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MBI FRAMEWORK EXTENSION TOWARDS CLOUD SERVICE IMPROVEMENT FROM CONSUMER PERSPECTIVE

Abstract: *Cloud computing is changing the way that organizations utilize IT resources with a corresponding impact on the role of IT management. To help organizations with managing their business informatics, Management of Business Informatics (MBI) framework has been developed. The problem was that this framework did not explicitly reflect managing cloud services from cloud service consumer perspective and specifically did not address managing of cloud service improvement from consumer perspective. Therefore, analysis of MBI framework was performed from cloud service consumer viewpoint to d*

esign extension of MBI framework towards cloud service improvement management. Proposal of MBI framework extension in an output of research process according to Design Science Research Methodology and its evaluation approach is based on methodology for the design and implementation of case studies for scientific purposes and on descriptive evaluation method using scenario.

Keywords: *Cloud service improvement, Management of Business Informatics (MBI), Cloud service consumer, Exit strategy, SLA, Quality of cloud service monitoring*

1. Introduction

During the last decade, organizations have started paying attention to the rapid growth of cloud based services. Cloud computing enables access to a shared pool of highly scalable computing resources using pay-as-you-go model without owning or managing these resources. However, benefits provided by cloud computing are accompanied by new types of problems and risks (Rebollo et al., 2014) resulting from the fact that the cloud service provider is an external third party. Both cloud service providers and consumers need to address many challenges to ensure successful adoption and operation of cloud services (Hobfeld et al., 2012). Management in cloud ecosystem therefore requires understanding, moderating and regulating relationships between cloud service provider and consumer (Felici et al., 2013). Cloud service provider is responsible for the design, operation and maintenance of cloud services. Cloud service consumers expect cloud services to be available whenever they need them to optimally support their business processes and to meet performance, security and cost targets. If cloud service performance levels do not reach consumer's expectations due to cloud service quality and its price, customers

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refuse adoption of cloud service, do not want to continue to use cloud service or change cloud service provider (Hobfeld et al., 2012). Due to dynamic nature of cloud environment, the need to measure and assess the actual level of quality of cloud service by cloud consumers continuous to grow (Aceto et al., 2013). Monitoring and validating performance of cloud service is needed to enforce Service Level Agreements (SLAs) in which targets levels of quality of cloud service as well as economic penalties associated to SLA violations are specified (Ardagna et al., 2014). Monitoring helps to detect if agreed levels of quality characteristics were delivered and helps to understand if any failure or performance issue of cloud service is caused by internal factors or by cloud service provider. If cloud service is unsatisfactory in terms of cost effectiveness, efficiency, risk level or support of business processes or if cloud service provider fails to fulfil contractual obligations, it is necessary to initiate the process of cloud service improvement so that the cloud service meets the organization's requirements. From the cloud consumer perspective, cloud service improvement represents changes in delivery of cloud services in terms of quality parameters of cloud services defined in SLA, in cloud service functionality or changing of cloud service provider. Planning of activities relating to termination of contractual based relationship with cloud service provider should be done before cloud migration process starts. Detailed specifications of these activities should be part of exit strategy. Exit strategy should include steps to deal with disengaging from cloud service provider and with migration to another provider or to own on-premise solution as well as recovering data from cloud service provider (Bisong and Rahman, 2011). In public cloud environment exit strategy mitigates the impact on business continuity resulting from security, privacy and compliance issues regarding to data, data commingling, service and data portability, provider lock-in, high costs caused by failure of the transition to the use of cloud services, high costs of migration to another provider or to on-premise solution, contract termination, provider goes out of business, provider's organizational changes or changes in ownership, SLA breach, changes of terms and conditions, price changes, changes in cloud service levels, changes in cloud services implemented by provider, cloud service interruption and failure, etc. Continuous cloud service improvement function therefore needs to be established for the management levels with a clear defined exit strategy.

This paper analyses MBI (Management of Business Informatics) framework for IT management from cloud computing point of view. MBI helps to design, implement and document a more efficient IT management system using best IT management practice guidelines and enables through the effective use of IT to achieve an increase overall business efficiency (Voříšek et al., 2015). This paper aims to improve the understanding of factors inhibiting or fostering effective adoption and utilization of cloud services in context of MBI framework.

