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STRATEGY FOR COST EFFICIENCY CALCULATION OF THE ADOPTION COST OF THE MULTI-CLOUD SOLUTION THROUGH THE DELIVERABLE-ORIENTED BREAKDOWN

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Summary. The main reason for usage of multi-cloud solutions is cost effectiveness. The accuracy of the cost benefits analysis that should be used in decision making process is directly related to the approach for the cost of development and cost of operation efforts calculation.
Keywords: quality attributes, multi-cloud, cost benefit analysis, cost efficiency, WBS.

Multi-cloud environments are becoming more and more common nowadays. More and more companies start using different platforms to host their data. As per Gartner, three-quarters of medium and large companies are adopting this type off strategy by the end of this year. IDC too has reported that 90% of all companies globally have adopted a variety of platforms to host their data by 2022 [1].

Problem Statement. During cloud solution design stage, the architecture is developed, and quality attributes are defined and prioritised with the usage of attribute trade off analysis method (ATAM). This method was developed to provide a principled way to evaluate a software architecture's fitness with respect to multiple competing quality attributes: modifiability, security, performance, availability, and so forth. These attributes interact, and improving one often comes at the price of worsening one or more of the others [2]. The popular cloud providers to attract clients drives them to use calculators-like tools for making the decisions. But such tools help only to calculate operational cost of the ownership cloud facilities. To make the decision of achieving quality attribute the cost benefits analysis (CBA) method is used. The prerequisite for accurate CBA is the detailed work breakdown structure (WBS). Such deliverable-oriented breakdown of a project is a key project deliverable that divides the team's work into manageable sections. The problem is that usually such work activities as multi-cloud monitoring and logging setup, multi-cloud orchestration, etc.

And finally, when the system is driven with the cost efficiency it means that this has direct impact on the other important quality, for example portability.

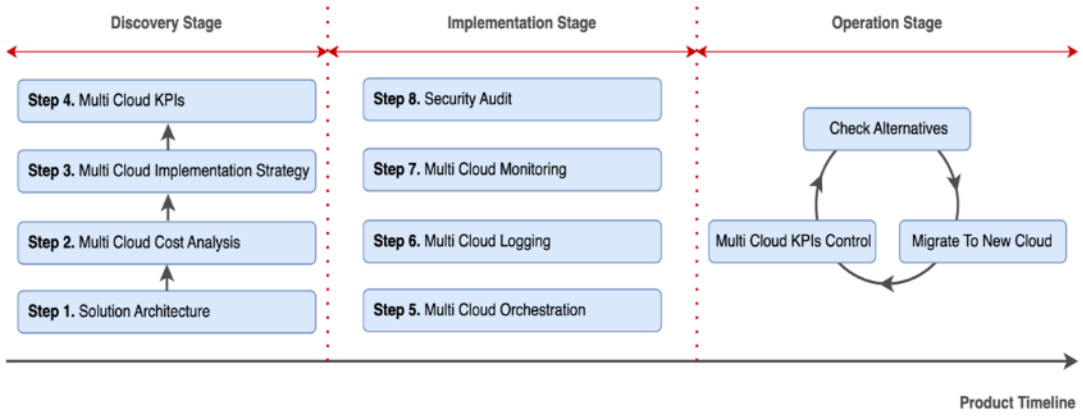
	Correctness	Analyzability	Changeability	Stability	Testability	Flexibility	Portability	Reusability	Interoperability	Time (Lead-time)	Effort (Cost)	Content	Productivity	Reliability	Tailorability	Interactive Performance
Analyzability	o															
Changeability	o	+														
Stability	o	+	+													
Testability	o	o	o	o												
Flexibility	o	+	+	+	o											
Portability	o	+	+	+	o	+										
Reusability	o	o	o	o	o	o	+									
Interoperability	o	o	o	o	o	+	+	+								
Time (Lead- time)	-	-	-	-	-	-	-	-	-							
Effort (Cost)	-	-	-	-	-	-	-	-	-	-						
Content	-	-	-	-	-	-	-	-	-	-	-					
Productivity	-	-	-	-	-	-	-	-	-	o	o	o				
Reliability	+	o	o	o	o	o	-	o	o	-	-	-	-			
Tailorability	o	-	-	-	-	+	-	o	+	-	-	-	-	-		
Interactive Performance	o	o	o	o	o	-	-	-	o	-	-	-	-	o	-	
Usability	o	o	o	o	o	o	o	o	o	-	-	-	-	o	o	o

