level activities and techniques and then categorize them to form generalized	Ivon Miranda Santos
Jamshidi2013-Cloud_migration_research_A_systematic_review	CLOUD MIGRATION PROCESS > Cloud migration	Fig. 4 represents the Cloud-RMM migration framework, which consists of four processes and 20 migration tasks. Any activities within the scope of porting a software system (or a part of the system) from on-premise hosts such as local data centers to selected cloud platforms preserving the core functionalities are regarded as migration tasks.	Ivon Miranda Santos
Jamshidi2013-Cloud_migration_research_A_systematic_review	CLOUD MIGRATION PROCESS > Process of cloud migration	4 represents the Cloud-RMM migration framework, which consists of four processes and 20	Ivon Miranda Santos
Jamshidi2013-Cloud_migration_research_A_systematic_review	CLOUD MIGRATION PROCESS > Process of cloud migration	Process I. Migration planning.	Ivon Miranda Santos
Jamshidi2013-Cloud_migration_research_A_systematic_review	CLOUD MIGRATION PROCESS > Process of cloud migration	In the first process, pre-liminary migration tasks such as feasibility study [S8] [S10] [S11] [S12] [S21], migration requirement analysis [S8] [S13] [S14] [S17], as well as some decision making regarding which provider to choose [S1] [S2] [S5] [S10] [S11] [S14] [S23], which subsystems to be migrated [S1] [S10] [S11] [S13] [S22], and which cloud services to use [S4] [S6] [S9] [S10] [S11] [S23], and migration strategy development [S8]	Ivon Miranda Santos
Jamshidi2013-Cloud_migration_research_A_systematic_review	CLOUD MIGRATION PROCESS > Cloud migration	According to Fig. 4, test, architecture recovery, and decision of cloud providers are the most common migration tasks and crosscutting tasks as well as architecture adaptation are the least popular tasks among the primary studies. In terms of automated support, for processes I and III, there is satisfactory evidence, but for process II and crosscutting concerns, the evidence amount is	Ivon Miranda Santos
Jamshidi2013-Cloud_migration_research_A_systematic_review	CLOUD MIGRATION PROCESS > Cloud migration	This reference model helps to conceptualize a process-centric view for state-of-the-research and literature classification into processes and associated tasks. Cloud-RMM can distinguish solutions for migration. 4.2 A Characterization Framework for Cloud Migration In this section, we present a framework consisting of 12 data items to characterize approaches that enable legacy migration toward cloud-based	Ivon Miranda Santos
Jamshidi2013-Cloud_migration_research_A_systematic_review	CLOUD MIGRATION PROCESS > Cloud migration	5.1 Overview of the Primary Studies To examine the state of research on cloud migration, the following complementary questions are considered: . When did research on cloud migration become active in computing community? . What are the fora in which work on cloud migration has been	Ivon Miranda Santos
Jamshidi2013-Cloud_migration_research_A_systematic_review	CLOUD MIGRATION PROCESS > Cloud migration	. What are the active research communities and groups in cloud migration research? . How cloud migration research is reported and what is the maturity level of the research in this field? 148 IEEE TRANSACTIONS ON CLOUD COMPUTING, VOL.	Ivon Miranda Santos
Jamshidi2013-Cloud_migration_research_A_systematic_review	CLOUD MIGRATION PROCESS > Cloud migration	5. The work in cloud migration started with experiences with small case studies [S7] in 2010. This is complemented by a variety of contributions enabling migration (e.g.,	Ivon Miranda Santos
Jamshidi2013-Cloud_migration_research_A_systematic_review	CLOUD MIGRATION PROCESS > Cloud migration	, migration decision support [S3]). For the last two years with good evidence of cloud migration approaches, the trend continues with quite mature best practice and surveys [S8]. 5.1.2 Publication Fora	Ivon Miranda Santos

Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	Restrictions apply.5.1.4 Research Methods for Cloud Migration Since the included studies are peer reviewed, data about research methods (comprising contribution type and evaluation method) adopted have been	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	Based on the analysis of Fig. 6, we can conclude that the largest set of contributions in the legacy-to- cloud migration relates to solution proposals (65 per-cent). Experience report and evaluation research are, respectively, associated with 22 and	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	7 indicates there is a clear lack of mathematical proofs, survey, and experience reports and evaluation approaches in the selected studies. 5.2 A Taxonomical Classification and Comparison of Cloud Migration Methods and Techniques The results of study syntheses are now summarized to answer the primary research	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	The characteriza-tion framework, introduced in Section 4, is used as a holistic framework for taxonomical classification and comparison. 5.3 Primary Drivers for Cloud Migration We answer RQ1 to identify primary motivations for cloud adoption. Based on data synthesis, we identified three primary factors that drive migration to the cloud, see Fig. 8:	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	We answer RQ2 by illustrating different migration types. The other part of this question regarding involved migra-tion tasks is already answered through the Cloud-RMM framework in Section 4.1.2). To distinguish between different types of migration, we borrowed the classification	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	Fig. 9), partly because this type of migration is regarded as a cloud enhancing treatment around on-premise legacy application, rather than a pure cloud enabling [32]. This type of migration requires a series of reconfigurations to adjust incompatibilities to use functionalities of the ported	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	This type of migration needs no adaptation assuming the application stack can be ported "as is" into a virtual machine. Type IV (cloudify) is the most complete migration, where an application is converted to a full-fledged cloud-enabled system by composing cloud services [S1] [S2] [S3] [S8] [S9] [S11] [S13] [S19] [S20] [S23]. Types IV and II are similar, but the scope of migration in type II is limited to selected	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	5.4.1 Methods, Techniques and Tool Support for Cloud Migration We answer RQ3 by exploring approaches that support cloud migration. Tables 10, 11, and 12 present the classification of studies according to	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	Since the items related to the migration support theme are not related to experience reports, we do not consider them in Table 11. Decision support in migration processes covers tasks to facilitate decision making, such as the study of migration feasibility, deciding which subsys-tem to be migrated or which cloud provider to choose (see Table 10). Migration execution comprises tasks that enable the actual migration of a legacy	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	A summary of experience reports on cloud migration can be found in Table 12. Cloud migration approaches range from decision making to enabling legacy software migration with approaches report-ing best practice, experience, and lessons learned in between. Decision making for cloud adoption [S1] [S3] [S4] [S5] [S10] [S11] [S12] [S14] [S16] [S18] [S20] [S21] [S22] [S23] is	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	Migration type IV (i.e., cloudify) represent a minority type in this migration class. A fair percentage of the studies in this class (i.e.,	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	Migration techniques. According to Table 11, only four studies are categorized as enabling cloud migration. Within this class, architecture extraction, test, code modification, and transformation are the most common migration	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	, 39 percent) provide a degree of automa-tion. Five studies [S1] [S3] [S20] [S22] [S23] provide full automation for cloud migration approaches they are presenting. For example, [S20] is a fully automated approach for conformance checking in cloud migration	Ivon Miranda Santos

Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	TABLE 12 Characterization of Legacy Software Migration toward Cloud (Summary of Evaluation Research and Experience Reports) Fig.	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	The techniques in 10 studies [S5] [S10] [S11] [S12] [S13] [S14] [S16] [S17] [S18] [S19] were fully manual. For instance, [S18] presented a methodology for estimating the size of cloud migration projects based on function points, in which the data for model estimation had to be manually provided. The remaining four studies [S6] [S7] [S8] [S9] were not directly involved with specific solutions, but with other aspects of	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	6 RESEARCH IMPLICATIONS AND FUTURE DIMENSIONS We have presented a systematic review to analyze the collective coverage and impact of research that enables or enhances cloud migration. We classified and compared existing work in Section 5 to answer the first three research questions	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	We first discuss the maturity level of research in Section 6.1, after which we summarize research progress and principle findings to highlight trends and possible future research. Finally, we look at the key benefits of this study for researchers and practitioners in cloud migration in Section 6.3. 6.1 Maturity of Cloud Migration Research We show an overview of evidence gathered from the analysis of cloud migration in three different facets in Fig. 11.	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	There are 12 articles out of 23 where the contribution type is a specific solution technique; its means of migration is meant to support decision making in a migration process. We use this map to discuss the maturity of cloud migration based on our systematic review. Fig. 11 shows there are contributions to cloud migration research primarily proposing migration decision support. To date, a controlled experiment is the most adopted evaluation method, but there	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Process of cloud migration	There are 12 articles out of 23 where the contribution type is a specific solution technique; its means of migration is meant to support	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	Fig. 11 also indicates that the field is in a formative stage—experience report and evaluation research that determine cloud migration applicability in an industrial context are lacking. However, we retrieved a number of whitepapers and technical reports that are adopted in industry, but since they lack scientific rigor, we excluded	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	The growing maturity level. Although we observed that the maturity of cloud migration is in a formative stage, however, we can note a clear growth in maturity. As another sign of improvement, all types of migration (as discussed	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	We can conclude that conducting validation research across all types of contributions is an area that still needs attention. In addition, more research results on cloud migration evaluation with real-world case studies and experience reports are needed. More case studies will result in more confidence of researchers and practitioners regarding the benefits of cloud migration and the validity of research. One dimension that is a future direction for cloud migration studies is the importance of open	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	We provided a reference model in Section 4.1. However, the research community needs to propose a cloud migration framework such as the ones that we reviewed in Section 3 for SOA migration with concrete evidence of solutions in terms of methods and techniques supporting the process areas. A migration framework defines a systematic process to perform the migration, while evidence defines concrete tasks, methods, and	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Process of cloud migration	A migration framework defines a systematic process to perform the migration, while evidence defines concrete tasks, methods, and techniques.	Ivon Miranda Santos

Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	This indicates a lack of comprehensive evidence for tasks and methods to support the migration framework above. Therefore, research re-garding crosscutting concerns covering all processes can be considered as a future dimension for cloud migration.	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system	CLOUD MIGRATION PROCESS > Process of cloud migration	Automated support in migration process.	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	The needs for architectural adaptation support. In the context of cloud migration, different layers of software cannot be considered isolated from each other. More concretely adapting business processes, for example, to move parts to the cloud, may affect underlying services and	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Process of cloud migration	The characterization framework (Section 4) provides a holistic view of different migration aspects to be considered in the context of the	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	As a result, the user can query and analyze the knowledge base to choose a migration strategy based on his requirements, for example, <Subject: Legacy to Cloud Migration> [Object: using Model Transformation] (Type of Environment: IaaS,	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	Style-agnostic, Target Platform: platform agnostic). This is beneficial for researchers who require a quick identification of relevant studies and detailed insight into state of the art that supports cloud migration, but also for practitioners inter-ested in understanding existing methods for migration decision support or legacy migration. When choosing a method for migration, a variety	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	This might impose a higher risk for business critical systems and a higher cost for enterprise systems than replacing them entirely with a cloud-native application [23]. In summary, there is no single solution to the problem of migration a legacy system to the cloud. The choice of method for migration depends on the goals, the available budget and resources, and the time needed to	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	In our search strategies, the key idea was to retrieve as much as possible of the available literature to avoid any bias. Another challenge in addressing these threats was to determine the scope of our study, since cloud migration relates to different communities including software engineering, information systems, and networks. These communities use different terminologies for	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	8 CONCLUSIONS The objective of this study was to consolidate existing research on legacy software migration to the cloud regard-ing the claimed benefits and the provided evidence of migration. The main contribution of this study is a characterization framework for cloud migration and a comparison of systematically selected studies through the framework to point out existing research gaps. We identified unexplored areas by synthesizing	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Benefits of cloud migration	The objective of this study was to consolidate existing research on legacy software migration to the cloud regard-ing the claimed benefits and the provided evidence of migration.	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	The results of classification and comparison are presented as structure tables and visual diagrams—as a means to transfer knowl-edge among cloud computing researchers and practitioners about a collective impact of existing research. We have extracted the core migration processes with specific tasks to define cloud migration	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system	CLOUD MIGRATION PROCESS > Process of cloud migration	We have extracted the core migration processes with specific tasks to define cloud migration	Ivon Miranda Santos

Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Cloud migration	Section 5.2.3 has in detail identified methods and techniques used. This allows comparing and differentiating cloud from SOA migration, which becomes evident in terms of the need to consider a layered cloud stack or the importance of specific targeted platforms or the different configuration of the migration process stages, where particularly the migration execution requires techniques different from SOA that establishes cloud migration as a concern in its own right. The field is still in a formative stage, but stabilizing. We identified a need for a concrete migration framework to enable systematic migration to the cloud. Our study indicates that crosscutting concerns are not adequately addressed. We also observed a lack of tool support for enhancing cloud migration. An interesting observation also	Ivon Miranda Santos
Jamshidi2013- Cloud_migration_research_A_system atic_review	CLOUD MIGRATION PROCESS > Process of cloud migration	This allows comparing and differentiating cloud from SOA migration, which becomes evident in terms of the need to consider a layered cloud stack or the importance of specific targeted platforms or the different configuration of the migration process stages, where particularly the migration execution requires techniques different from SOA that establishes cloud migration as a	Ivon Miranda Santos
Jamshidi2015- Cloud_migration_patterns_A_multi- cloud_service_arc	CLOUD MIGRATION PROCESS > Cloud migration	Many organizations migrate their on-premise software systems to the cloud. However, current coarse-grained cloud migration solutions have made a transparent migration of on-premise applications to the cloud a difficult, sometimes trial-and-error based endeavor. This paper suggests a catalogue of fine-grained service-based cloud architecture migration patterns that target multi-cloud settings and are specified with architectural notations. The proposed migration patterns are based on empirical evidence from a number of migration projects, best practices for cloud	Ivon Miranda Santos
Jamshidi2015- Cloud_migration_patterns_A_multi- cloud_service_arc	CLOUD MIGRATION PROCESS > Cloud migration	Keywords: Cloud architecture □ Cloud migration □ Migration pattern □ Multi-cloud 1 Introduction Cloud migration [1] benefits from the cloud promise of converting capital expenditure to operational cost [2]. Mixing cloud architecture with private data centers adds operational efficiency for workload bursts while legacy systems [3] on-premise still support core business services.	Ivon Miranda Santos
Jamshidi2015- Cloud_migration_patterns_A_multi-	CLOUD MIGRATION PROCESS > Benefits of cloud migration	Cloud migration [1] benefits from the cloud promise of converting capital expenditure to	Ivon Miranda Santos
Jamshidi2015- Cloud_migration_patterns_A_multi- cloud_service_arc	CLOUD MIGRATION PROCESS > Cloud migration	Current migration solutions are coarse-grained, making detailed planning difficult. For these cloud migration processes [1], a migration plan as a verifiable artefact is not considered. The plan is prepared at either a very broad strategic level with no technical value or very thorough and technical not suitable for non-technical stakeholders.	Ivon Miranda Santos
Jamshidi2015- Cloud_migration_patterns_A_multi-	CLOUD MIGRATION PROCESS > Process of cloud migration	For these cloud migration processes [1], a migration plan as a verifiable artefact is not	Ivon Miranda Santos
Jamshidi2015- Cloud_migration_patterns_A_multi-	CLOUD MIGRATION PROCESS > Process of cloud migration	Thus, the repeatability of migration processes decreases.	Ivon Miranda Santos
Jamshidi2015- Cloud_migration_patterns_A_multi- cloud_service_arc	CLOUD MIGRATION PROCESS > Cloud migration	We report on 9 fine-grained core and 6 variant cloud-specific architecture migration patterns, extracted based on empirical evidence from a number of migration projects [5], best practice for cloud architectures [4, 6] and a systematic literature review [1]. Our main contribution is a set of fine-grained service-oriented migration fragments that allows application developers and architects to plan the migration and communicate	Ivon Miranda Santos
Jamshidi2015- Cloud_migration_patterns_A_multi- cloud_service_arc	CLOUD MIGRATION PROCESS > Cloud migration	A migration plan is defined as a composition of selected patterns for specific situations. Cloud migration methods define activities to plan, execute and evaluate migration [7]. To account for the situational context of applications, e.g.,	Ivon Miranda Santos
Jamshidi2015- Cloud_migration_patterns_A_multi- cloud_service_arc	CLOUD MIGRATION PROCESS > Cloud migration	This allows creating a migration plan from scratch by combining existing migration building blocks in the form of migration patterns. The usability of the approach is evaluated through a cloud migration case study at the end. 2 Background We first introduce architecture migration patterns and the multi-cloud deployment setting.	Ivon Miranda Santos
Jamshidi2015- Cloud_migration_patterns_A_multi-	CLOUD MIGRATION PROCESS > Multi-cloud migration	migration	Ivon Miranda Santos

Jamshidi2015-Cloud_migration_patterns_A_multi-	CLOUD MIGRATION PROCESS > Multi-cloud migration	multi-cloud	Ivon Miranda Santos
Jamshidi2015-Cloud_migration_patterns_A_multi-cloud_service_arc	CLOUD MIGRATION PROCESS > Cloud migration	3 Research Methodology The first step to identify migration patterns was to identify the concerns of organizations moving on-premise applications to the cloud. We have identified four categories based on feedback from industry partners in our IC4 research centre [5]: We used focus groups to identify migration process concerns.	Ivon Miranda Santos
Jamshidi2015-Cloud_migration_patterns_A_multi-	CLOUD MIGRATION PROCESS > Process of cloud migration	Through migration expert interviews, we looked at common processes for migration towards cloud as a framework for more fine-grained patterns.	Ivon Miranda Santos
Jamshidi2015-Cloud_migration_patterns_A_multi-cloud_service_arc	CLOUD MIGRATION PROCESS > Process of cloud migration	(2) modernization performed primarily for technical reasons resulting in sub-optimal response to business change, (3) architectures determined bottom-up from existing APIs and transactions may need re-evaluation for multi-clouds.	Ivon Miranda Santos
Jamshidi2015-Cloud_migration_patterns_A_multi-cloud_service_arc	CLOUD MIGRATION PROCESS > Cloud migration	4 Cloud Architecture Migration Patterns Some applications are integrated and support core business processes and services, but many of them support utility needs, are certainly non-core	Ivon Miranda Santos
Jamshidi2015-Cloud_migration_patterns_A_multi-cloud_service_arc	CLOUD MIGRATION PROCESS > Process of cloud migration	To enable migration planning as a tractable process, appropriate building blocks have to be selected and combined.	Ivon Miranda Santos
Jamshidi2015-Cloud_migration_patterns_A_multi-cloud_service_arc	CLOUD MIGRATION PROCESS > Cloud migration	The usability of the migration patterns shall be evaluated through a case study. We use a sample migration project based on our work with Microsoft Azure as a PaaS cloud for illustration and validation. This project acts as a representative for a range of migrations we examined (and for the	Ivon Miranda Santos
Jamshidi2015-Cloud_migration_patterns_A_multi-	CLOUD MIGRATION PROCESS > Process of cloud migration	, different IaaS/PaaS/SaaS migration processes [5].	Ivon Miranda Santos
Jamshidi2015-Cloud_migration_patterns_A_multi-cloud_service_arc	CLOUD MIGRATION PROCESS > Cloud migration	7 Related Work We conducted a review [1] aiming to identify, taxonomically classify, and systematically compare the existing research focused on planning, executing, and validating migration of legacy systems towards cloud-based software based on earlier architecture evolution work [13]. We found a lack of repeatable and verifiable practices as one of the key reasons that cloud migration is not a fully mature domain. In the context of the Cloud-RMM migration framework [1], our work here can be categorized as a contribution to migration planning. Cloud migration approaches range from decision making to enabling legacy software migration with	Ivon Miranda Santos
Jamshidi2015-Cloud_migration_patterns_A_multi-cloud_service_arc	CLOUD MIGRATION PROCESS > Cloud migration	The objective there was mainly classification of existing best practice into migration strategies. The key advantage and novelty of our work, more than a set of patterns, is the notion of assembly-based situational migration at the architecture level, specifically towards pattern-based migration planning for multi-cloud deployment. It enhances the state-of-the-art by a tractable planning	Ivon Miranda Santos
Jamshidi2015-Cloud_migration_patterns_A_multi-	CLOUD MIGRATION PROCESS > Multi-cloud migration	migration	Ivon Miranda Santos
Jamshidi2015-Cloud_migration_patterns_A_multi-	CLOUD MIGRATION PROCESS > Multi-cloud migration	multi-cloud	Ivon Miranda Santos
Jamshidi2015-Cloud_migration_patterns_A_multi-cloud_service_arc	CLOUD MIGRATION PROCESS > Cloud migration	8 Conclusion and Outlook We identified cloud migration patterns, which in combination allow planning the migration of applications for multiple cloud platform deployment. The introduction of migration patterns complements existing migration practices and allows for an engineering approach towards	Ivon Miranda Santos
Jamshidi2015-Cloud_migration_patterns_A_multi-cloud_service_arc	CLOUD MIGRATION PROCESS > Multi-cloud migration	8 Conclusion and Outlook We identified cloud migration patterns, which in combination allow planning the migration of applications for multiple cloud platform deployment. The introduction of migration patterns complements existing migration practices and allows for an engineering approach towards	Ivon Miranda Santos
Jamshidi2015-Cloud_migration_patterns_A_multi-cloud_service_arc	CLOUD MIGRATION PROCESS > Process of cloud migration	The migration patterns are reusable and composable architectural change patterns that we see as building blocks of an overall migration process, reflected through a migration plan as a	Ivon Miranda Santos
Jamshidi2015-Cloud_migration_patterns_A_multi-cloud_service_arc	CLOUD MIGRATION PROCESS > Process of cloud migration	To demonstrate the usability and completeness of the patterns beyond business-oriented SaaS and standard PaaS-level services such as storage, currently we are in the process of evaluating others for migration planning in three cases with	Ivon Miranda Santos

Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	10.1002/spe.2442 Pattern-based multi-cloud architecture migration Pooyan Jamshidi1,*,†, Claus Pahl2 and Nabor C. Mendonça3	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	10.1002/spe.2442 Pattern-based multi-cloud architecture migration Pooyan Jamshidi1,*,†, Claus Pahl2 and Nabor C. Mendonça3	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	Many organizations migrate on-premise software applications to the cloud. However, current coarse-grained cloud migration solutions have made such migrations a non transparent task, an endeavor based on trial-and-error. This paper presents Variability-based, Pattern-driven Architecture Migration .V-PAM), a migration method based on (i) a catalogue of fine-grained service-based cloud architecture migration patterns that target multi-cloud, (ii) a situational migration process framework to guide pattern selection and composition, and (iii) a variability model to structure system migration into a coherent framework. The proposed migration patterns are based on empirical evidence from several migration projects, best practice for cloud architectures and a systematic literature review of existing research. Variability-based, Pattern-driven Architecture Migration allows an organization to (i) select appropriate migration patterns, (ii) compose them	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	V-PAM), a migration method based on (i) a catalogue of fine-grained service-based cloud architecture migration patterns that target multi-cloud, (ii) a situational migration process framework to guide pattern selection and composition, and (iii) a variability model to structure system	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	multi-cloud	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	migration	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	migration	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	Received 23 December 2015; Revised 17 August 2016; Accepted 29 August 2016 KEY WORDS: cloud architecture; microservice architecture; cloud migration; migration pattern; multi-cloud; situational method engineering;	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	Received 23 December 2015; Revised 17 August 2016; Accepted 29 August 2016 KEY WORDS: cloud architecture; microservice architecture; cloud migration; migration pattern; multi-cloud; situational method engineering;	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	INTRODUCTION The migration of V-PAM software applications to the cloud [1] enables to benefit from the cloud promise of converting capital expenditure to operational cost [2]. Mixing cloud architecture with private data centers adds operational efficiency for workload bursts while legacy systems on-premise	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Benefits of cloud migration	The migration of V-PAM software applications to the cloud [1] enables to benefit from the cloud promise of converting capital expenditure to	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	Instead of re-architecting applications, they can be re-hosted from on-premise to possibly multiple cloud offerings, either private or public ones. We are concerned with the migration of legacy on-premise software to multi-cloud architectures. According to a Gartner report [4], multicloud strategies will become common for 70 percent of migration	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	multi-cloud	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	Cloud-based applications must be resilient to the loss of a single data center or cloud provider. Current cloud migration methods are coarse-grained, making detailed planning difficult. In particular, existing cloud migration processes do not consider a migration plan as a verifiable multi-step artifact [1]. The plan is prepared at either a very broad strategic level with no technical reference or	Ivon Miranda Santos

Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	Current cloud migration methods are coarse-grained, making detailed planning difficult. In particular, existing cloud migration processes do not consider a migration plan as a verifiable multi-step artifact [1]. The plan is prepared at either a very broad strategic level with no technical reference or	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	In particular, existing cloud migration processes do not consider a migration plan as a verifiable multi-step artifact [1].	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	Thus, the repeatability of those migration processes is limited.	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	A migration process to explicitly guide activities that include migration planning and execution via a repeatable and transparent pattern selection and	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	, cloud platforms or on-premise platform), while preserving and in most cases enhancing the desired properties of the application. In this paper, we present V-PAM (Variability-based, Pattern-driven Architecture Migration), a cloud architecture migration method, see Figure 1. V-PAM defines activities to plan and execute cloud migration [7] based on the concept of patterns or templates, here describing the entities involved in the process. To account for the situational context of applications, for example, security, performance, availability needs, existing approaches suggest a trade-off between flexibility, and ease of migration using a fixed set of	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	This allows creating a migration plan from scratch by combining existing migration building blocks in the form of migration patterns. We present nine core and six variant cloud-specific architecture migration patterns, extracted based on empirical evidence from a number of migration projects [10], best practice for cloud architectures [5, 11] and a systematic literature review [1]. Our main contribution is a set of fine-grained service-oriented migration patterns, framed in a migration process, that allows architects (i) to plan the migration based on patterns and (ii) communicate the migration plan	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	Our main contribution is a set of fine-grained service-oriented migration patterns, framed in a migration process, that allows architects (i) to plan the migration based on patterns and (ii) communicate the migration plan and the decision	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	The pattern selection and migration plan formulation is embedded into an overarching migration process [12] and a variability model [13] that has been repurposed to support the pattern	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	PATTERN-BASED MULTI-CLOUD ARCHITECTURE MIGRATION 1161 The usability of the approach is then evaluated through a cloud migration case study in Section 7, before ending with related work (Section 8) and conclusions (Section 9).	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	RESEARCH METHODOLOGY The first step to determine a migration process and patterns was to identify the concerns of organizations moving on-premise applications to the cloud. We have identified four categories based on feedback from industry partners in IC4 research	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	The first step to determine a migration process and patterns was to identify the concerns of organizations moving on-premise applications to the	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	We use three methods to determine process and patterns under consideration of the key migration	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	We used focus groups to identify migration process concerns.	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	The organizations involved were consultants for Small and medium-sized enterprises (SMEs) migration and larger multi-nationals; technology providers and systems integrators [10, 14]. Through migration expert interviews, we looked at common processes for migration towards cloud as a framework for more fine-grained patterns.	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	Through migration expert interviews, we looked at common processes for migration towards cloud as a framework for more fine-grained patterns.	Ivon Miranda Santos

Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	We recorded existing cloud design and architecture patterns [5, 11]. A major role in this process was played by a SLR on cloud migration [1]. We detected shortcomings associated with these design patterns when we applied them in	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	SITUATIONAL DESCRIPTION AND PROCESS MODEL Central activities of the overall migration process are the guided identification and analysis of factors that might influence the selection of the cloud architecture and the planning of the migration	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	Central activities of the overall migration process are the guided identification and analysis of factors that might influence the selection of the cloud architecture and the planning of the migration	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	The situational migration description and process model.	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	Once the entity profiles are created, the next step is an analysis to identify potential migration risks and constraints and map them onto architectural patterns. The situational description process is organized into nine activities – from the definition of pro-files to the actual migration of the application to the cloud, see Figure 2. Please note that we do not	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	The situational description process is organized into nine activities – from the definition of pro-files to the actual migration of the application to the	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	One of the key reasons that we selected the process model in [12] in this paper is that it covers all the migration processes (including planning, execution, evaluation, and crosscutting concerns) in the Cloud-RMM reference framework [1].	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	Usage characteristics refer to features of the application related to its use and operation. The aim is to identify key functional and non-functional aspects of the application possibly affecting its migration to the cloud, such as:	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	We propose a set of constraint types, see Figure 3, that a developer should define and evaluate. We have extracted seven main constraint types based on reviews of cloud migration approaches (e.g., [1, 7, 16–21]), and on our on experience in deploying real-word applications in the cloud [22].	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	Define migration plan and perform migration Finally, the definition of a migration plan combine all the concerns raised during the situational capture process. This process starts with a collection and preparation exercise of relevant information for decision making about the cloud migration. Constraints need to be addressed by either finding solutions or by circumventing them. At the core of the method, which we detail over the next three sections for a multi-cloud setting, is a collection of architecture-oriented migrations patterns that help to manage and find solutions for the technical constraints in particular. Using a variability	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	Define migration plan and perform migration Finally, the definition of a migration plan combine all the concerns raised during the situational cap-	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	multi-cloud	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	migration	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	To match these requirements and dimensions, we identified 15 suitable patterns, reported in [23]. The key reasons behind a multi-cloud migration are already indicated in the situational description and process model captured in the organization, application and platform profiles: Location.	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	multi-cloud	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	migration	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	To address the challenges identified here and allow to guide the architecture migration process, we define an orthogonal variability model, as we	Ivon Miranda Santos

Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	Furthermore, all variations in VM functionality are related to at least one variation point in either VM platform or VM access. The 3-pronged variability model is loosely based on other established models, combined here to specifically address the cloud migration concerns: VM platform is based on the OVM Orthogonal Variability Model [27], which allows us to use a simpler model that does not model commonality.	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	We need a customization process – part of the last process stage of the situational migration plan	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	Architecture migration is a special step in the overall migration process that is organised around the application of migration patterns.	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	The variability model helps to map the profiles and constraints from the process model onto the patterns. We first introduce the structure and content of architecture migration patterns and the multi-cloud deployment setting before providing a more comprehensive catalogue of patterns in the next section. 5.1. Migration patterns in multi-cloud setting Our migration patterns are sequences of architectural changes (refactoring) in the application deployment setting, through which the migration	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration		Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	multi-cloud	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	Migration	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	multi-cloud	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	These can be coordination services that orchestrate different components in larger compartments or simply configurable IaaS resources providing required operating system or storage features. After migration, this component, instead of using on-premise platforms, uses services offered by a public cloud platform. Thus, the application component is re-deployed as-is on a	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	5.3. Cloud architecture migration patterns To obtain unambiguous pattern descriptions and to ground pattern-based migration planning in the description, process and variability models, we use a template-based definition of migration patterns. This definition is based on the semantics of architectural schematics before and after migration.	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	Cloud architecture migration patterns To obtain unambiguous pattern descriptions and to ground pattern-based migration planning in the description, process and variability models, we use a template-based definition of migration patterns.	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	The description of the situational context through profiles and constraints leads to a selection of patterns that need to be assembled into a staged architecture migration process.	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	The usability of the migration patterns in the V-PAM method shall be validated through a case study. We use a sample migration project based on our work with Microsoft Azure as a PaaS cloud for illustration and validation [30]. This project acts as a representative for a range of migrations, we examined (and for the latter two categories also	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	Thus, we need to demonstrate two important properties: firstly, the utility of all patterns applied in the migration process and, secondly, also that the set is sufficiently complete to model a range of	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	Another goal is portability, that is, it can be moved between a public cloud platform and a private data center without modification to application code or operations. Furthermore, a tractable migration plan to the cloud platform is essential. 7.2.	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	The migration plan follows the process defined in Section 3.	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	However, we have analyzed and considered other migration projects, for example, different IaaS/PaaS/SaaS migration processes [10].	Ivon Miranda Santos

Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	We conducted a literature review [1] aiming to identify, taxonomically classify, and systematically compare the existing research focused on planning, executing, and validating migration of legacy systems towards cloud computing platforms based on earlier architecture evolution work [33]. We found a lack of repeatable and verifiable practices as one of the key reasons that cloud migration is not a fully mature domain. In the context of the Cloud-RMM migration framework [1], our work here can be categorized as a contribution to migration planning. Cloud migration is a form of software modernization [34]. As a consequence, it requires sound continuous development frameworks with methodologies and patterns, languages and tool support [35]. Cloud migration frameworks. Cloud migration approaches range from decision making to	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	Some other work reports on lessons learned and best practices from real migration case studies (e.g., [16, 24, 41]) — providing empirical evidence for further cloud migration research. Our work is complementary to those approaches, as none of them provides a variability-driven planning solution based on a constructive pattern catalogue, and which is particularly suited to support migration decisions targeting multi-cloud architectures. Cloud migration patterns. A number of migration strategies and best practices have been sug-	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	migration	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	multi-cloud	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	The objective there was mainly classification of existing best practice into migration strategies. The key advantage and novelty of our work, more than a set of patterns, is the notion of assembly-based situational migration at the architecture level, specifically towards pattern-based migration planning for multi-cloud deployment. It enhances the state-of-the-art by proposing a tractable planning approach based on composable patterns. A pattern catalogue for cloud migration is proposed in [11, 26], but it differs from our approach in at least two important ways. First, the patterns in their work is mainly development patterns that are useful for application developers,	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	migration	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Multi-cloud migration	multi-cloud	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	, non-cloud based) and target (i.e., cloud-based) architectures of our architectural migration patterns.	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	Models play a central role to capture the essential structure and qualities of architectures in the ARTIST approach. This allows for model transformation techniques to be utilised as part of the cloud migration process [45]. In this regard, the ARTIST approach is more geared towards the execution and verification of actual migrations than our solution, which provides a cloud migration analysis and planning tool. Models at runtime can be used to coordinate the continuous deployment of services in the cloud, as proposed by the MODACLOUDS project in	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	This allows for model transformation techniques to be utilised as part of the cloud migration process	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	While the two solutions coincide in their aim to define a migration plan (the process model in our case), our solution focuses on the combination of variability modeling and patterns to plan and reason about the required architectural transformations. Microservice migration Microservices have been discussed recently as an architectural style suitable to design, deploy, and manage services in the cloud [31, 47]. In [32], we have reported our	Ivon Miranda Santos

Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	While the two solutions coincide in their aim to define a migration plan (the process model in our case), our solution focuses on the combination of variability modeling and patterns to plan and reason about the required architectural	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Cloud migration	CONCLUSION AND OUTLOOK We have presented a cloud migration method – V-PAM for Variability-based, Pattern-driven Architecture Migration – built around architecture change patterns, which allows planning the migration of applications for multiple cloud platform deployment. The introduction of migration patterns complements existing migration practices and allows for an engineering approach towards	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	The migration patterns are reusable and composable architectural change patterns that we see as building blocks of an overall migration process, reflected through a migration plan as a	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	The migration process needs to rely on a combination of suitably selected and properly	Ivon Miranda Santos
Jamshidi2017-Pattern-based_multicloud_architecture_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	To demonstrate the usability and completeness of the patterns beyond business-oriented SaaS and standard PaaS-level services such as storage, currently we are in the process of evaluating others for migration planning in three cases with	Ivon Miranda Santos
Kratzke2017-Understanding_cloud-native_applications_after_10_years	CLOUD MIGRATION PROCESS > Cloud migration	Softwarization of infrastructures should be strived for to support DevOps principles more consequently. Operation of CNAs in multi- and hybrid clouds should be supported by applying migration and interoperability principles. CNA architecture include general CNA design aspects like service-oriented architecture approaches (particular the microservice architecture approach) as well as accompanying service	Ivon Miranda Santos
Lahmar2018-Multicloud_service_composition_Analysis_of_current_state	CLOUD MIGRATION PROCESS > Cloud migration	Furthermore, some selected services from a single cloud cannot totally satisfy the user requirements, such as security and compliance or business and technical needs.50 This is why services used in the composition process must be combined from several clouds. The migration from a single-cloud service composition to the MCSC has multiple reasons, among which we can quote especially the limited utility in the single cloud and the improved QoS levels when composing services from multiple clouds. The latter allow better satisfying the users' QoS	Ivon Miranda Santos
Lahmar2018-Multicloud_service_composition_Analysis_of_current_state	CLOUD MIGRATION PROCESS > Multi-cloud migration	Furthermore, some selected services from a single cloud cannot totally satisfy the user requirements, such as security and compliance or business and technical needs.50 This is why services used in the composition process must be combined from several clouds. The migration from a single-cloud service composition to the MCSC has multiple reasons, among which we can quote especially the limited utility in the single cloud and the improved QoS levels when composing services from multiple clouds. The latter allow better satisfying the users' QoS	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	A structured and tool-supported approach would facilitate the migration process, which is why this paper proposes a model-driven engineering based	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_migration	CLOUD MIGRATION PROCESS > Cloud migration	The requirements are specifically targeted at the necessary models, but also consider the overall approach. The necessities for the realization of a model-driven cloud-native migration approach are shown and remaining challenges are discussed. Keywords Cloud-native · Model-driven · Migration · Microservices · FaaS · Decomposition	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_migration	CLOUD MIGRATION PROCESS > Process of cloud migration	But there is still a lack of structured and broadly applicable approaches to facilitate the migration	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_migration	CLOUD MIGRATION PROCESS > Cloud migration	90 R. Lichtenthaler et al. – Which information at which level of abstraction is needed for a model-driven cloud-native migration approach? – Which aspects need to be included in the model-driven	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_migration	CLOUD MIGRATION PROCESS > Cloud migration	7. 2 Towards cloud-native migration 2.1 Cloud-native	Ivon Miranda Santos

Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Cloud migration	In this paper, the most important ones are the fine-grained architectures and the cloud computing paradigms. 2.2 Cloud migration With ongoing innovation and the availability of new technologies, the migration of existing applications is always an important topic to benefit from these innovations and remain competitive. Migration to the cloud has been considered as a research topic since the emergence of the first cloud platforms. Jamshidi et al. have reviewed the research on cloud migration and already describe different types of migration scenarios [11]. One possibility would be to move an existing	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Process of cloud migration	In general, a migration of an existing application to a CNA is therefore difficult and structured approaches to support the migration process are	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Process of cloud migration	1	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Process of cloud migration	to describe the migration process adapted to more, the migration process itself is not an explicit project, but done incrementally "as part of the daily work" [2].	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Process of cloud migration	Another aspect to consider is that in the projects surveyed by Francesco et al. nearly always new features were added as part of the migration	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Process of cloud migration	Migration processes and approaches used in practice have also been explored by Taibi et al. in	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Cloud migration	In fact, the basic mechanism of MDE to generate a PSM from an existing system, transform it into a PIM, refine the architecture by transforming the PIM, and finally transforming the PIM to a PSM again, maps well to the horseshoe model presented by Francesco et al. The basis for applying MDE as an approach for cloud-native migration, however, is to have fitting models which accurately support the splitting of an existing system into a more fine-grained architecture and additionally introduce cloud computing paradigms. Therefore, the goal of this paper is to derive the necessary requirements for the models to use in	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Process of cloud migration	Therefore, the goal of this paper is to derive the necessary requirements for the models to use in the cloud-native migration process.	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Cloud migration	To derive requirements for a model-driven cloud-native migration approach, we use a two-fold methodology. On the one hand, we analyze existing literature considering projects or approaches for cloud-native migration. The concrete procedure for the literature analysis is	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Cloud migration	3.1. And on the other hand, we performed a cloud-native migration which we use as a case study to validate the requirements from the literature and derive further requirements. General information on the case study is given in Sect.	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Cloud migration	[14]. For the search we used the following keywords: migration, decomposition, microservices, cloud-native, model-driven, model-based. We used the keywords with Google Scholar, IEEE Xplore, and Semantic Scholar to	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Cloud migration	Out of this set, we selected literature which: – describes explicitly a model-driven approach to cloud migration, – describes a migration project to a microservices architecture or cloud-native architecture – or describes an architecture transformation approach for a cloud-native migration. Finally, we only selected literature which describes a migration project or approach in sufficient detail to derive requirements for a model-driven cloud-native migration. This level of detail is necessary	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Process of cloud migration	It has to be noted, that the goal of the project was not to improve the existing application considering performance, cost or maintainability, but to explore the migration process of transforming an existing monolithic application into a CNA.	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Process of cloud migration	The first logical step in the migration process is to analyze and model the existing application.	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Cloud migration	[6] discuss relevant services for their transformed application, which include reliable message queuing, caching and security-concerned services like virtual cloud networking and managed firewalls. During the cloud-native migration, components can be replaced with services.	Ivon Miranda Santos

Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Process of cloud migration	3 are derived from the literature, the goal of the case study is to validate these requirements and potentially add further requirements based on practical experience with the migration process.	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Cloud migration	5 Discussion Based on literature and a case study, we have derived requirements for a model-driven cloud-native migration approach summarized in Fig. 3.	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Cloud migration	5.1 Importance of a feasibility study prior to the migration Jamshidi et al. have developed a comprehensive cloud migration framework [11] which has the main phases of migration planning, migration execution, and migration evaluation. The model-driven approach discussed in this paper fits into	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Cloud migration	The migration planning phase, however, is key for a successful migration project, because in that phase an evaluation and feasibility study is done to decide whether a migration is necessary and what the goals of the migration are. The proposed model-driven cloud-native migration approach might not be suitable for all types of applications. Therefore a thorough analysis and evaluation of the feasibility of a migration should be done prior	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Cloud migration	6 Related work The topic of this paper is at the intersection of several research topics such as CNAs, microservices, cloud migration, and model-driven engineering. A noteworthy work having a similar	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-driven_cloud-native_	CLOUD MIGRATION PROCESS > Cloud migration	The requirements and the overview for the proposed approach are the contributions of this paper. The requirements can be used to advance model-driven research for cloud-native migration. In particular, meta-models for the PIMs and PSMs of the approach can be developed based on the	Ivon Miranda Santos
Lichtenthaler2019-Requirements_for_a_model-	CLOUD MIGRATION PROCESS > Process of cloud migration	Furthermore, typical migration patterns and rules to guide a migration process can be expressed	Ivon Miranda Santos
Maniah2022-A_systematic_literature_review_Risk_analysis_in_clou	CLOUD MIGRATION PROCESS > Cloud migration	Cloud Service Providers (CSP) offer attractive services, making more and more companies want to migrate to the cloud. Sometimes the migration process to cloud computing faces problems or even failures, and this is certainly a risk for cloud service users. This study will identify the types of risks and risk components in cloud migration using the Systematic Literature Review (SLR) method. The databases used in selecting articles that	Ivon Miranda Santos
Maniah2022-A_systematic_literature_review_Risk_analysis_in_clou	CLOUD MIGRATION PROCESS > Process of cloud migration	Sometimes the migration process to cloud computing faces problems or even failures, and this is certainly a risk for cloud service users.	Ivon Miranda Santos
Maniah2022-A_systematic_literature_review_Risk_analysis_in_clou	CLOUD MIGRATION PROCESS > Cloud migration	The results of this study, there were 74 articles selected according to the criteria and reviewed. The output of this study shows that there are 7 types of risk in cloud migration, namely information security risk, risk of losing data access, risk of using virtual machines, errors in choosing CSPs, risk of compliance with various laws and regulations, financial risk, and management failure, the weights of 25%, 21%, 18%, 14%, 11%, 7%, and 4% respectively, as well as 5 risk components, namely threats, impacts, risk factors, vulnerabilities, and damage with a weight of 33%,	Ivon Miranda Santos
Maniah2022-A_systematic_literature_review_Risk_analysis_in_clou	CLOUD MIGRATION PROCESS > Cloud migration	In this study, researchers used the SLR method to carry out the process of selecting articles according to the criteria selected and reviewed (Al-Ruithe et al., 2019) focusing on the type of risk and risk components that may arise during the cloud migration process. A large data management system within a company certainly requires a very large data	Ivon Miranda Santos
Maniah2022-A_systematic_literature_review_Risk	CLOUD MIGRATION PROCESS > Process of cloud migration	, 2019) focusing on the type of risk and risk components that may arise during the cloud	Ivon Miranda Santos
Maniah2022-A_systematic_literature_review_Risk_analysis_in_clou	CLOUD MIGRATION PROCESS > Cloud migration	, 2018), challenges in adopting cloud computing (Khan and Al-Yasiri, 2016), it is important to do further research in the field of cloud computing. In this study, this study is different from previous studies, where this study focuses more on the grouping of what is included in the types of risk in cloud migration, and wants to know what the risk components are, so that this can be used as a reference as components in assessing risk in cloud migration. The next section describes the research	Ivon Miranda Santos

Maniah2022- A_systematic_literature_review_Risk _analysis_in_clou	CLOUD MIGRATION PROCESS > Process of cloud migration	Section 4 explain the results and discussion, which contains analysis of the results of the literature review, which relates to the types of risks and risk components in the cloud migration process, as well as trends in state-of-the-art	Ivon Miranda Santos
Maniah2022- A_systematic_literature_review_Risk _analysis_in_clou	CLOUD MIGRATION PROCESS > Cloud migration	With the SLR method, we can find out the trends of research topics that are of great interest to previous researchers, so that this can be used as a reference for further research. The importance of the SLR method in this research is that researchers can identify and analyze journals systematically according to the recommended stages related to journals about the types and components of risk in cloud migration.	Ivon Miranda Santos
Maniah2022- A_systematic_literature_review_Risk _analysis_in_clou	CLOUD MIGRATION PROCESS > Cloud migration	Search based on compatibility with given keywords, using "Boolean" "OR" and "AND", where the keywords used are: "risk type" or "risk component" or "risk type on public cloud" or "risk component on public cloud" or ["Risk type"] and ["risk component"] and "cloud migration" or ["risk type"] and ["risk component"] and "cloud migration". The literature search strategy is based	Ivon Miranda Santos
Maniah2022- A_systematic_literature_review_Risk _analysis_in_clou	CLOUD MIGRATION PROCESS > Cloud migration	2. can be seen that the number of papers selected was 74 papers distributed from 2015 to 2020. The results of this study are based on the SLR method, which can determine the types of risks, risk components in Cloud Migration, and the trend of risk type that shown in	Ivon Miranda Santos
Maniah2022- A_systematic_literature_review_Risk _analysis_in_clou	CLOUD MIGRATION PROCESS > Cloud migration	Why migrate to the cloud? Cloud migration can save costs because cloud service providers already provide infrastructure so that it can reduce the provision of their own infrastructure (Ren et al., 2012).	Ivon Miranda Santos
Maniah2022- A_systematic_literature_review_Risk _analysis_in_clou	CLOUD MIGRATION PROCESS > Cloud migration	State-of-the-art risk type and State-of-the-art risk component. Based on the a forementioned categories, the results can be briefly described through the distribution years of publication and state-of-the-art analysis for types of risks and risk components in cloud migration.	Ivon Miranda Santos
Maniah2022- A_systematic_literature_review_Risk _analysis_in_clou	CLOUD MIGRATION PROCESS > Cloud migration	The results of selecting articles based on the objectives of this systematic literature review, there are 74 (seventy four) articles selected, the distribution of the number of articles related to risk types and risk components from 2015 to 2020 in detail is shown in Table 3 below: From the data above, we can see the trend in the number of articles in 2015–2020 related to risk	Ivon Miranda Santos
Maniah2022- A_systematic_literature_review_Risk _analysis_in_clou	CLOUD MIGRATION PROCESS > Cloud migration	, 2019). Next will be explained related to risk components that often arise in the cloud migration environment as follows: 1) Threat are all things that will bring loss to the company's assets stored in the cloud that will	Ivon Miranda Santos
Maniah2022- A_systematic_literature_review_Risk _analysis_in_clou	CLOUD MIGRATION PROCESS > Cloud migration	Attractive service offerings by Cloud Service Providers (CSPs), more and more companies want to migrate to the cloud, but companies as users of cloud services are also faced with risks. Information security risk, which is the type of risk that most often occurs in cloud migration. Information security risk is closely related to data breaches, so the impact of the risks that often	Ivon Miranda Santos
Maniah2022- A_systematic_literature_review_Risk _analysis_in_clou	CLOUD MIGRATION PROCESS > Cloud migration	The use of servers together (multitenant) is also a risk factor that exists in cloud computing. There are several risk factors in cloud migration, including technology factors, environmental factors and organizational factors. Choosing the right cloud service provider is also an important thing to pay attention to before migrating to the cloud. To ensure security on cloud migration, it is a shared responsibility for related parties, for example government, private organizations, education sector and researchers. Research in the field of cloud computing still opens up great opportunities for researchers in the future, but the challenges will certainly increase, for this reason,	Ivon Miranda Santos
Mateen2021- A_dynamic_decision_support_system _for_selection_of_c	CLOUD MIGRATION PROCESS > Cloud migration	The technique is evaluated and refined by the reviews from the domain experts and three users. It benefits organizations for migration to the cloud according to their circumstances. Appl. Sci. 2021,	Ivon Miranda Santos
Mateen2021- A_dynamic_decision_support_system	CLOUD MIGRATION PROCESS > Benefits of cloud migration	It benefits organizations for migration to the cloud according to their circumstances.	Ivon Miranda Santos

Mateen2021- A_dynamic_decision_support_system	CLOUD MIGRATION PROCESS > Process of cloud migration	This model explains the cloud computing migration process.	Ivon Miranda Santos
Mateen2021- A_dynamic_decision_support_system _for_selection_of_c	CLOUD MIGRATION PROCESS > Cloud migration	to adhere to requirements. The problem of web-server cloud migration can be reduced by using a DSS that can reveal the quality of the cloud system service and the cloud virtual machine image options. A cloud system service or a cloud virtual machine image is used to maintain many aspects that are compared and examined on certain	Ivon Miranda Santos
Mateen2021- A_dynamic_decision_support_system _for_selection_of_c	CLOUD MIGRATION PROCESS > Cloud migration	Developing the knowledge-based module begins with collecting significant data. Three main techniques are utilized to build up the cloud migration framework. The significant issues of concern, and the enterprise prerequisites perceived by analyzing the after-effects of the study, are watched all through the implementation	Ivon Miranda Santos
Mateen2021- A_dynamic_decision_support_system _for_selection_of_c	CLOUD MIGRATION PROCESS > Cloud migration	The consequence of this procedure is utilized as the information base of Cloud-DSF, on which a representation segment is based and implemented to encourage connection with clients. The Migration-Decision-Support-System (MDSS) [21] is specially designed for pre-dicting cloud services on the basis of requirements. An acceptable cost is an important parameter, so the client can easily	Ivon Miranda Santos
Mateen2021- A_dynamic_decision_support_system _for_selection_of_c	CLOUD MIGRATION PROCESS > Cloud migration	Another issue is the static database that may not reflect the latest offerings. The Reuse and Migration of Legacy Systems to Interoperable Cloud Service (REMICS) project by Mohagheghi et al. [22] proposes a way to transfer legacy systems into the cloud service paradigm.	Ivon Miranda Santos
Mateen2021- A_dynamic_decision_support_system _for_selection_of_c	CLOUD MIGRATION PROCESS > Cloud migration	Another issue is the static database that may not reflect the latest offerings. The Reuse and Migration of Legacy Systems to Interoperable Cloud Service (REMICS) project by Mohagheghi et al. [22] proposes a way to transfer legacy systems into the cloud service paradigm.	Ivon Miranda Santos
Mateen2021- A_dynamic_decision_support_system _for_selection_of_c	CLOUD MIGRATION PROCESS > Cloud migration	The majority of the described systems emphasize only the vendor selection and calculation of costs. Besides these aspects, a decision-making system specific to application migration to the cloud needs to consider more dimensions. Along with calculating costs, other tasks such as performance forecast and countermeasures	Ivon Miranda Santos
Mateen2021- A_dynamic_decision_support_system _for_selection_of_c	CLOUD MIGRATION PROCESS > Cloud migration	At the end of this section, we summarize the steps involved in application migration and the technologies used in previous frameworks as shown in Table 1. Application for migration to a cloud computing environment and the decision process has six main phases: service suitability, a business strategy check, analyzing the cloud environment, risk assessment, vendors' evaluations, and implementation. These steps help to organize a hierarchical procedure for the decision of migration by determining the criteria	Ivon Miranda Santos
Mateen2021- A_dynamic_decision_support_system _for_selection_of_c	CLOUD MIGRATION PROCESS > Process of cloud migration	Application for migration to a cloud computing environment and the decision process has six main phases: service suitability, a business strategy check, analyzing the cloud environment, risk assessment, vendors' evaluations, and	Ivon Miranda Santos
Mohamed2020- A_multicriteria_optimization_model_for_cloud_service	CLOUD MIGRATION PROCESS > Cloud migration strategies	Multicloud computing is a strategy that helps customers to reduce reliance on any single cloud provider (known as the vendor lock-in problem). The value of such strategy increases with proper selection of qualified service providers. In this paper, a constrained multicriteria multicloud provider selection mathematical model is	Ivon Miranda Santos
Mohamed2020- A_multicriteria_optimization_model_for_cloud_service	CLOUD MIGRATION PROCESS > Cloud migration strategies	Multicloud is a strategy that uses services and resources from multiple cloud provider,23 therefore the application can be run on different IaaS platforms based on those applications' unique	Ivon Miranda Santos
Mostajabi2021- A_Systematic_Review_of_Data_Models_for_the_Big_Data	CLOUD MIGRATION PROCESS > Cloud migration	So, the study of data models is a key and fundamental aspect in structuring, organizing, storing, and manipulating big data. It is also the essence in various areas of cloud migration, web-scale, and so forth. In this paper, we have systematically reviewed different types of data models, the rationale behind them, their applications and support capabilities, and the	Ivon Miranda Santos