The aim of this paper is (1) to analyse methods required for cloud consumer to improve cloud services, (2) to analyse MBI framework from cloud service improvement perspective and (3) to design an extension of MBI framework to enable managing cloud service improvement from consumer point of view. This paper proposes the extension of MBI's objects by a new set of objects (tasks) that reflects cloud service improvement from cloud consumer perspective. These tasks are described in detail in subsections 4.1, 4.2, 4.3 and 4.4. Approach to the design of cloud service improvement management is based on Design Science Research Methodology (Peffers et al., 2008). Starting with literature review, the research problem and tree above listed objectives were defined. Based on literature review research questions that help to define the current state of the real environment were formulated. Specifically,

this paper investigates following research questions:

RQ1: Allows MBI framework to fully support the adoption, utilization and continual improvement of cloud services?

RQ2: How cloud consumer can improve cloud services and in what context?

RQ3: What methods or tools are required for cloud consumer to improve cloud services?

Finding answers to these research questions helped to meet the above listed objectives and carried out the extension of MBI framework by a new set of tasks intended for cloud service consumers that contain best practices and recommendations to manage cloud service improvement.

In the next section (Section 2), related literature is reviewed. Section 3 describes MBI framework, its purpose, structure using meta-model and various types of objects and describes method of analysis of MBI framework from cloud service improvement perspective. Section 4 introduces MBI framework extension towards cloud service improvement management. Section 5 explains the verification method of proposed tasks. Section 6 describes the evaluation of the proposed extension. Section 7 gives conclusions.

2. Literature review

Generally, dimensions of service improvement are quality, performance, efficiency, outcomes, equity, value for money and consumer satisfaction (Boyne, 2003). ITIL defines seven-step improvement process which is responsible to ensure that IT services are provided more efficiently over time while achieve cost efficiency and optimally enable to meet business requirements (Jansen, 2012). Service improvement in cloud computing environment from consumer point of view has two main objectives which are availability of cloud services with needed functionality and needed level of quality of cloud services (Wang et al., 2014). Quality of cloud service parameters are run-time related performance metrics such as response time, transaction rate or cloud service availability (Wang et al., 2014). Levels of values of these parameters should float within pre-agreed limits according to the SLA (Burkon, 2013). An important activity of cloud service improvement is therefore monitoring actually measured values of cloud services and their comparison with the values defined in the SLA (Montes et al., 2013). Monitoring is essential for measuring and assessing cloud services in terms of performance, reliability and ability to meet SLAs (Aceto et al., 2013). It enables measure a certain aspect of cloud service as defined in SLA and evaluate and deviation from its normal state (Meng and Liu, 2013). In case of cloud computing, the definition appropriate monitoring metrics, which are strongly dependent on the terms defined in SLAs for each cloud service, is a crucial aspect (Montes et al., 2013). Monitoring considerably affect planning of utilization of cloud services, because outputs from monitoring serves as a basis for cloud service improvement and making decisions about cloud services. SLA typically contains specification of contracting parties, scope, cloud service characteristics, target levels of qualitative parameters of cloud service (SLO), technical specifications and management procedures, terms and conditions like guarantees, SLA violation, penalty or local legislative requirements, payment method and rules for contract termination including definition of exit strategy (Comuzzi et al., 2013; Šubrta, 2015). Exit strategy helps organizations to develop a clear plan for cost effective and efficient termination of any cloud arrangement and return to on-premise solution or switch to another cloud service provider. Exit strategy helps to overcome problems of vendor lock-in and data retrieval (Comuzzi et al., 2013). Importance of exit strategy is also emphasized by Cloud Security Alliance which ranked exit strategy as the second most confident issue of cloud

adoption (CSA, 2012). Exit strategy should be integral part of cloud migration strategy as it defines a contingency strategy to ensure business continuity for planned or emergency migration including specification of which data will be retrieved from provider and identification of other potential service providers and their services (Wilson, 2011). Since the process of data retrieval can be both time and money-consuming activity, must be methods of contract termination and thus relevant requirements from exit strategy describing details of exit process negotiated and included to SLA (Chou, 2015). It must also include responsibilities of cloud service provider and consumer and conditions of premature agreement termination. Opara-Martins (2016a) sees data portability as a key assumption to enable to develop a feasible and viable exit strategy (Opara-Martins et al., 2016b). Other important factor to develop exit strategy is knowledge of the differences between the different syntax and semantics of data, interface technologies offered by different providers and used standards and protocols (Opara-Martins et al., 2016b). The fundamental problem, which exit strategy should deal with, is transfer of data stored at one provider to another provider. Data transfer should be addressed particularly from a technical perspective. Data transfer can be facilitated by adoption of the same standards (eg. REST) by different providers (Schaffer, 2014). Creation of exit strategy is a demanding process, which requires individual approach to planning and constant monitoring of IT market environment. Moreover, exit strategy for SaaS is even more complicated, because SaaS integrates software, platform and storage (Schaffer, 2014). Despite these arguments about the need for good exit strategy, most of the scientific articles have not taken exit strategy as critical component of cloud adoption process when discuss security, economic, legal and other cloud governance and cloud management concerns. There is no guidance on the development of exit strategy and no scientific article does treat of what exactly should be included in exit strategy.

