Bulletin of the *Transilvania* University of Braşov
Series I: Engineering Sciences • Vol. 4 (53) No. 1 - 2011

PERFORMANCE METRICS FOR THE IT SERVICES PORTFOLIO

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Abstract: *The metrics for the Software as a Service model exists mostly from the financial perspective and it is a though task to measure the contribution of the services that are part from a portfolio inside this model. During the paper, several indicators are introduced, based on the project management techniques, to quantify the contribution of each service to the portfolio benefits and goals. This kind of approach reveals the services relations inside the portfolio, with the possibility to estimate each service contribution to portfolio revenue in a defined point of time.*

Key words: *Software as a Service, key performance indicators, metrics.*

1. Introduction

The Software as a Service (SaaS) paradigm is one of the IT trend that is already impacting the companies daily business and represents a software delivery model that allows companies' to rent an application under a service shape from another companies like Service Providers. The payment of such services can have different strategies such as monthly or yearly fee or service per usage fee. This concept becomes sustainable due to the Internet propagation which now performs as a big IT platform available everywhere, advancing of the virtualization technologies in close relation with the trend towards open source software and standardization and ultimate because of the pressure in the companies to cut the IT related costs.

In this landscape, for a Service Provider (SP), it is important to track the performance of its services using different perspectives. Thus, tools are use in this regard, to understand in a timely manner the meaning of performance for each service from the business portfolio and to react as quickly as possible to the most urgent and important trends and problems. The indicators are one of the SaaS performance metrics used to determine service performance but most of them are financial- and marketing- based.

The aim of this article is to introduce a set of key performance indicators (*KPI*) which take into account the performances of each service from the SP portfolio in such a way to measure the generally strategic performance of the services portfolio, covering the benefits that are necessary to achieve the SP goals.

The recognition of the services performance variance that impacts the overall service portfolio strategy is possible by using the indicators proposed in this paper, that allow the implementation of quick action plans to attenuate the variance.

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The SaaS indicators introduced in this article are based on the services portfolio strategy perspective and they are split in three levels: quantifying the realization degree of the services portfolio benefits, quantifying the degree of the services portfolio goals and quantifying of the services portfolio revenue taking into account the benefits and the goals of the portfolio.

The paper has been organized in such a way that the first section contains an overview of the existing SaaS metrics and some of the services portfolio benefits; the second section introduces the theoretical approach that is the basis of the realization of the key strategic performance indicators for SaaS services portfolio; third and forth section contain the strategic performance indicators development and explanations with concrete results and the last section presents the conclusions and further developments in this area.

2. SaaS Metrics and Benefits Overview

The SaaS model allows the usage of the IT infrastructure in an optimized way, from technical and business point of view, due to the efficient usage of IT equipment and other operational resources [1]. This gives the possibility to the SPs to maintain lower fees for the tenants that are using the services.

Thus, SPs have to track the performance of their services taking into consideration the financial aspects, the benefits that their services bring to the organization and the completion degree of the services goals [7].

The services can be grouped in portfolios based on different criteria like market targets, application types, and addressed industries. Also, the services can deliver different types of benefits which have to be aligned to the SP strategy. Benefits have to be agreed and planned before the service creation and the portfolio aggregates all benefits delivered by each service that is part of it.

The benefits of each service contribute to the SPs organization and should give the market competitive advantages and the desired market place [6].

Same as in project management, the role of a services portfolio is the verification of the expected benefits to be delivered as the services as it has been planned.

2.1. Overview of existing SaaS Metrics

One of the SaaS metric generally used by the SPs in their effort to track the services performances is the Churn Rate [8], [9]. This metric represents in percentage the users' rate in cancelling a service over a specific period of time [8]. If the value of this metric is high, it means that there are problems with the service users' satisfaction or with the service renewals meaning that the number of the new customers is less that the ones which cancel the service.

Another metric that is in a direct relation with the Churn Rate is the Recurring Revenue of the service [8]. It represents the service income money from the customers that are using and paying the service in a specific time interval like months, quarters or years [9].

The Average Recurring Revenue is a derivation from the previous metric and represents the total recurring revenue on average per customer [9].

Related to the service development and running, one of the metrics used is the Cost of Service per customer [8]. It represents the average recurring costs per customer that are needed to develop and maintain the service including the necessary infrastructure and SP personnel costs to run the service.