Mostajabi2021- A_Systematic_Review_of_Data_Models_for_the_Big_Data	CLOUD MIGRATION PROCESS > Cloud migration	The results suggest that the research focus has mainly been on the classification of data models, storage of various data types and variety, support capabilities and basic features of data models, and the popularity and basic technology in recent years. The results of this review will be helpful for users not only in the domain of database and data storage but also in various domains of big data, cloud, data migration, and so on. The elegance of this article lies in its allowing for the possibility of comparing data models based on their critical	Ivon Miranda Santos
Opara-Martins2016- Critical_analysis_of_vendor_lock-in_and_its_i	CLOUD MIGRATION PROCESS > Cloud migration	It is the way to-ward a more competitive market for cloud providers and customers. Lock-in affects cloud migration Interoperability and portability are essential qualities that affect the cloud under different perspectives [7, 13], due to the risk of vendor lock-	Ivon Miranda Santos
Opara-Martins2016- Critical_analysis_of_vendor_lock-in_and_its_i	CLOUD MIGRATION PROCESS > Cloud migration	Like-wise the customers, who are willing to choose the cloud services without being strictly bond to a specific solu-tion, are mostly neglected. Advances in cloud computing research have in recent years resulted in a growing inter-est for migration towards the cloud. But due to concerns about the risks of vendor lock-in, as noted by [33], organisations would particularly welcome stand-	Ivon Miranda Santos
Opara-Martins2016- Critical_analysis_of_vendor_lock-in_and_its_i	CLOUD MIGRATION PROCESS > Cloud migration	This suggests that organisations are allured to utilising cloud services due to the perceived business benefits of cost savings, IT flexibility and business agility. The business benefits of cloud migration In addition to the reasons for why the cloud model has achieved a mainstream deployment status across UK organisations, identifying the actual benefits of cloud computing is critical to further our	Ivon Miranda Santos
Opara-Martins2016- Critical_analysis_of_vendor_lock-in_and_its_i	CLOUD MIGRATION PROCESS > Benefits of cloud migration	This suggests that organisations are allured to utilising cloud services due to the perceived business benefits of cost savings, IT flexibility and business agility. The business benefits of cloud migration In addition to the reasons for why the cloud model has achieved a mainstream deployment status across UK organisations, identifying the actual benefits of cloud computing is critical to further our	Ivon Miranda Santos
Opara-Martins2016- Critical_analysis_of_vendor_lock-in_and_its_i	CLOUD MIGRATION PROCESS > Cloud migration	Cloud application usage and service adoption among UK organisations In order to identify the opportunities which may affect stakeholders' and decisions for or against cloud migra-tion, this study explored which applications have adopted from cloud services, which local applications are considered for moving to the cloud. It also explored which applications for whatever reason, were not	Ivon Miranda Santos
Opara-Martins2016- Critical_analysis_of_vendor_lock-in_and_its_i	CLOUD MIGRATION PROCESS > Cloud migration	The one application which is identified by most respondents as not suitable for cloud deployment is accounting and finance (39 %), perhaps due to data security concerns. Moreover, further data analysis in cloud adoption rate across organisations, realised that larger enterprises find disaster recovery, (ERP) and business process management applications (BPM) as the best fit for cloud migration. However, for smaller enterprises, the adoption of (non-mission critical) cloud-based applications mirrors their use of email messaging, desktop hosting and Customer Relationship	Ivon Miranda Santos
Opara-Martins2016- Critical_analysis_of_vendor_lock-in_and_its_i	CLOUD MIGRATION PROCESS > Cloud migration	Core risk factors of lock-in In an effort to highlight factors which may affect future cloud migration decisions, participants were requested to identify practical challenges of lock-in they encountered when using cloud services. These issues relate to lack of integration points between existing management tools (47.7 %), incompatibility issues with on-premise software, and inability to move to another service provider or	Ivon Miranda Santos
Opara-Martins2016- Critical_analysis_of_vendor_lock-in_and_its_i	CLOUD MIGRATION PROCESS > Cloud migration	However, as shown in Fig. 11, when asked to identify best practices to minimize lock-in risks in cloud migration, most business respondents identified the following as top mitigation strategies: (a) making well-informed decisions before selecting vendors and/or signing cloud contracts (66.4 %); (b) the need for an open environment for continuous competition between providers in the cloud service market (52.3 %); (c) use of standard software components with industry-proven	Ivon Miranda Santos

Opara-Martins2016-Critical_analysis_of_vendor_lock-in_and_its_i	CLOUD MIGRATION PROCESS > Cloud migration	Well-informed decision making The study has found that for UK organisations, when it comes to evaluating the business risks of vendor lock-in for or against cloud migration, surprisingly, a vast majority (66.4 %) of respondents said making well-informed decisions before selecting vendors and/or signing the cloud service contract is an extremely important part of In essence, this is particularly important given the plethora of vendors in the market place today, with each offering businesses proprietary cloud-based services and contracts that have different specification (and legal agreements). In regard to the interpretation of this finding, our study suggests that the vetting process for selecting vendors is a critical aspect for effective cloud migration with minimized risk of lock-in. Moreover, such finding exemplify the need for organisations to look beyond the vendor selection phase, and focus on constantly monitoring any development or changes in the cloud that may impact data se-	Ivon Miranda Santos
Opara-Martins2016-Critical_analysis_of_vendor_lock-in_and_its_i	CLOUD MIGRATION PROCESS > Cloud migration	Standards and cloud-based solutions The impact caused by vendor lock-in problem due to lack of standards is what enterprises should be wary about when considering migration to cloud computing [29]. Despite the number of studies in recent years underlining the high relevance of standards in cloud computing, unfortunately this study reveals that most UK organisations still lack a comprehensive understanding on the informative example in this context is seen in research in [50], arguing that many cloud providers are concerned with the loss of customer that may come with standardisation initiatives which may flatten profits, and do not regard the solution favourable. Based on our research findings, from a business perspective, we suggest the following as key measures to improve customer retention and engender trust in enterprise cloud migration: 1) the quality of service (QoS) guarantee, 2) data protection and	Ivon Miranda Santos
Opara-Martins2016-Critical_analysis_of_vendor_lock-in_and_its_i	CLOUD MIGRATION PROCESS > Cloud migration	The aim is to minimize the human efforts in redesign and re-deployment of application and data when moving from one cloud to another. To this end, it becomes vital that any enterprise cloud migration project can be carried out without any disruption to data availability since data is an organisation's most critical, ubiquitous, and essential business asset [29].	Ivon Miranda Santos
Opara-Martins2016-Critical_analysis_of_vendor_lock-in_and_its_i	CLOUD MIGRATION PROCESS > Cloud migration	7). On a conclusive note, it is believed that the discussions presented herein, above all, indicate hypothetically that vendor lock-in risks will reduce cloud migration, which in turn affects the widespread adoption of cloud computing across organisations (small or large). Thus an emerging	Ivon Miranda Santos
Opara-Martins2016-Critical_analysis_of_vendor_lock-in_and_its_i	CLOUD MIGRATION PROCESS > Cloud migration	Discussion and conclusion In this paper a comprehensive analysis of vendor lock-in problems was discussed and the impact to companies as a result of migration to cloud computing was explored. A survey was conducted and revealed that the cloud paradigm has greatly impacted on many organisations subsequent to migrating IT and business applications to the	Ivon Miranda Santos
Perrons2013-Cloud_computing_in_the_upstream_oil_and_gas_industry	CLOUD MIGRATION PROCESS > Cloud migration	abstract Despite the compelling case for moving towards cloud computing, the upstream oil & gas industry faces several technical challenges—most notably, a pronounced emphasis on data security, a reliance on extremely large data sets, and significant legacy investments in information technology infrastructure—that make a full migration to the public cloud difficult at present. Private and hybrid cloud solutions have consequently emerged within the industry to yield as much benefit from cloud-based technologies as	Ivon Miranda Santos
Petcu2014-Portability_in_clouds_Approaches_and_research_opportunities	CLOUD MIGRATION PROCESS > Cloud migration	Abstract. The migration towards Cloud environments is still hindered by several barriers. One of them is the low portability of the applications that are consuming Cloud services.	Ivon Miranda Santos

Petcu2014-Portability_in_clouds_Approaches_and_research_opportunities	CLOUD MIGRATION PROCESS > Cloud migration	The lack of attention to crosscutting concerns and migration execution is also observed. The study also showed a lack of tool support to automate and facilitate Cloud migration tasks.	Ivon Miranda Santos
Petcu2014-Portability_in_clouds_Approaches_and_research_opportunities	CLOUD MIGRATION PROCESS > Cloud migration	A roadmap for the Cloud software engineering was proposed by Da Silva and Lucredio [36]. The key-points of their roadmap are: solutions for avoidance of data lock-in; decision making about the migration towards the Cloud; legacy software migration; a re-engineering process for the Cloud migration; mechanisms to facilitate the hybrid Cloud; implementation of Modelling as a Service; Cloud service composition; case studies; open source platforms.	Ivon Miranda Santos
Petcu2014-Portability_in_clouds_Approaches_and_research_opportunities	CLOUD MIGRATION PROCESS > Process of cloud migration	The key-points of their roadmap are: solutions for avoidance of data lock-in; decision making about the migration towards the Cloud; legacy software migration; a re-engineering process for the Cloud migration; mechanisms to facilitate the hybrid Cloud; implementation of Modelling as a Service; Cloud service composition; case studies; open	Ivon Miranda Santos
Rai2015-Exploring_the_factors_influencing_the_cloud_computing_adoption	CLOUD MIGRATION PROCESS > Cloud migration	In this background, cloud services offer a more agile and cost effective platform, to support business applications and IT infrastructure. As the adoption of cloud services has been increasing recently and so has been the academic research in cloud migration. However, there is a genuine need of secondary study to further strengthen this research. The primary objective of this paper is to scientifically and systematically identify, categorize and compare the existing research work in the area of legacy to cloud migration. The paper has also endeavored to consolidate the research on Security issues, which is prime factor hindering the	Ivon Miranda Santos
Rai2015-Exploring_the_factors_influencing_the_cloud_computing_adoption	CLOUD MIGRATION PROCESS > Cloud migration	SLR (Systematic Literature Review) of thirty selected papers, published from 2009 to 2014 was conducted to properly understand the nuances of the security framework. To categorize the selected studies, authors have proposed a conceptual model for cloud migration which has resulted in a resource base of existing solutions for cloud migration. This study concludes that cloud migration research is in seminal stage but simultaneously it is also evolving and maturing, with increasing participation from academics and industry alike. The paper also identifies the need for a secure migration model, which can fortify organization's trust into cloud migration and facilitate necessary tool support to automate the	Ivon Miranda Santos
Rai2015-Exploring_the_factors_influencing_the_cloud_computing_adoption	CLOUD MIGRATION PROCESS > Process of cloud migration	The paper also identifies the need for a secure migration model, which can fortify organization's trust into cloud migration and facilitate necessary tool support to automate the migration process.	Ivon Miranda Santos
Rai2015-Exploring_the_factors_influencing_the_cloud_computing_adoption	CLOUD MIGRATION PROCESS > Cloud migration	Given the multiple benefits of cloud computing, many organizations are keen to adapt to this innovative technology. However, tackling security issues regarding the cloud and the migration process has hampered the cloud adoption rate	Ivon Miranda Santos
Rai2015-Exploring_the_factors_influencing_the_cloud_computing_adoption	CLOUD MIGRATION PROCESS > Process of cloud migration	However, tackling security issues regarding the cloud and the migration process has hampered the cloud adoption rate (Rosado et al.	Ivon Miranda Santos
Rai2015-Exploring_the_factors_influencing_the_cloud_computing_adoption	CLOUD MIGRATION PROCESS > Cloud migration	2009). This paper is directed towards finding a viable solution to facilitate secure migration of on-premises software application to the cloud environments. Given the inherent advantages of cloud computing and the desire to migrate to cloud, there has been noteworthy research in the area of cloud migration (Khadka et al. 2013;	Ivon Miranda Santos
Rai2015-Exploring_the_factors_influencing_the_cloud_computing_adoption	CLOUD MIGRATION PROCESS > Process of cloud migration	Most of the approaches have proposed frameworks, techniques, processes and methods which help in the migration and assist in decision process for migrating to cloud.	Ivon Miranda Santos

Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	application is in nascent stage as they are hosted on a local server, before the migration. During the limited study, it was found that a systematic literature review of research on secure cloud migration hasn't been undertaken. Besides considering the growing demand for migration toward cloud, there is an equal need to investigate a research framework for secure cloud migration. A SLR identifies, classifies, and synthesizes a comparative overview of the ongoing research and enables knowledge transfer within the	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	2007). Likewise, for this paper, a SLR was conducted, with the primary objective to identify, taxonomically classify, and systematically compare the existing research, focused on planning, executing, and validating migration of legacy systems toward cloud-based software. More specifically, to the paper endeavors to answer the following questions, through	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	2 Related work The research on cloud migration is incomplete without talking about SOA (Service-Oriented Architecture). As both cloud migration and SOA exhibit numerous similarities as well as differences at the same time, it would not be appropriate to position the study on cloud migration without SOA migration. Recently, several studies have focused on migration to SOA, but not many are found for cloud migration. Both these technologies offer key benefits as reduced overall	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Process of cloud migration	(2013) is based on the three different case studies in industry, which proposed a common migration process, based on expert interviews.	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Process of cloud migration	The goal is to understand the existing gaps in cloud security framework and cloud migration process RQ4- What are the obstacles in the cloud	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	The intervention is the tool or technology or procedure that addresses a specific issue. ii Intervention-Cloud Migration iii.	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Process of cloud migration	Need, benefits, requirement, motivation, cloud, migration	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Process of cloud migration	Survey on secure migration process	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Process of cloud migration	Survey on the secure migration process was done, to identify key concerns related to the secure adoption of cloud by both industry and academia and also to seek their expert opinion on the	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Process of cloud migration	RQ2 (Challenges OR Issues OR Security Concerns) AND (cloud computing OR Cloud Migration OR Migration Process OR Migration) AND (Security	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	ii. Secondly, the framework for secure cloud migration was presented to the participants, and they were asked for their expert opinion and advice on the model. iii. Thirdly, each participant was asked to describe a cloud migration project, which they worked on, together with the time spent on each migration	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	Interactive conversation survey method was used for conducting fair survey. Here in this method, professional websites as m LinkedIn, different blogs related to Cloud and Cloud Migration was leveraged for conducting the survey. Questionnaires were posted into those sites to have an interactive conversation with the	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	Author also had few conversations with select organizations using live chat who are working in the field of Cloud. 4 A 5-phase model for classification and comparison of cloud migration research In this section, a conceptual model called as '5-Phased Cloud Migration Model' has been introduced, to classify and categorize cloud migration research, in terms of distinct phases or processes involved in the cloud migration. While developing this reference model, situational method engineering has been adopted to consolidate the existing frameworks (e.g.P3, P4, P9, P23 etc.) in cloud migration. Method	Ivon Miranda Santos

Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Process of cloud migration	In this section, a conceptual model called as '5-Phased Cloud Migration Model' has been introduced, to classify and categorize cloud migration research, in terms of distinct phases or	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	Alternatively, a top-down approach forms a framework or a conceptual model consisting of phases, processes and activities. Based on these existing frameworks and guidelines, we have identified the key phases in cloud migration. By reviewing the primary studies and exploring the defined migration tasks, migration process has been categorized in five phases. Figure 3 below represents the '5-phased cloud migration model' which is also inspired by the well-known 'Water	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Process of cloud migration	By reviewing the primary studies and exploring the defined migration tasks, migration process has been categorized in five phases.	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	SpringerPlus (2015) 4:197 Page 5 of 12 of studies according to 5-Phase Cloud Migration Model Phase-1:	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	Feasibility study [5 studies] In the first phase the goal is to identify or determine whether the cloud migration is financially/ technically feasible or not [P2] [P6] [P8] [P13] [P14].	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	In the migration execution phase, the actual migration of data and application is carried out. The process like data extraction [P2] [P11] [P22], code modification [P15] [P17] [P20], architecture recovery [P9] [P11] [P2] [P22] [P18] [P20], cloud migration [P9] [P22] [P17] etc. are actually implemented.	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	For instance the cost saving has been the major driver for cloud adoption as mentioned and discussed about in several studies, also indicated in the Table 7 below. Challenges in cloud migration process In our previous work (Rashmi et al. 2013) we have identified (refer Table 8) various challenges in the cloud migration process and have attempted to answer the RQ2 by listing out various challenges which organizations face, while adopting the cloud.	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Process of cloud migration	Challenges in cloud migration process	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Process of cloud migration	2013) we have identified (refer Table 8) various challenges in the cloud migration process and have attempted to answer the RQ2 by listing out various challenges which organizations face,	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Process of cloud migration	It classifies the migration process into following types:	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	Type 4: Cloudify Cloudify is an example of full migration, where an application is converted to a fully-fledged cloud enabled system by composing cloud services. Table 9 below categorizes all the four types of migration along with the Cloud Deployment models, which were used in the migration process. The table also identifies various tools/frameworks which are used in the selected	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Process of cloud migration	Table 9 below categorizes all the four types of migration along with the Cloud Deployment models, which were used in the migration	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	Current state and ongoing research issues in secure cloud migration In this section, we have attempted to answer RQ 4 by carrying out a systematic review of the existing approaches for legacy to cloud migration. This review is done to summarize the existing approaches, models, tools and techniques and also to identify and analyze the security issues considered in these migration approaches. The focal objective is to identify the possible solutions offered to address the security concerns or needs in the cloud migration process. In this regard, a set of approaches have been collated which is	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Process of cloud migration	The focal objective is to identify the possible solutions offered to address the security concerns or needs in the cloud migration process.	Ivon Miranda Santos

Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	Conclusion The central objective of this review paper was to consolidate the existing research on cloud migration and identify the security concerns reflected in these selected review papers. The foremost contribution of this systematic review is the proposition of conceptual model for cloud migration for the characterization of the studies and a comparative analysis of the existing literature through the model, to indicate the tools and techniques used in the various studies. Authors have also tried to identify the security cloud migration process in a 5-Phased model.	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Process of cloud migration		Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	After analyzing the studies collected through this Systematic Review Process, a number of research challenges were observed and which indicated future directions of this research. i. Growing maturity of cloud migration – Even though it has been acknowledged that the maturity of the cloud migration is in its pivotal stage, one can observe a clear sign of growth by observing various types of cloud migration being reported in the literature (already discussed in Section 2.3). Proper validation across all these types of migration is an area that needs immediate	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration strategies	After analyzing the studies collected through this Systematic Review Process, a number of research challenges were observed and which indicated future directions of this research. i. Growing maturity of cloud migration – Even though it has been acknowledged that the maturity of the cloud migration is in its pivotal stage, one can observe a clear sign of growth by observing various types of cloud migration being reported in the literature (already discussed in Section 2.3).	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	ii. Need for more results on cloud migration evaluation - By observing the results on cloud migration in the selected studies one can clearly identify the need for more and more results and real-time case studies from industries on cloud migration. More evaluation, survey and experience reports on legacy-to-cloud migration will be needed, which will result in more trust and confidence of	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Cloud migration	Although, the Authors have presented a 5- Phase model for cloud migration in Section 4, the cloud researchers needs to propose a more comprehensive framework such as the ones proposed for SOA migration (Discussed in Section 2) with tangible evidence of solutions in terms of methods and techniques. iv. Solutions to address Security Concerns – As per the distribution of studies based on the 5-Phase model for cloud migration (Figure 4), the main focus of the research is on the requirement analysis and cloud migration planning (approx. 38%), however very few of them address the security concerns hovering over the cloud migration (discussed in Section 5.4). To summarize, one can conclude that cloud migration is still in its nascent stage, but is maturing at a fast pace. The Authors have acknowledged the call for a tangible secure migration framework, to facilitate systematic and	Ivon Miranda Santos
Rai2015- Exploring_the_factors_influencing_the_cloud_computing_a	CLOUD MIGRATION PROCESS > Process of cloud migration	• Six step migration process	Ivon Miranda Santos
Ranchal2020- Disrupting_healthcare_silos_Addressing_data_volume_	CLOUD MIGRATION PROCESS > Cloud migration	Our work focuses on identifying the requirements and presents a design for building a state-of-the-art cloud-native healthcare data ingestion service irrespective of data volume, variety or velocity. This service is a prerequisite for any healthcare cloud migration and key to promoting interoperability, sharing, and integration of the healthcare data leading to new advancements.	Ivon Miranda Santos

Raza2019- A_review_on_security_issues_and_th eir_impact_on_hybrid	CLOUD MIGRATION PROCESS > Cloud migration	In order to key benefit with hybrid cloud model, there are different security issues that have been shown to address. In this paper, we explain security issues in detail such as to maintain trust and authenticity of information, Identity management and compliance which is influencing in enterprises due to migration of IT cloud technologies are increasingly turning to hybrid clouds. Here, work outcomes with comparative study of different existing solution and target the common problems domains and security threads. Keywords—Hybrid cloud; migration; security issues; security techniques	Ivon Miranda Santos
Raza2019- A_review_on_security_issues_and_th eir_impact_on_hybrid	CLOUD MIGRATION PROCESS > Cloud migration	C. Portability of Applications Using cloud aware development builds systems from re-usable components that will work the same across cloud environments. D. Monitoring and Management across Cloud Environments In a Hybrid clouds, monitoring and management is essential for the health of the system, visibility into system health across clouds is crucial In spite of such significant benefits, migration of IT cloud technologies from enterprises have important aspect over privacy, integrity, security concerns and compliance considerations due to reliability on multi cloud vendors such as Microsoft, Amazon and Google [7]. The descriptive study in this paper is summarised with a view to discuss and different security issues that have	Ivon Miranda Santos
Raza2019- A_review_on_security_issues_and_th eir_impact_on_hybrid	CLOUD MIGRATION PROCESS > Benefits of cloud migration	In spite of such significant benefits, migration of IT cloud technologies from enterprises have important aspect over privacy, integrity, security concerns and compliance considerations due to reliability on multi cloud vendors such as	Ivon Miranda Santos
Repschlaeger2012- Cloud_requirement_framework_Requ irements_and_e	CLOUD MIGRATION PROCESS > Cloud migration	Furthermore, many offers only partially meet customers' requirements and it is not clear how exactly Cloud Computing influences the IT. That makes it difficult for customers to plan migration projects and implement sustainable Cloud solutions. There are important factors and considerations for the decision to adopt Cloud	Ivon Miranda Santos
Repschlaeger2012- Cloud_requirement_framework_Requ irements_and_e	CLOUD MIGRATION PROCESS > Cloud migration	Furthermore, many offers do not meet - or only partially meet - customers' requirements (Forrester, 2009). The absence of defined Cloud requirements and evaluation criteria makes it difficult for customers to plan migration projects and implement sustainable Cloud solutions. The fact that interoperability between providers hasn't been achieved makes a provider selection often irreversible or requires much effort (Hoefer and	Ivon Miranda Santos
Repschlaeger2012- Cloud_requirement_framework_Requ irements_and_e	CLOUD MIGRATION PROCESS > Cloud migration	(2011b), where the relationships between Cloud services, SLAs, technical implementation and provider characteristics are described. Associated with Cloud services, Kaisler (2011) examined the service migration in the Cloud Computing environment, by examining security and integration issues associated with service	Ivon Miranda Santos
Repschlaeger2012- Cloud_requirement_framework_Requ irements_and_e	CLOUD MIGRATION PROCESS > Cloud migration	monitoring of services and volume control via APIs. Transformation management describes consulting and migration support for Cloud implementation projects.	Ivon Miranda Santos
Rosati2018- Making_the_cloud_work_for_software _producers_Linking	CLOUD MIGRATION PROCESS > Cloud migration	Keywords: Cloud Migration, Total Cost of Ownership, Monetization, Architecture Migration, Software Producer. Abstract: Cloud migration is concerned with moving an on-premise software system into the cloud. In this paper, we	Ivon Miranda Santos
Rosati2018- Making_the_cloud_work_for_software _producers_Linking	CLOUD MIGRATION PROCESS > Process of cloud migration	Furthermore, the actual cost of the migration process might be substantial for SPs and for their legacy customers, while nonexistent for cloud-	Ivon Miranda Santos
Rosati2018- Making_the_cloud_work_for_software _producers_Linking	CLOUD MIGRATION PROCESS > Cloud migration	This paper is organized as follows. Section 2 reviews related work and presents the cloud migration context. Section 3 introduces the	Ivon Miranda Santos
Rosati2018- Making_the_cloud_work_for_software _producers_Linking	CLOUD MIGRATION PROCESS > Process of cloud migration	2.2 Two Migration Business Cases Cloud computing adoption can dramatically change a company business model and internal organization, and requires investing a significant amount of resources in the migration process.	Ivon Miranda Santos