3. MBI

Many IT governance frameworks including COBIT, ITIL or ISO 38500 has been developed up to now. These widely accepted frameworks are mainly implemented and used especially by large organizations which can allocate big budgets to information technology needs of the organization (Pour et al., 2013). A survey on business informatics management issues conducted by Pour (2012) shows that widely accepted frameworks are too complex, time-consuming, costly and way complicated for small and middle enterprises. Another general problem of small and middle enterprises is a lack of necessary resources and skills for effective operation and support of IT. Along with it the following challenges have arisen (Pour, 2012; Pour et al., 2013):

- Low efficiency of IT service management
- Missing IT service catalogue and underestimation of the importance of SLA
- Low or no IT process documentation
- Lack of a comprehensive system of metrics
- Limited utilization of outsourcing and cloud computing given their potential
- Relatively low ratio of investment into strategic applications compared to investment into technology and inadequate cost management

To address these issues, the Department of Information Technology at the University of Economics Prague in collaboration with the Department of Software Engineering at the Czech Technical University have developed Management of Business Informatics (MBI) framework (Dohnal and Pour, 2013) to provide a support in the form of best IT management practice guidelines that can be

easily adapt to specific needs in end-user organizations (Buchalcevová, 2016).

MBI framework is on conceptual level described by meta-model (Buchalcevova and Pour, 2015). Figure 1 shows MBI meta-model indicating the key classes of objects and their relationships.

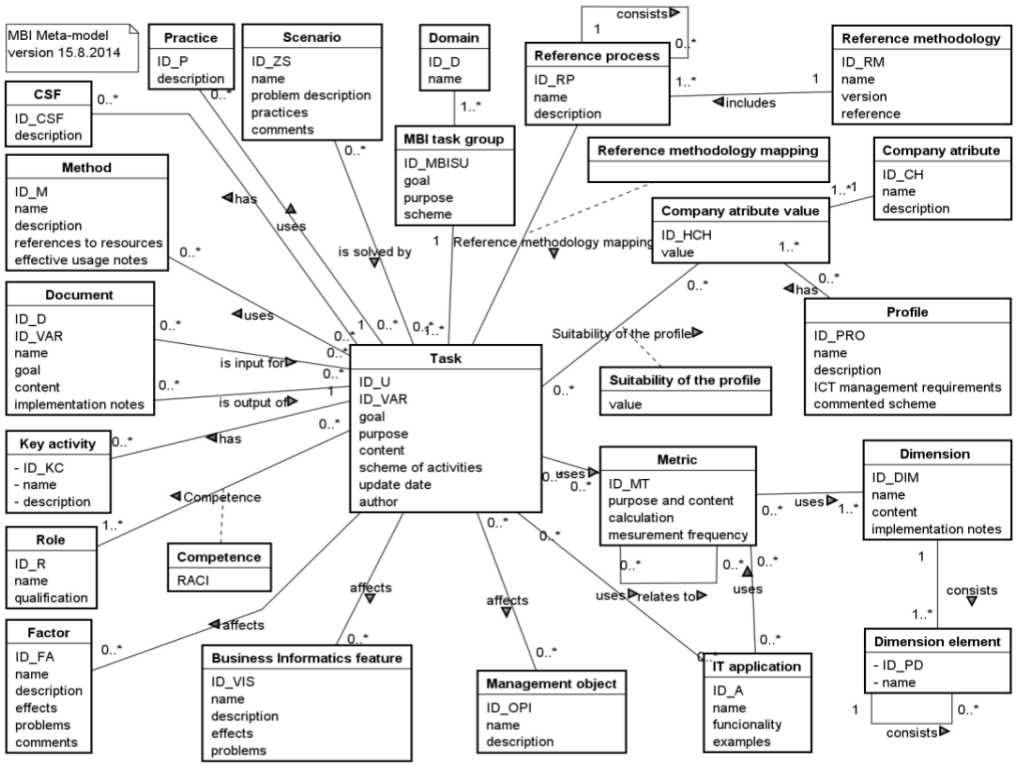

Figure 1. MBI meta-model, source: (Buchalcevova and Pour, 2015)

3.1. Analysis of MBI framework from cloud service improvement perspective

Analysis of MBI framework was focused on MBI objects related to management of cloud services, especially on management of continuous improvement of cloud services from consumer perspective. Using scientific methods of analysis, individual parts of MBI framework were explored starting with management levels and individual levels included domains (see Figure 2). Analysis was performed logically from top management level to bottom management level, i.e. from strategic management to operational management. Within each management level, all domains were explored including its objects and relationships between them. MBI considered cloud computing as one of the factors influencing solving of a specific IT management problem. Some tasks refer to cloud computing services rather as a form of IT sourcing. MBI framework has defined only a few tasks dealing with cloud computing which were cloud governance, cloud risk management and managing effects and benefits from cloud computing. But MBI framework did not explicitly take into account all aspects of managing of cloud services from cloud consumer viewpoint. This resulted in the design of MBI framework extension towards managing of cloud services.