Metrics related to customer acquisition costs depend on what the SP needs to

follow up. There are service metrics to determine the costs related to marketing activities for customer acquisition, to calculate sales expenses or to estimate the return of acquisition investment [8].

2.2. SaaS Benefits Overview

One of the service benefits is the time to market of a service that is deployed on an existing infrastructure as well as the access of the service at a global level [7].

Another benefit is the predictability of the service usage growth based on real time monitoring. In a direct relation, the revenue flow of the services can be estimated more accurate because of the SaaS payment model which is generally based on the service subscription methods.

SPs have aggregated operating environments which have as a benefit the lower level of the operations costs using also standardization and automation of the services IT related activities.

The SaaS model offers the possibility to the companies to enter on the new market segments represents one of the SaaS strategic benefits that it is translated in the respective services portfolio benefits.

3. Indicators and Critical Success Factors

The *KPI* represents a quantitative metric related to the expected performance of a process, accomplishment of the objectives and it is in a direct relation with the critical success factors [3]. Complementary to a *KPI*, there has to be a goal that represents the desired level of the performance, defined before the *KPI* measurement [5].

The critical success factor represents the essential element necessary to "ensure the successful competitive performance for the organization" [4]. By using this approach, the identification of the issues that impact the strategy of the services portfolio is done.

Before defining the *KPIs*, it is essential to perform an analysis of the services portfolio objectives and their critical success factors. Most of the services *KPIs* are financially related or based on a specific performance of the services. Because of this, the evaluation of the services portfolio has some limitations since the success factors and the objectives of the portfolio are not evaluated. Based on this, only financial related forecasts can be done for the services portfolio which not all the time may reflect the SP strategic objectives and targets. For example, a SP has a services portfolio with three related services, two services are performing from economic point of view and one not. But, the last service is very strategic for the company, because it brings more benefits that the other two on longer run. With only the financial perspective, the last service has to be cancelled but the relations inside the services portfolio give the possibility to evaluate all the variations of the services performances that can effect the achievement of the defined portfolio objectives.

4. Definition of Strategic Key Performance Indicators for Services Portfolio

In 2010, Hynuk S. and Benoit R. from Canada have published an article related to the measurement of the projects portfolio strategic performance, where they have introduced several indicators that were correlated with the projects contribution to the benefits and goals of the portfolio [2]. Based on the critical success factors, in the article were defined several steps to reach the point to determine the contribution of the projects to the realization of the portfolio objectives [2]. First step is to determine the objectives of the portfolio based on the strategy and the needs of the company. Second step is to analyze the key benefits that are essential to reach the portfolio goals. Third step is to establish

the relation between the benefits and each project from portfolio as well as with the portfolio objectives. The relationship is established using percentage values to describe the contribution of the projects to the portfolio key benefits. Same procedure is used to find out the benefits contribution to the portfolio objectives [2].

In the same way as in the project management, the objectives and the benefits of the services portfolio are derived from the Service Provider's company strategy. Based on the described steps and research, the authors of this paper have adapted and introduced new indicators to estimate the contribution of the services to the SPs' portfolio.

As in the projects case, the contribution of a service to the corresponding portfolio is defined as in the next formula [2]:

$$C_{SO} = \sum_{B=1}^{n} (C_{SB} \cdot C_{BO}) . \quad (1)$$

The meanings of the parameters are related to the described steps as follows:

C_{SO} - contribution of service S to the objective O, based on n portfolio benefits,

C_{SB} - relative contribution of service S to the benefit B,

C_{BO} - contribution of benefit B to the objective O.

Restrictions have to be applied, since proportional values are used [2]:

$$\sum_{S=1}^{m} (C_{SO}) = 1 , \quad (2)$$

$$\sum_{B=1}^{n} (C_{BO}) = 1 . \quad (3)$$

The both formulas are applicable for all objectives O from the services portfolio [2]:

$$\sum_{S=1}^{m} (C_{SB}) = 1 . \quad (4)$$

The formula is applicable for all the portfolio benefits B based on the contribution of all m services to the respective benefits.

Based on the presented formulas and steps, there is the possibility to identify, according to portfolio objectives and benefits, which service is performing inside the portfolio as estimated and which service needs special attention like actions plan that should stabilize it or even to cancel it in time.