Rosati2018- Making_the_cloud_work_for_software_producers_Linking	CLOUD MIGRATION PROCESS > Cloud migration	3 INTEGRATED MIGRATION FRAMEWORK AND PROCESS Typically, a cloud migration is organized around an architectural transformation of the legacy system, independent of cost and pricing considerations. We propose an integrated process for migration	Ivon Miranda Santos
Rosati2018- Making_the_cloud_work_for_software	CLOUD MIGRATION PROCESS > Process of cloud migration	We propose an integrated process for migration planning:	Ivon Miranda Santos
Rosati2018- Making_the_cloud_work_for_software_producers_Linking	CLOUD MIGRATION PROCESS > Cloud migration	Right-pricing: determine pricing for the software service based on analysis of direct operational costs driven by predicted usage and experimental consumption figures generated from the feasibility study. While a comprehensive discussion of cloud migration patterns, processes and issues are	Ivon Miranda Santos
Rosati2018- Making_the_cloud_work_for_software_producers_Linking	CLOUD MIGRATION PROCESS > Cloud migration	Walterbusch et al. (2013) provide a comprehensive list of cost components that may be considered for estimating TCO of SP cloud migration. In order to estimate the cost associated with the expected SaaS usage, we consider costs at the	Ivon Miranda Santos
Rosati2018- Making_the_cloud_work_for_software_producers_Linking	CLOUD MIGRATION PROCESS > Cloud migration	4.1 Cost Estimation Process In a cloud migration scenario, an SP needs to migrate the system architecture of the product and change the corresponding cost and revenue models at the same time. As highlighted before, the new models heavily depend on expected or predicted usage, both of which are difficult to	Ivon Miranda Santos
Rosati2018- Making_the_cloud_work_for_software_producers_Linking	CLOUD MIGRATION PROCESS > Cloud migration	Now we consider the adoption of PaaS to provision a SaaS product. We assume here a migration to a PaaS architecture to be cloud-native in style, i.e., platform services, such as databases, are provided as packaged services in	Ivon Miranda Santos
Rosati2018- Making_the_cloud_work_for_software_producers_Linking	CLOUD MIGRATION PROCESS > Cloud migration	Research has covered costing and migration separately. Our literature review did not identify a detailed framework that integrated both costing and software architecture within a cloud migration scenario. An investigation linking architectural decisions and the impact on costing in cloud migration is therefore important and this paper	Ivon Miranda Santos
Rosati2018- Making_the_cloud_work_for_software_producers_Linking	CLOUD MIGRATION PROCESS > Cloud migration	(Misra and Mondal, 2011). We sought to explore and illustrate a relatively simple but practical process for cost estimation in cloud migration targeting small and medium enterprises. Further studies may account for more complex models suitable for larger and more mature	Ivon Miranda Santos
Saif2022-CSO- ILB_chicken_swarm_optimized_inter-cloud_load_balanc	CLOUD MIGRATION PROCESS > Cloud migration strategies	Balancing the load in multi-cloud is challenging; Table 1 shows that the exist-ing load balancing strategies focus on balancing the load in a single	Ivon Miranda Santos
Sailer2018- Healthcare_application_migration_in_compliant_hybrid	CLOUD MIGRATION PROCESS > Cloud migration	Our approach, as reported in this paper, utilizes two innovative concepts: compliance conformance validation and environment reconstruction supported by a Platform as a Service (PaaS) environment performing healthcare application automated migrations in hybrid clouds. We show how the migration process is conducted with dynamic reconstruction of the application	Ivon Miranda Santos
Sailer2018- Healthcare_application_migration_in_compliant_hybrid	CLOUD MIGRATION PROCESS > Process of cloud migration	We show how the migration process is conducted with dynamic reconstruction of the application dependencies on the PaaS services.	Ivon Miranda Santos
Sailer2018- Healthcare_application_migration_in_compliant_hybrid	CLOUD MIGRATION PROCESS > Cloud migration	Keywords: Healthcare ¶ Platform as a Service ¶ Migration ¶ Hybrid cloud 1 Introduction	Ivon Miranda Santos
Sailer2018- Healthcare_application_migration_in_compliant_hybrid	CLOUD MIGRATION PROCESS > Process of cloud migration	We show how the migration process is conducted with dynamic reconstruction of the application dependencies on the PaaS services.	Ivon Miranda Santos
Sailer2018- Healthcare_application_migration_in_compliant_hybrid	CLOUD MIGRATION PROCESS > Cloud migration	There is a rich body of literature that addresses the migration of legacy or enterprise applications to cloud [9–15] and its security and cloud hybrid aspects [12, 16–20]. Because migration to cloud is a major change for a service provider, carefully thought-out decisions factoring in technical, economical and compliance related aspects [16] need to be made and executed. Decision models may consider factors affecting migration in a holistic way and quantify them to provide a	Ivon Miranda Santos
Sailer2018- Healthcare_application_migration_in_compliant_hybrid	CLOUD MIGRATION PROCESS > Cloud migration	A survey on cloud migration decision making methodologies has been conducted in [13]. Migration to hybrid or federated clouds is another aspect addressed by current research. This type of migration requires partitioning of the application.	Ivon Miranda Santos

Sailer2018- Healthcare_application_migration_in_ compliant_hybrid	CLOUD MIGRATION PROCESS > Cloud migration	From the security and compliance perspective, ideally the application or system migrated to a target cloud environment is desired to be at least as secure and compliant as it was originally in the source environment. An analysis of cloud migration methodologies has been conducted [19], and from the security perspective the authors conclude that there is little research on the migration of the security and compliance aspects. Moving to cloud remains a complex endeavor which requires planning and execution of multiple steps and various vendors such as AWS [22] and Cisco [18] have published guides for the service	Ivon Miranda Santos
Sailer2018- Healthcare_application_migration_in_ compliant_hybrid	CLOUD MIGRATION PROCESS > Process of cloud migration	Figure 2 shows the process flow of our system migration from a hosting PaaS environment to a compliant target environment.	Ivon Miranda Santos
Sailer2018- Healthcare_application_migration_in_ compliant_hybrid	CLOUD MIGRATION PROCESS > Process of cloud migration	Migration system process flow	Ivon Miranda Santos
Sailer2018- Healthcare_application_migration_in_ compliant_hybrid	CLOUD MIGRATION PROCESS > Process of cloud migration	These calls expect the migration process was completed.	Ivon Miranda Santos
Sailer2018- Healthcare_application_migration_in_ compliant_hybrid	CLOUD MIGRATION PROCESS > Cloud migration	The Access Directory is responsible to store the API access credentials which are generated during the service instance binding call. Our migration system has been deployed in our Health Compliant Cloud and in the following section we detail the options and findings of our experiments. 734 A. Sailer et al.	Ivon Miranda Santos
Sailer2018- Healthcare_application_migration_in_ compliant_hybrid	CLOUD MIGRATION PROCESS > Process of cloud migration	This option to install an application from scratch presents however a few risks when compared to a migration process, as follows:	Ivon Miranda Santos
Sailer2018- Healthcare_application_migration_in_ compliant_hybrid	CLOUD MIGRATION PROCESS > Process of cloud migration	Figure 3 illustrates the orchestration of our migration processes. We use Jenkins to coordinate the resources migration pipeline and UCD (IBM UrbanCode Deploy [15]) to automate the deployment across the two environments. Our implementation in UCD covers the automation of the main migration steps presented in Sect. 4, i.e., retrieval of the application profile and artifacts, validation of the conformance, setup of the environment, reconstruction of the dependencies, deployment of the application in the regulated	Ivon Miranda Santos
Sailer2018- Healthcare_application_migration_in_ compliant_hybrid	CLOUD MIGRATION PROCESS > Process of cloud migration	Migration process implementation	Ivon Miranda Santos
Sailer2018- Healthcare_application_migration_in_ compliant_hybrid	CLOUD MIGRATION PROCESS > Process of cloud migration	Migration process build and deployment pipeline	Ivon Miranda Santos
Shastry2022- Approaches_for_migrating_non_cloud-native_applications	CLOUD MIGRATION PROCESS > Cloud migration	The paper concludes with a consolidated set of steps for each migration strategy, while factoring in the range of applications they are best suited for, considering their complexity and scope. Keywords—cloud, migration strategies, legacy applications, containerization, microservices, cloud-native, GCP, AWS, Azure, Oracle cloud, rehosting, replatforming, re-architecting I. INTRODUCTION	Ivon Miranda Santos
Shastry2022- Approaches_for_migrating_non_cloud-native_applications	CLOUD MIGRATION PROCESS > Cloud migration strategies	The paper concludes with a consolidated set of steps for each migration strategy, while factoring in the range of applications they are best suited for, considering their complexity and scope. Keywords—cloud, migration strategies, legacy applications, containerization, microservices, cloud-native, GCP, AWS, Azure, Oracle cloud, rehosting, replatforming, re-architecting I. INTRODUCTION	Ivon Miranda Santos
Shastry2022- Approaches_for_migrating_non_cloud-native_applications	CLOUD MIGRATION PROCESS > Process of cloud migration	Thus, organizations and individuals looking to migrate their legacy applications often find the process of migration complex, tedious and	Ivon Miranda Santos
Shastry2022- Approaches_for_migrating_non_cloud-native_applications	CLOUD MIGRATION PROCESS > Cloud migration	RELATED WORK Research surrounding migration of applications to cloud has been underway since the advent of cloud. A significant challenge initially in cloud migration is the lack of a general process in selecting cloud models and the studies on the risks and benefits involved in migration. There are now many step-by-step decision processes such as Restrictions apply. Strategy specific research on cloud migration mostly revolves around the 5 Rs strategy first proposed by Gartner [3]. These strategies have since been revised and revisited many times and have been expanded to 6 Rs [4]. Since the advent of the 6Rs strategies, cloud vendors like AWS and GCP have provided services and frameworks to facilitate migration including cloud readiness assessments to aid	Ivon Miranda Santos

Shastry2022- Approaches_for_migrating_non_cloud-native_applications	CLOUD MIGRATION PROCESS > Cloud migration strategies	Restrictions apply. A strategy specific research on cloud migration mostly revolves around the 5 Rs strategy first proposed by Gartner [3]. These strategies have since been revised and revisited many times and have been expanded to 6 Rs [4].	Ivon Miranda Santos
Shastry2022- Approaches_for_migrating_non_cloud-native_applications	CLOUD MIGRATION PROCESS > Cloud migration strategies	V. MIGRATION STRATEGIES: REHOSTING Rehosting is the most simplistic of the 3 chosen migration strategies. It requires little to no changes to the existing application. It is the process of moving legacy software and applications to a different platform, in this case, the cloud, usually with the sole aim of solving issues relating to expensive maintenance. It is also called the 'lift-and-shift' process. This is one of the fastest solutions for migration but has limited scalability, as the true benefits of cloud cannot be reaped. Moreover, most legacy applications are specifically designed for local usage and are not equipped to handle distributed workloads.	Ivon Miranda Santos
Shastry2022- Approaches_for_migrating_non_cloud-native_applications	CLOUD MIGRATION PROCESS > Cloud migration strategies	B. Replatforming	Ivon Miranda Santos
Shastry2022- Approaches_for_migrating_non_cloud-native_applications	CLOUD MIGRATION PROCESS > Cloud migration strategies	C. Re-architecting	Ivon Miranda Santos
Shirvani2018- An_iterative_mathematical_decision_model_for_cloud	CLOUD MIGRATION PROCESS > Cloud migration	For instance, some of the related works focus on just sheer economic or limited factors, which have less influence on security issues. Nevertheless, so far, there is yet no decision model to decide between cloud migration versus on-premises IT development with regard to cost and cybersecurity risk perspectives. Moreover, each of which is not agile enough to take into account a variety of service types, a new organization policy, new cloud pricing schemes, and multisourcing cloud for reaching a sustainable decision point. To deal with the aforementioned problem and challenges, we develop an iterative decision model to decide between the development of internal IT and cloud migration for organization. The main contributions	Ivon Miranda Santos
Shirvani2018- An_iterative_mathematical_decision_model_for_cloud	CLOUD MIGRATION PROCESS > Cloud migration	1. To present an iterative decision model with regard to cost and security risk perspectives to decide between internal IT development and cloud migration in a multicloud environment.	Ivon Miranda Santos
Shirvani2018- An_iterative_mathematical_decision_model_for_cloud	CLOUD MIGRATION PROCESS > Multi-cloud migration	2. 1. To present an iterative decision model with regard to cost and security risk perspectives to decide between internal IT development and cloud migration in a multicloud environment.	Ivon Miranda Santos
Shirvani2018- An_iterative_mathematical_decision_model_for_cloud	CLOUD MIGRATION PROCESS > Cloud migration	2. In several scenarios, participant variables should be customized. For instance, in on-premises deployment, we can assume loss omission for the sake of full control over IT, or FC is omitted in the case of full migration to cloud, but loss is constituted with cybersecurity losses owing to cloud disability to cover the security requirement. The final decision is based on cash flows of different deployment options in a determined life	Ivon Miranda Santos
Shirvani2018- An_iterative_mathematical_decision_model_for_cloud	CLOUD MIGRATION PROCESS > Cloud migration	Finally, we can deduce the salvage value of assets from CPV at the end of the investment. 3 CONCEPTUAL FRAMEWORK OF THE PROPOSED ITERATIVE DECISION MODEL FOR CLOUD MIGRATION The SMEs need to decide between traditional IT development and cloud services to cover their IS	Ivon Miranda Santos
Shyamasundar2017- Information_flow_control_for_building_security	CLOUD MIGRATION PROCESS > Cloud migration	C. Discussion Zhu et al. [12] present a technique for scalable service and data migration in a collaborative cloud scenario where multiple public cloud providers store and maintain an organization's data. Their technique employs cryptographic schemes to	Ivon Miranda Santos
Sorheller2018- Implementing_cloud_erp_solutions_A_review_of_soci	CLOUD MIGRATION PROCESS > Cloud migration	Although according to Duan and colleagues this is rarely an issue for small organizations [4], the concern is raised in several articles that focus on SMEs [3, 13, 14]. Data Migration: the implementation of cloud-based ERP systems can be challenged when there is a need to migrate data from existing repositories to the cloud-ERP database. The rules and data structures of cloud ERP solutions can be very	Ivon Miranda Santos