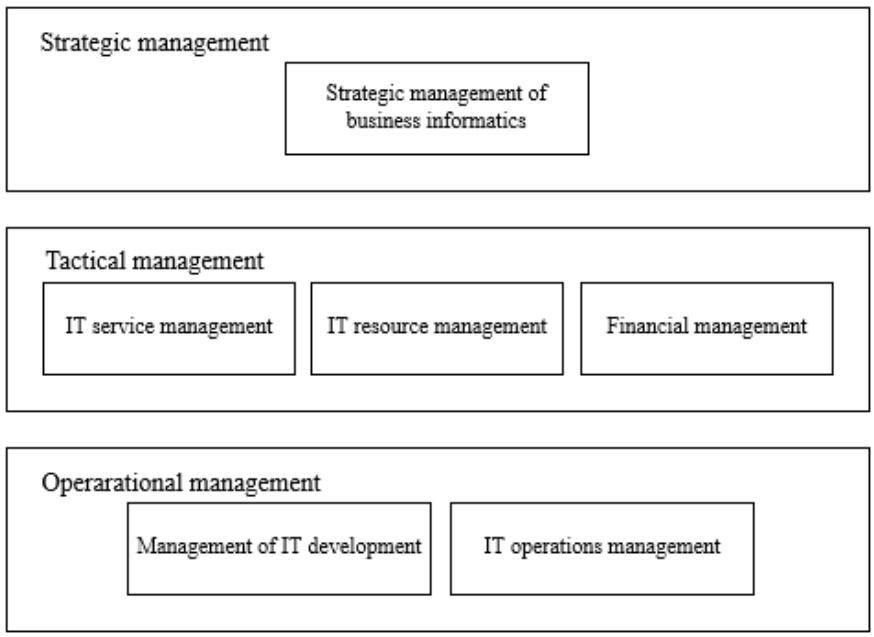

Figure 2. Hierarchical level of domains in MBI framework, source: (Buchalcevová, 2016)

4. Proposed MBI framework extension

The analysis of MBI framework shows that this framework does not fully support managing of cloud services and does not reflect specifics of cloud service improvement from consumer point of view. MBI framework does not take into consideration exit strategy at all. However, MBI framework is designed with regard to continual development and can be easily extended to new objects or existing objects can be easily modified (Buchalcevová, 2016). All adjustments of MBI framework were carried out at strategic management level in domain strategic management of business informatics. A new group of tasks TG007 Cloud Governance and Cloud Management was created. This group of tasks was created by merging the existing task Cloud governance and some other tasks and by the definition of a set of new tasks. Group of tasks TG007 Cloud Governance a Cloud Management specifies its purpose, list of all included tasks (see Figure 3), factors that affect these tasks, main metrics, related roles and relationships to other relevant tasks across all domains.

The proposed extension of MBI framework to manage cloud service improvement from cloud consumer perspective consists of definition of following tasks which are further described in more detail:

The proposed extension of MBI framework to manage cloud service improvement from cloud consumer perspective consists of definition of following tasks which are further described in more detail:

- Managing cloud exit strategy (U063A)
- Managing cloud service agreements (U066A)
- Cloud service monitoring (U076A)
- Managing continual cloud service improvement (U077A)

U052A Cloud Governance	**U053A** Cloud Management	**U054A** Cloud Readiness Assessment	**U055A** Managing effects from the use of cloud services
U056A Cloud service risk management	**U061A** Financial management for cloud services	**U062A** Cloud service compliance management	**U063A** Managing cloud exit strategy
U064A Cloud provider portfolio management	**U065A** Cloud service portfolio management	**U066A** Managing cloud service agreements	**U067A** Cloud service transition planning
U068A Cloud service validation and testing	**U069A** Cloud service access management	**U070A** Cloud service deployment management	**U071A** Cloud service event management
U072A Cloud service incident management	**U073A** Cloud service problem management	**U074A** Cloud service request fulfilment	**U075A** Cloud service request for access management
U076A Cloud service monitoring	**U077A** Managing continual cloud service improvement		