Also, for the services portfolio it is important the measurement and estimation of each service contribution to the portfolio revenue from the benefits and objectives perspective. Based on the Recurring Revenue introduced in the previous paragraphs, measured for the each month, the authors of the paper define the contribution of the service S to the Monthly Recurring Revenue, as it is in the next formula:

$$C_{SMMR} = \sum_{O=1}^{p} (C_{SO} \cdot C_{OMMR}) . \quad (5)$$

The significance of the new introduced parameters is:

C_{SMMR} - contribution of service S to the Monthly Recurring Revenue, based on p portfolio objective,

C_{OMMR} - relative contribution of objective O to the Monthly Recurring Revenue.

The restriction that has to be applied for each estimated Monthly Recurring Revenue is:

$$\sum_{S=1}^{m} (C_{SMMR}) = 1 . \quad (6)$$

This new introduced dimension is used in the definition of the *KPIs* that show the status of the services portfolio based on decisive factors, agreed deviations and strategic viewpoint [3].

The performance level of the services and the contribution to the benefits and objectives of the portfolio are described in the next two indicators, derived from project management research area. Thus, the level of the benefit *B* realization for a service portfolio expressed by the KPI_B, where the performance metric of the service *S* that contributes to the benefit *B* is in direct relationship with the contribution of the service *S* to the benefit *B*, is expressed in the next formula:

$$KPI_B = \sum_{S=1}^{m} (KPI_{SB} \cdot C_{SB}) . \quad (7)$$

The value of the KPI_B is interpreted as a rate of the performance with intervals between "0" and "1", which means that the benefit *B* is under the required target; above "1" it means that the key performance of *B* is over achieved and exactly "1" means that the key indicator reached the target.

The rate expression of the achievement capacity of the portfolio objective *O* based on the key performance indicator of the benefit *B* and contribution of the portfolio benefit *B* to the objective *O* is shown in the next formula:

$$KPI_O = \sum_{B=1}^{n} (KPI_B \cdot C_{BO}) . \quad (8)$$

The interpretations of the KPI_O values are the same as for the KPI_B.

Additionally to these key indicators adapted for the services area, the authors introduced other new indicators which show the status of the portfolio performances, based on which evaluations and reactions to mitigate any impact of the risks can be done in a timely manner.

The key performance for the portfolio represents the contribution of the each service *S* to the each objective *O* in a direct relation with the realization measurement of each objective *O* expressed by KPI_O:

$$KPI_{Porfolio} = \sum_{S=1}^{m} \sum_{O=1}^{p} (KPI_O \cdot C_{SO}) . \quad (9)$$

The interpretation of this *KPI* can be done according to the number of objectives, but the target is reached when the value of this indicator is equal with the number of objectives *p*. What is below this value is in the risk area of the portfolio and depending on the numbers and root cause of the problems that can be determine also from the previous formulas, actions have to be taken.

A key performance indicator can be established also for the Monthly Recurring Revenue in a direct relation with the services portfolio objectives performances and the relative contribution of the portfolio objectives to reach the Monthly Recurring Revenue. This indicator is presented in the next formula, where all the parameters where previously introduced.

$$KPI_{MMR} = \sum_{O=1}^{p} (KPI_O \cdot C_{OMMR}) . \quad (10)$$

The value of KPI_{MMR} is interpreted as a rate, where the "1" means that the targeted performance was accomplished, what is more than "1" it means that from the strategic point of view the *MMR* performance is in the opportunity area, and what is in the "0" and "1" interval is interpreted as a risk zone, where the achievement of portfolio performance is endanger by the objectives performances.

Since a *KPI* is measured during time intervals and the service portfolio evolves, review of each indicator has to be done regularly to check the validity of it.

The last proposed indicator is the deviation of the service contribution to the portfolio Monthly Recurring Revenue, which

is calculated as the margin between the estimated contribution of the service *S* to the *MMR*, C_{SMMR} and the actual contribution of the service *S* to the actual *MMR*, A_{SMMR}, in a certain point of time:

$$KPI_{SMMR} = C_{SMMR} - A_{SMMR}. \quad (11)$$

If the value of the *KPI* is negative, then the actual contribution of the service to the *MMR* is bigger than estimated and if positive, the actual contribution is less than the forecast. But, the services being part of the portfolio, even if the actual contribution of a service is bigger than estimated will impact another service from portfolio which will have less contribution than the forecast.