Fig. 1. Decision Matrix

If looking at comparisons between the different perspectives on the decision matrix on the figure 1, it is clear that the management attributes always have negative dependencies on other attributes. This is not very surprising since improving the other attributes always carries some amount of costs [3]. It means that is the main goal is cost efficiency, the portability goal could not be achieved. It breaks the dilution that multi-cloud solution is portable by default.

Strategy for cost efficiency calculation.

To make the correct work breakdown structure for multi-cloud solution implementation the product timeline should be split on the three stages discovery, implementation and each stage should be decomposed accordingly (figure 2). During the discovery phase on the initial stage the solution architecture should be developed considering major quality attributes. Driving with the cost efficiency the multi-cloud cost benefits analysis should be conducted and the multi-cloud implementation should be developed. The multi-cloud strategy will help with identification of the logging, monitoring approaches, the required security ad load testing that should be conducted during the implementation stage. There, in the discovery phase scope just after the multi-cloud strategy, the KPIs should be introduced.



Fig/ 2. Strategy of the multi-cloud implementation during product development

The total costs of implementation, configuration, integration and migration (imp) are dependent on the expenditure of time (eot) to fulfill the required tasks like implementation, configuration, integration and migration of services and data. An important cost factor in this category is the need of data porting from the customer to the provider (port). As mentioned, the providers charge their customers for inbound data transfer. The costs of the initial transfer of data to the Cloud for the purpose of system migration belong to this cost type. They are calculated by multiplying the data volume per unit (i.e. gigabyte) by the price of one unit. Some providers offer hard disk shipping services to input the customer's data. However, this approach does not focus on data volume but rather on the number of hard drives and data loading time. The cost factor "porting" is not made dependent on temporal price shifts because it is assumed that the data porting process can be completed within one period *t*

$$C_{port}^{imp} = a_{port}^{imp*} p_{port}^{imp} \quad [1]$$

The expenditure of time C_{eot}^{imp} is determined:

$$C_{eot}^{imp} = \sum p_{eot,m}^{imp} * a_{eot,m}^{imp} \quad [2]$$

[4].

Multi-cloud KPIs and optimization cycle.

The KPIs of cloud solutions are the most important metrics to measure the success of any business. They should be monitored regularly to identify any issues that might arise in the future.

Price is the first concern and KPI for tracking the effectiveness of usage of the multi-cloud approach. Different cloud providers offer different prices for different sets of features of their services. In addition to basic price of the cloud services, some cloud service providers charge extra for additional features they provide, for example, additional security features like for data storage and transfer, data encryption, firefall, etc. So it's important to carefully identify required features of the target cloud services and their prices from different cloud providers ongoingly for a better comparison [5].

Conclusions. Earlier, multi-cloud was only interesting for enterprise products. The main reason for that was its complexity of orchestration and security issues. Recently, we've started seeing a trend away from the mono-cloud approach. The new cloud-agnostic services make managing and controlling your IT systems easier than ever, and they're perfect for anyone who wants to start with a multi-cloud approach. It makes it possible for startups to start with a multi-cloud approach from day one of the product. Since the main purpose of using the multi-cloud solution is a possibility to reduce the cost of the infrastructure, it's important to start with the price comparison in the discovery stage of the product development. The multi-cloud implementation strategy and KPIs defined at this stage will provide many benefits at the operation stage. The multi-cloud control wheel makes it easy to check the effectiveness of each cloud service and, in case of more favorable pricing, migrate to a new cloud service without losing control of these KPIs.

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