Figure 3. A list of tasks contained in group of task TG007 Cloud Governance a Cloud Management, source: (author)

4.1. Managing cloud exit strategy

Task U063A Managing cloud exit strategy aims to creation plans for termination of use of cloud service from particular cloud service provider. These plans contain individual steps needed to terminate use of cloud services and to move all data to another service provider or to go to on premise solutions. These plans cover two variants of cloud service termination:

- Termination of use of cloud service initiated by consumer
- Termination of cloud service delivery by service provider

The main tasks of planning activities and resources needed to terminate use of cloud service from provider include:

- Definition of data model of business process or its part which is supported by cloud service
- Identification data necessary for termination of use of cloud service
- Definition of methods to obtain data to perform termination of use of cloud service
- Definition of infrastructure resources for data transmission from the cloud service provider and store them in-house or at another cloud service provider
- Definition of human resources needed to carry out termination of use of cloud service
- Definition of time horizon of feasibility of termination of use of cloud service

- Identification of costs related to infrastructure and human resources maintained by cloud service consumer services in case of termination of use of cloud service
- Definition of costs of cloud service termination according to contractual arrangement
- Identification of costs related to transition to another service provider or to on-premise solution
- Definition of requirements for contractual arrangement with cloud service provider which create conditions for feasibility of termination of use of cloud service

Inputs of task are:

- Artefacts defining the use of cloud service

Outputs of task are:

- Plans of organizational activities
- Plans of technical activities
- Plans of infrastructure resources
- Plans of human resources
- Plans of time horizon of feasibility of exit strategy
- Financial plans for cloud service termination
- Financial plans for transition to another service provider or to on-premise solution

4.2. Managing cloud service agreements

Task U066A Managing cloud service agreements aims to ensure that contracts about the cloud service provisioning concluded between cloud service provider and consumer include contractual arrangements contain legally enforceable ensuring that services are provided as expected. This task manages identification of cloud consumer's requirements for content of cloud service agreements, definition of cloud service quality levels, negotiation of contractual terms and conditions like means of formal communication and procedures for resolving disputes, obligations and liabilities of closing parties. Task further manages changes in service agreements during the provisioning and utilization of cloud services and contract termination.

Inputs of task are:

- Cloud consumer's requirements for cloud service
- Information about cloud service from a cloud provider service catalogue

Outputs of task are:

- Master cloud service agreement
- Cloud service agreement
- Cloud service level agreement

This task can be performed by applying the following steps:

- Identification contractual and service levels requirements
- SLA negotiation to agree on the values of SLA parameters related to specific services, costs and terms and conditions
- Execution of the contract
- Change proposal for SLA, amend the SLA to include the proposed change
- SLA termination

Cloud service agreements must reflect consumer requirements for managing cloud service security, privacy and performance and legislative and regulatory requirements. Purpose and scope of cloud service agreements may vary depending on type of relationship between cloud service provider and consumer, type of cloud service provided, type of processed data, risk arising from the use of cloud service and on related legislation. Types of cloud service agreements are master cloud service agreement, cloud service agreement and cloud service level agreement (SLA). Master cloud service agreement is a contract between cloud service provider and consumer covering the basic terms and conditions that govern ordering, delivering and utilizing of cloud services or future cloud service agreements and SLA's. Both cloud service agreement and SLA

complement terms agreed in master cloud service agreement by special conditions and metrics of the provision of particular cloud service. Master cloud service agreement enable to quickly negotiate future conditions or agreements, because they rely on the terms agreed in master cloud service agreement, so that the same terms need not be repetitively negotiated, and to negotiate only the deal-specific terms. Master cloud service agreement may differ from provider to provider, but an exemplary structure can includes terms of ordering services, service delivery, access to the subscription services, conditions of use of services, customer data obligations, data protection, service warranties, customer's responsibilities, intellectual property rights, billing and payments terms and method, claims and disputes, taxes, technical support, agreement modification, agreement termination, agreement renewal, cancellation of auto-renewal, warranty disclaimer, limitation of liability, confidentiality clause, indemnification clause, jurisdiction, applicable law, geographic regulative or severability clause. Cloud service agreement is a document establishing a contractual relationship between cloud service provider and consumer, which includes general information about provider and consumer and other parties and terms and condition of cloud service provisioning. SLA defines business and technical characteristics of cloud service in the terms of quality of cloud service, price, remedies and sanction in case of SLA breach. The structure of cloud SLA may be the following:

- Basic characteristics
  - Purpose and scope of SLA
  - Cloud service provider identification
  - Cloud service consumer identification
  - Cloud service description
  - Validity of SLA
  - Relevant stakeholder's identification
- Performance indicators
  - Cloud service level objectives
  - Availability (cloud service uptime/downtime)
  - Response time
  - Capacity (number of concurrent connections to cloud service at any given time, number of users who can use cloud service at any given time)
  - Scalability (capacity of resources available)
  - Throughput
  - Number of transactions
  - Interoperability (ability to cooperate with external systems and services)
  - Reliability (ability to provide function correctly and without faults within a defined period of time, level of cloud service capabilities to automatically switch to a redundant or backup cloud service in case of failure)
- Security indicators
  - Identity and access management
  - Cryptographic methods
  - Cloud provider's security policy
- Operation indicators
  - Cloud service monitoring and reporting
  - Incident management and reporting
  - Data backup, data recovery
  - Service Desk support
- Technical specifications and business policy
  - Cloud provider's vulnerability management
  - Cloud provider's data management
  - Allowed geographic locations to store cloud consumer's data
  - Scheduled maintenance and upgrade
  - Change management, information on changes, escalation procedures
  - Methods of formal communication
  - Cloud provider's compliance management

  - List of documents available for audit, list of certification obtained
  - Acceptable use policy of cloud computing service
  - Use of services of third parties
- Terms and conditions
  - Inclusion of master cloud service agreement clauses
  - Liabilities
  - Conditions of changes in SLA
  - Data ownership
  - Jurisdiction, unique geographically specific and national legal requirements
  - Intellectual property, licensing arrangements
- Payment
  - Payment methods
  - Payment schedule
  - Taxes
  - SLA breach penalty
- SLA termination
  - Conditions of termination of SLA
  - Exit strategy definition
  - Agreement renewal (automatic renewal, continuous billing, compulsory renewal)
- Glossary

Qualitative parameters of cloud service levels defined in SLA vary depending on the deployment model. The most important metric for measuring level of cloud infrastructure services (IaaS) are related to computing power, network and storage parameters. These metrics are:

- CPU capacity, number of virtual CPUs,
- Server uptime
- Memory size, storage size
- Scalability (automatic, up, down)
- Database size, database response time, number of database operations performed,
- Data processing, data integrity
- Throughput
- Availability
- Load balancing
- Back-up, disaster recovery
- Support response time
- Network bandwidth, network throughput, transferring bandwidth, network uptime target, network latency, network response time, outgoing and incoming network traffic, packet delay, jitter, packet loss, network egress
- Virtual private network
- Type of XML API method

IaaS metrics are applicable also like metrics for measuring level of cloud platform services (PaaS) because of need for infrastructure resources to build and run applications. Examples of PaaS specific metrics are:

- Data transfer between cloud server and business application
- Intrusion Prevention Service (IPS)
- Number of requests for predefined functions
- Execution time of code, amount of memory allocated for code execution,
- Supported environments (both development and deployment), supported browsers, operating system software licensing, software licensing, operating system and application management (installation, configuration, and maintenance), user management (authentication methods, user authentication roles, user records, SSO)
- Public IP Address, Managed DNS per zone, SMTP Relay Service per emails sent
- Number of active users, who can access the platform

Metrics specific to SaaS model are:

- Usability, reliability
- Interoperability
- Availability, application uptime/downtime, response time, recovery time

- Scalability (automatic, up, down)
- Storage size, file storage size
- Number of API calls, number of records
- Software licenses, application functionality
- Customizability, personalization, testability, auditability
- Number of administrators, number of users
- Identity and access management, technical support

4.3. Cloud service monitoring

Task U076A Cloud service monitoring aims to collect data on operation of cloud service, detection deviations from expected values of metrics of cloud service defined in SLA and escalation detected deviations. This task manages monitoring and reporting values of metrics currently operating cloud services and their evaluation with contractually agreed parameters and values of metrics in SLA. In case that any deviation from agreed level of metrics occurs, generating reports is initiated and these reports are distributed to relevant roles of both cloud consumer and cloud provider based on conditions agreed in contractual arrangements.

Inputs of task are:

- Values of metrics defined in SLA
- Definition of escalation procedures.

Outputs of task are:

- Sets of measured data
- Reports on deviations from values of parameters currently delivered cloud service from agreed levels in SLA.