5. Results and Discussions

Demonstration of the theoretical approach is done based on a portfolio that has four services, three key benefits and two strategic portfolio objectives defined.

Based on different techniques, the contributions of the services to the portfolio benefits (Table 1) as well as the contribution of the benefits to the strategic portfolio objectives (Table 2) are done in the beginning of the services deployment phase.

Services to Benefits Table 1

Contribution	B_1	B_2	B_3
S_1	0.1	0.1	0.3
S_2	0.2	0.8	0.2
S_3	0.4	0.05	0.1
S_4	0.3	0.05	0.4

Benefits to Objectives Table 2

Contribution	O_1	O_2
B_1	0.2	0.4
B_2	0.6	0.4
B_3	0.2	0.2

After the consensus is obtained, the next step is to calculate the contribution of each service to each portfolio objective like in the next example based on formula 1:

$$C_{S_1O_1} = 0.1 \cdot 0.2 + 0.1 \cdot 0.6 + 0.3 \cdot 0.2 = 0.14.$$

The table below contains all the results:

Services to Objectives Table 3

Contribution	O_1	O_2
S_1	0.14	0.14
S_2	0.56	0.44
S_3	0.13	0.2
S_4	0.17	0.22

The determination of the objectives contribution to the Monthly Recurring Revenue in this step is done subjectively (Table 4) and has to be modified during the time according to the portfolio strategy.

Objectives to Each MRR Table 4

Contribution	MRR M_1	MRR M_2
O_1	0.2	0.4
O_2	0.8	0.6

Based on the formula 5, the next step consists in the calculation of each portfolio service contribution to the *MRR*, for the two months M_1 and M_2:

$$C_{S_1MMR\_M_1} = 0.14 \cdot 0.2 + 0.14 \cdot 0.8 = 0.14,$$
$$C_{S_2MMR\_M_1} = 0.56 \cdot 0.2 + 0.44 \cdot 0.8 = 0.464,$$
$$C_{S_3MMR\_M_1} = 0.13 \cdot 0.2 + 0.20 \cdot 0.8 = 0.186,$$
$$C_{S_4MMR\_M_1} = 0.17 \cdot 0.2 + 0.22 \cdot 0.8 = 0.21,$$
$$C_{S_1MMR\_M_2} = 0.14 \cdot 0.4 + 0.14 \cdot 0.6 = 0.14,$$
$$C_{S_2MMR\_M_2} = 0.56 \cdot 0.4 + 0.44 \cdot 0.6 = 0.488,$$
$$C_{S_3MMR\_M_2} = 0.13 \cdot 0.4 + 0.20 \cdot 0.6 = 0.172,$$
$$C_{S_4MMR\_M_2} = 0.17 \cdot 0.4 + 0.22 \cdot 0.6 = 0.20.$$

After the values estimation, when the real values of the portfolio services contribution to the each *MRR* are received due to the services running in time (Table 5), the deviation for each service contribution to the each *MRR* is performed using the proposed KPI_{SMMR} and formula 11. The Figure 1 and Figure 2 show the deviations in percentage for each portfolio service contribution to the revenue together with the comparison between real and estimated contribution rate.

Services to Each Actual MRR Table 5

Contribution	MRR M_1	MRR M_2
S_1	0.21	0.16
S_2	0.2	0.5
S_3	0.3	0.16
S_4	0.29	0.18

$$KPI_{S_1MMR\_M_1} = 0.14 - 0.21 = -0.07,$$

$$KPI_{S_2MMR\_M_1} = 0.464 - 0.2 = 0.264,$$

$$KPI_{S_3MMR\_M_1} = 0.186 - 0.3 = -0.114,$$

$$KPI_{S_4MMR\_M_1} = 0.21 - 0.29 = -0.08,$$

$$KPI_{S_1MMR\_M_2} = 0.14 - 0.16 = -0.02,$$

$$KPI_{S_2MMR\_M_2} = 0.488 - 0.5 = -0.012,$$

$$KPI_{S_3MMR\_M_2} = 0.172 - 0.16 = 0.012,$$

$$KPI_{S_4MMR\_M_2} = 0.20 - 0.18 = 0.02.$$

The Table 6 represents the rate values for the performance indicator of each portfolio service contributing to each benefit.