Stavru2013- Challenges_for_migrating_to_the_ser vice_cloud_paradi	CLOUD MIGRATION PROCESS > Cloud migration	Abstract. Migrating to the Service Cloud Paradigm implies the migration of legacy software systems to a service-oriented architecture with deployment in the cloud. Although this specific software modernization paradigm promises numerous strategic and operational advantages, it poses also many complex organizational and technical challenges, among which is the lack of mature	Ivon Miranda Santos
Stavru2013- Challenges_for_migrating_to_the_ser vice_cloud_paradi	CLOUD MIGRATION PROCESS > Cloud migration	This paper examines the questions of whether agile methods and techniques could be scaled to fit the migration to the Service Cloud Paradigm and how they could help overcoming the challenges of software modernization in this specific context. The research methodology presented here first extracts the challenges of the migration to Service Cloud Paradigm through a systematic literature review and then, using expert judgment, evaluates how different agile techniques, taken from Scrum and Extreme Programming (XP), could address the identified challenges. As a result, a ranked list of applicable agile techniques is presented and suggestions for	Ivon Miranda Santos
Stavru2013- Challenges_for_migrating_to_the_ser vice_cloud_paradi	CLOUD MIGRATION PROCESS > Cloud migration	These agile techniques are taken from Scrum and XP software development methods since they are the most widely adopted methods through the agile community in the recent years (in more than two thirds of the projects surveyed by VersionOne1). The results of the evaluation step are used for making suggestions on the applicability of the techniques and their inclusion in a particular agile method for migration to Service Cloud Paradigm. The design of the agile method is out of the scope of this paper since it involves an extensive research, which cannot be presented within the limits of this paper. The present study has been carried as part of FP7 European research project for reuse and	Ivon Miranda Santos
Stavru2013- Challenges_for_migrating_to_the_ser	CLOUD MIGRATION PROCESS > Process of cloud migration	The migration process consists of several steps:	Ivon Miranda Santos
Stavru2013- Challenges_for_migrating_to_the_ser vice_cloud_paradi	CLOUD MIGRATION PROCESS > Cloud migration	The reminder of the paper is organized as follows: Section 2 describes the methodology used for conducting literature review and evaluating agile techniques; Section 3 presents the challenges from SOA and Cloud Computing fields, extracted by the review process and relevant for the migration to the Service Cloud Paradigm; Section 4 discusses the results of the evaluation of agile techniques and their potential to address the identified challenges; and Section 5 concludes the paper and outlines directions for future research.	Ivon Miranda Santos
Stavru2013- Challenges_for_migrating_to_the_ser vice_cloud_paradi	CLOUD MIGRATION PROCESS > Process of cloud migration	Section 2 describes the methodology used for conducting literature review and evaluating agile techniques; Section 3 presents the challenges from SOA and Cloud Computing fields, extracted by the review process and relevant for the migration to the Service Cloud Paradigm; Section 4 discusses the results of the evaluation of agile techniques and their potential to address the identified challenges; and Section 5 concludes the paper and outlines directions for future research.	Ivon Miranda Santos
Stavru2013- Challenges_for_migrating_to_the_ser vice_cloud_paradi	CLOUD MIGRATION PROCESS > Cloud migration), and which were mostly process and people oriented; (2) Technical challenges, which included design, implementation, verification challenges and deployment challenges, and were product and technology oriented. As the focus of this study was on the migration to the Service Cloud Paradigm, we expected that not all of the challenges discussed by the reviewed articles would be relevant. For that reason, we limited the extraction of challenges to:	Ivon Miranda Santos
Stavru2013- Challenges_for_migrating_to_the_ser vice_cloud_paradi	CLOUD MIGRATION PROCESS > Process of cloud migration	Afterwards, it might continue with Product / Sprint Backlogs, Daily Scrums, Continuous Integration and On-Site Customer in order to further address the challenges of the migration process.	Ivon Miranda Santos
Tona2020-DPS- AA_Intranet_migration_strategy_mod el_for_clouds	CLOUD MIGRATION PROCESS > Cloud migration	The study deeply investigated and analyzed the issues, challenges and limitations i.e. features and performances of the current state of the art of the intranets in general and on-premise Intranet of AMU in specific. Finally, an Intranet Migration Strategy Model over Hybrid Cloud was designed	Ivon Miranda Santos

Tona2020-DPS-AA_Intranet_migration_strategy_model_for_clouds	CLOUD MIGRATION PROCESS > Cloud migration strategies	The study deeply investigated and analyzed the issues, challenges and limitations i.e. features and performances of the current state of the art of the intranets in general and on-premise Intranet of AMU in specific. Finally, an Intranet Migration Strategy Model over Hybrid Cloud was designed	Ivon Miranda Santos
Tona2020-DPS-AA_Intranet_migration_strategy_model_for_clouds	CLOUD MIGRATION PROCESS > Cloud migration	Index Terms: Intranet, Intranet-ware, computing, communication, Migration Strategy Model, Cloud, On-premise	Ivon Miranda Santos
Tona2020-DPS-AA_Intranet_migration_strategy_model_for_clouds	CLOUD MIGRATION PROCESS > Cloud migration strategies	Index Terms: Intranet, Intranet-ware, computing, communication, Migration Strategy Model, Cloud, On-premise	Ivon Miranda Santos
Tona2020-DPS-AA_Intranet_migration_strategy_model_for_clouds	CLOUD MIGRATION PROCESS > Cloud migration	There will be an incredible increase in the number of Cloud platforms available today. Cloud computing is a new paradigm in the fields of technology and system migration that focuses on sharing data and computational resources via or over a scalable worldwide network of nodes (such as end user's computer, data centers, and web services). Therefore, this network of nodes is	Ivon Miranda Santos
Tona2020-DPS-AA_Intranet_migration_strategy_model_for_clouds	CLOUD MIGRATION PROCESS > Cloud migration	C. Intranet over Cloud Intranet over cloud is proposed to be the next generation technology strategy for boundary-less access at any time for the user's community via internet. The Cloud based Intranet Migration Model especially designed for the academicians, researchers and students can enhance the systems efficiency and performance in compare to	Ivon Miranda Santos
Tona2020-DPS-AA_Intranet_migration_strategy_model_for_clouds	CLOUD MIGRATION PROCESS > Cloud migration	The proposed migration strategy model based intranet over cloud shown the promising features which are not available in the existing state of art on premise intranet over local servers. The major contribution of this research is to show an alternative pathway from migration of the old fashioned intranets running over the on premise servers to the cloud. During the functional demo and survey it was clearly revealed that the current state of art intranets in the educational institutions of Ethiopia are not scalable, cost effective, rapidly upgradable, reliable, all time available with zero	Ivon Miranda Santos
Tona2020-DPS-AA_Intranet_migration_strategy_model_for_clouds	CLOUD MIGRATION PROCESS > Cloud migration	2, the migration strategy model i.e. DPS-AA was designed as roadmaps to consider different issues before strategic migration of the intranet over cloud. From the flow of the model, it was observed that the migration strategy needs to identify the two most important needs, 1) functional and 2) non-functional requirements to provide	Ivon Miranda Santos
Tona2020-DPS-AA_Intranet_migration_strategy_model_for_clouds	CLOUD MIGRATION PROCESS > Cloud migration strategies	2, the migration strategy model i.e. DPS-AA was designed as roadmaps to consider different issues before strategic migration of the intranet over cloud. From the flow of the model, it was observed that the migration strategy needs to identify the two most important needs, 1) functional and 2) non-functional requirements to provide	Ivon Miranda Santos
Tona2020-DPS-AA_Intranet_migration_strategy_model_for_clouds	CLOUD MIGRATION PROCESS > Cloud migration	i. Identification & Analysis of Functional Requirements: The functional requirements that can be identified for the smooth migration of the intranet over cloud in the proposed study are – 1) Identifying and analyzing data storages needs and data services before Migration/Migration	Ivon Miranda Santos
Tona2020-DPS-AA_Intranet_migration_strategy_model_for_clouds	CLOUD MIGRATION PROCESS > Process of cloud migration	1) Identifying and analyzing data storages needs and data services before Migration/Migration	Ivon Miranda Santos
Tona2020-DPS-AA_Intranet_migration_strategy_model_for_clouds	CLOUD MIGRATION PROCESS > Process of cloud migration	2) Gathering technical details (re-design issues) of On-premise and Off-premise support before	Ivon Miranda Santos
Tona2020-DPS-AA_Intranet_migration_strategy_model_for_clouds	CLOUD MIGRATION PROCESS > Cloud migration	These may be like search feature, project management and collaboration etc. v. Designing and Developing the Conceptual Intranet Migration Strategy Model over Cloud: In this phase, enhanced performance measures, add-on features which are mostly selected and popularly accepted by user's communities are required to be considered for conceptual design of	Ivon Miranda Santos
Tona2020-DPS-AA_Intranet_migration_strategy_model_for_clouds	CLOUD MIGRATION PROCESS > Cloud migration strategies	These may be like search feature, project management and collaboration etc. v. Designing and Developing the Conceptual Intranet Migration Strategy Model over Cloud: In this phase, enhanced performance measures, add-on features which are mostly selected and popularly accepted by user's communities are required to be considered for conceptual design of	Ivon Miranda Santos

CLOUD MIGRATION PROCESS

Tona2020-DPS-AA_Intranet_migration_strategy_model_for_clouds	CLOUD MIGRATION PROCESS > Cloud migration	Measuring the performance and effectiveness of the prototype of the Intranet over Cloud: Finally, performance of the Intranet migration Strategy model over Cloud can be measured for its	Ivon Miranda Santos
Tona2020-DPS-AA_Intranet_migration_strategy_model_for_clouds	CLOUD MIGRATION PROCESS > Cloud migration strategies	Measuring the performance and effectiveness of the prototype of the Intranet over Cloud: Finally, performance of the Intranet migration Strategy model over Cloud can be measured for its	Ivon Miranda Santos
Tona2020-DPS-AA_Intranet_migration_strategy_model_for_clouds	CLOUD MIGRATION PROCESS > Cloud migration	Internet) as a network backbone for delivering computing, communication and collaboration services. In order to develop a Migration Strategy Model for Intranet over Cloud Platform in general and AMU Intranet over Cloud i.e. AMU Cloud-Net as a special case, this research used different fact finding techniques for gathering qualitative	Ivon Miranda Santos
Tona2020-DPS-AA_Intranet_migration_strategy_model_for_clouds	CLOUD MIGRATION PROCESS > Cloud migration strategies	Internet) as a network backbone for delivering computing, communication and collaboration services. In order to develop a Migration Strategy Model for Intranet over Cloud Platform in general and AMU Intranet over Cloud i.e. AMU Cloud-Net as a special case, this research used different fact finding techniques for gathering qualitative	Ivon Miranda Santos
Zhou2017-Cost_reduction_in_hybrid_clouds_for_enterprise_computi	CLOUD MIGRATION PROCESS > Cloud migration	They propose a solution that employs Lyapunov optimization techniques. Unfortunately, most previous studies on enterprise application migration to hybrid cloud infrastructure use a centralized optimization solver to obtain the optimal placement of each server. These methods are effective when the instance is small.	Ivon Miranda Santos