With data on monitoring metrics available at run-time, specific actions previously defined by cloud consumer can be performed if agreed in SLA. This task can be performed by applying the following steps:

- Collecting data on monitoring metrics of cloud service
- Comparison of actual measured values of metrics with values defined in SLA
- Generating deviations
- Escalation of detected deviations
- Making operational decision

4.4. Managing continual cloud service improvement

Task U077A Managing continual cloud service improvement aims to ensure that cloud service performance corresponds to dynamically changing business requirements and needs of business processes in terms of efficiency, cost-effectiveness and acceptable level of risk. This task carries out activities focused on improving long-term performance of cloud service according to changing needs of business processes and depending on external environment and on cloud computing strategy. Task collects data enabling to identify the need for a change in delivery of cloud service and creates proposals for cloud service change. Task ensures that proposal for cloud service change will be communicated with all relevant stakeholders and that all approved changes in cloud service will be implemented.

Inputs of task are:

- Cloud computing strategy
- Collecting data on monitoring metrics of cloud service
- Business requirements
- Legal requirements
- Information obtained from cloud service catalogue about cloud service portfolio,
- Information obtained about portfolio of approved cloud service providers
- Existing SLA

Outputs of task are:

- Cloud service improvement strategy
- Cloud service monitoring plan
- Data collected on monitoring metrics of cloud service

- Data analysis
- Reports on cloud service performance
- Proposal for change of cloud service
- Verified proposal for change of cloud service by relevant stakeholders
- New proposal of SLA

This task can be performed by applying the following steps:

- Definition of cloud service improvement strategy
- Definition of cloud service monitoring plan
- Collecting data on monitoring metrics of cloud service
- Definition of proposal for change of cloud service
- Implementation of changes of cloud service

Based on strategic business needs, cloud service improvement strategy defines requirements for cloud service improvement including:

- Scope of cloud service improvement
- Level of cooperation with cloud service provider on cloud service improvement
- Determination of alternative solution to provided cloud service in terms of cloud service provided by different provider or internally provided IT service

Cloud service monitoring plan defines cloud service monitoring requirements in order to obtain data for improving cloud service. It includes business requirements for the level of metrics of provided cloud service and types of information which will be collected about provided cloud service. If provided cloud service does not meet business requirements, potential areas for improvement of cloud service must be identified.

Data collection on monitoring metrics of cloud service performs activities defined in cloud service monitoring plan and stores acquired data in pre-defined repositories. Data collection for the purpose of improving cloud service should be performed over a longer period of time, since the aim is not only to determine the current status of cloud service, but longer-term trends in cloud service performance. Similarly, monitoring of business requirements on cloud service allows to detect actually relevant reasons for proposal for change in cloud service or proposal for SLA redefinition.

Proposal for change of cloud service can be created either like proposal to change SLA or like proposal to change functionality of cloud service. In both cases, it is advisable to prepare a proposal in cooperation with cloud service provider. Proposal should include secondary effects such as cost related to change of cloud service, changes in cost of cloud service operation, changes in information security or changes in areas related to legislation. Cloud service provider may reject or verify the proposal with information about cost and time horizon of implementation all requested changes of cloud service.

Implementation of changes of cloud service ensures realization of all changes specified in the proposal for change agreed by relevant consumer's stakeholders. Change can be carried out at three levels:

- Change in SLA
- Change in functionality of cloud service
- Change of cloud service provider or transition to on-premise solution

In the case of change in SLA, new SLA will be negotiated and agreed both by cloud consumer and provider. In the case of change in functionality of cloud service, provider initiates new iteration of cloud service lifecycle. Provider performs in his test system change in functionality of cloud service. Consumer tests new or modified functionality of cloud service and performs integration tests when appropriate. After successfully performed tests, cloud service

will be deployed into productive operation. Consumer performs necessary complementary activities, which may include configuration of new permission for user profiles or modification monitoring metrics in monitoring system. The last case of change occurs if cloud service provider does not want or is not able to implement the proposed changes. For that reason, consumer decides to change current provider for another cloud service provider or to delivers services internally. In this case it is necessary to initiate the process of exit strategy and to start transition to a new cloud service provider. Both activities definition of proposal for change of cloud service and implementation of changes of cloud service have not been performed.

5. Verification of proposed tasks

Verification of the practical applicability of proposed group of tasks TG007 Cloud Governance and Cloud Management and in this study detailed described tasks dealing with managing cloud service improvement from cloud consumer perspective is based on a case study performed in an IT organization which provides IT services to organization operating in retail. The case study was performed in accordance with the methodology for the design and implementation of case studies for scientific purposes as defined in publication Case Study Research: Design and Methods (Yin, 2009). The IT organization decided to utilize a public cloud computing service for the first time and launched its adoption as a Proof-of-Concept project. This project of adoption and utilization of cloud service included planning, selection, implementation, operation and monitoring phases. The data collected during the project served as the basis for improving the proposed tasks.