Services to Benefits Table 6

KPI	B_1	B_2	B_3
S_1	1.2	0.3	1
S_2	1.4	0.5	0.5
S_3	1.2	0.2	1
S_4	1.1	0.9	1

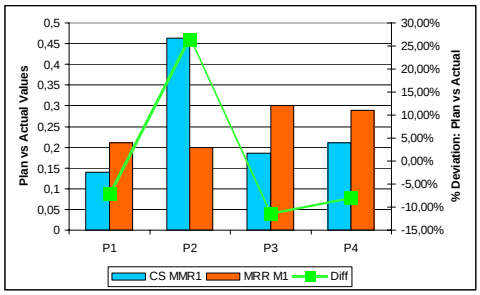

Fig. 1. *Services Portfolio Evolution in the Month 1 with high deviation values*

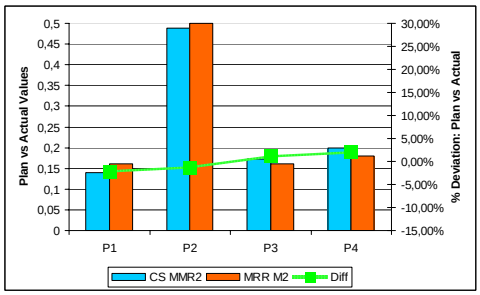

Fig. 2. *Services Portfolio Evolution in the Month 2 with normal deviation values*

The values from Table 6 are used to calculate the *KPIs* for the portfolio benefits (formula 7) and objectives (formula 8) as it is shown next:

$$KPI_{B_1} = 1.2 \cdot 0.1 + 1.4 \cdot 0.2 + 1.2 \cdot 0.4 + 0.3 \cdot 1.1 = 1.21,$$

$$KPI_{B_2} = 0.3 \cdot 0.1 + 0.5 \cdot 0.8 + 0.2 \cdot 0.05 + 0.9 \cdot 0.05 = 0.485,$$

$$KPI_{B_3} = 1 \cdot 0.3 + 0.5 \cdot 0.2 + 1 \cdot 0.1 + 1 \cdot 0.4 = 0.90,$$

$$KPI_{O_1} = 1.21 \cdot 0.2 + 0{,}485 \cdot 0.6 + 0.9 \cdot 0.2 = 0.713,$$

$$KPI_{O_2} = 1.21 \cdot 0.4 + 0{,}485 \cdot 0.4 + 0.9 \cdot 0.2 = 0.858.$$

After the first sum is calculated, $KPI_{Portfolio}$ has the value:

$$KPI_{Portfolio} = 0.21994 + 0.7768 + \\ + 0.26429 + 0.30997 = 1.571 .$$

The target value of the *KPI* in this case is 2, which means that all the services from the portfolio are at 100% realization of the target in relation with the benefits and objectives of the services portfolio. In this case, the target is not achieved, the value being in the portfolio risk area.

The same case applies also for the performance indicators of the *MMR* (formula 10), calculated for 2 months, where the values are under "1", meaning that they are in the risk zone:

$$KPI_{MMR\_M_1} = 0.713 \cdot 0.2 + 0.858 \cdot 0.8 = \\ = 0.829 ,$$

$$KPI_{MMR\_M_2} = 0.713 \cdot 0.4 + 0.858 \cdot 0.6 = \\ = 0.80 .$$

For all the defined *KPIs*, thresholds can be determined in such a way to define alarms and contingency plans.

6. Conclusions

The paper presents the development of metrics for the Software as a Service model. The metrics are focused on the measurement of the strategic contribution of the services to the portfolio benefits and objectives, having as starting point the project management techniques. Based on the new introduced *KPIs*, the decisions to run further a service from the strategic point of view can be done by analyzing the *KPIs* values. In this way, the Service Provider management can apply action plans to mitigate the risk or to use the opportunities detected in this way.

The next steps for the authors are to incorporate these *KPIs* in the services portfolio dashboard of the SaaS framework that collects all the necessary information and displays them in a real time manner, with triggers and alarms.

Acknowledgements

The authors wish to thank to all their colleagues from Siemens PSE that gave their support in producing results for this paper.

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