Task U063A Managing cloud exit strategy was fully applied. Scenario in case that utilization of cloud service will not be feasible was developed. Data model describing business processes supported by cloud service was modelled. Based on this data model, data, which IT organization will need to end the use of cloud service and for transition to another cloud provider, were defined. Further resources needed to terminate cloud service utilization and schedule to perform the termination were planned. Expected cost of cloud service termination and migration to another provider was analysed. Conditions for termination of using cloud service were specified in SLA and agreed by both parties. Task U063A Managing cloud exit strategy was fully applied. Task U076A Cloud service monitoring was fully applied. Monitoring of cloud service operation was divided into two parts, automated monitoring and manual collecting of data which is conducted once a day by technical administrators. The values obtained by manual collection of data are stored in for that purpose defined files. Guide for automated monitoring of IT service operation was extended to monitoring the values of metrics of new cloud service in accordance with SLA. Task U077A Managing continual cloud service improvement was partially applied. It was contractually agreed that cloud service provider will perform regular updates. Periodically performed analyses of data does not show need for changes in provisioning of cloud services nor need for changes in cloud service. Transition to another provider or a transition to on-premise solution at the time of execution of this case study was not considered.

6. Evaluation of MBI framework extension from cloud service improvement perspective

The MBI framework has not been implemented as a whole framework in any organization yet. Until now each organization has selected only specific tasks which has implemented as a basis for its own IT management system adapted to the specific business needs. Evaluation of

proposed MBI extension is based on descriptive evaluation method using scenario of specific situation which need to be solved.

Scenario: Currently consumed cloud service does not fulfil business requirements

Problems to be solved:

- Cloud service inefficiently supports business processes
- Cloud service does not reach the expected effects
- Cloud service is cost ineffective
- Cloud service exposes the organization to an unacceptable level of risk
- Cloud service does not reach the expected performance characteristics
- Measured values of cloud service characteristics show a trend of future failure of meeting business requirements
- Changes of terms and conditions of cloud service delivery
- Changes in cloud service levels
- Changes in cloud service implemented by provider that do not comply with business requirements

Practices and recommendations for solving the problem:

- The context for strategy for cloud service improvement using practice of task U077A Managing continual cloud service improvement is identified.
- Based on analysis of collected data in accordance with task U066A Managing cloud service agreements on monitoring specified by task U076A Cloud service monitoring and by task U077A Managing continual cloud service improvement, a problem to be solved is identified and fully logged.
- Task U077A Managing continual cloud service improvement is used for solving identified problem – problem is categorized, prioritized, diagnosis of cause is carried out and problem is escalated to relevant stakeholder in terms of provider or consumer. Cause can be change in business environment, change in business requirements, SLA breach, changes in cloud service carried cloud service provider bankruptcy. Then request for change is created including all relevant information relating to the nature of the request. In the case that change of provider is requested, practices and recommendations of task U063A Managing cloud exit strategy will be applied.
- Cloud service achievements are continually reviewed to ensure they remain in compliance with business requirements and service provisioning is continually align or re-align with outcome requirements as defined using task U066A Managing cloud service agreements.

7. Conclusions

This paper proposed extension of MBI framework to enable managing cloud service improvement from consumer perspective. MBI was developed to help organizations with managing business informatics. As cloud computing continues to increase its importance it is essential that organizations understand the way to meet business requirements through utilizing of cloud services while obtaining benefits, optimize investments and related risks. However, MBI is not intended for cloud service consumer to manage IT environment where cloud computing services owned by third party are utilized to support business processes. Analysis of MBI showed that this framework does not fully reflect specifics of cloud service improvement. Certain research into cloud computing management has been

conducted. However, existing research does not give detailed guidelines of cloud service improvement from cloud consumer perspective. There are some difficulties that organizations face while using cloud services like missing or poorly defined exit strategy, dependence on cloud service provider, lack of SLA standardization, vaguely defined responsibilities, underestimating the importance of monitoring, poorly defined cloud service monitoring plan or missing cloud service improvement strategy. Guidance on implementation of cloud service improvement management methods helps to overcome these difficulties and facilitate utilization of cloud services to meet business requirements anytime.

This paper describes the results of MBI analysis and the proposed extension of the MBI framework towards managing cloud service improvement from cloud consumer viewpoint. This extension includes the addition of new tasks and scenario which helps to solve potential real situations associated with cloud service operations by using recommended tasks. A new group of tasks for cloud computing governance and management was developed. Four tasks are designed specifically for cloud service improvement from cloud consumer perspective. Proposed tasks were verified by using the method of case study and proposed MBI extension was evaluated using scenario as a descriptive evaluation method. The future efforts will focus on a more detail definition of metrics, documents and roles of each task.

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