

PARAMETERS OF IT SERVICE MONITORING FOR BUSINESS PROCESS QUALITY SUPPORT

Stanislava Šimonová, Ivan Helcelet

Abstract: *Business processes need relevant applications of information systems with relevant data and relevant operation for current functioning, they also need adequate technological platform with necessary functions; in general, business processes need a suitable IT service (or a group of IT services) for correct performance. These IT services have to fully support business processes as well as they have to be developed according to the needs of business process quality support. IT services have to be created and parameterized in such a way that in case of a problem, a quick reaction follows in both senses – damage minimization and fast restoration of provided IT services. Business processes are monitored and evaluated and based on the results, changes in particular processes are designed. This process support utilizes time-proven methods and standards. The requirements for IT services quality is similar as for business processes, however, recommended procedures include usually general recommendations only. Another fact is that the importance of IT services is not the same as there are different influences, such as process, time criticality, other IT services and other influences. The text focuses on setting the parameters for measuring IT services quality within an organization.*

Keywords: *IT services, Monitoring, Process quality, Restoration of provided IT service.*

JEL Classification: *M15, M11, L86.*

Introduction

Business process can be defined in accordance with the norm ČSN EN ISO 9000:2006 as a group of mutually related or interacting activities within which the inputs are transferred to outputs while this process bring benefits to external or internal customer. Process approach to organization management puts emphasis on continuous support and improvement of processes, i.e. continuous flow of changes in process performance, while these changes are initiated by influence (impulses) inside and outside the organization [16]. Improvement is also related to resources including technological resources within relevant IT services utilization.

The degree of requirements on IT management in a company is directly proportional to economic and operational needs of the company; at the same time it is determined by progress and abilities of information and communication technologies. The main goals for IT management are:

- Goal: to ensure high functionality of information system; this means not only functions of keeping records and transactions but also analytic, functions for decision support and control functions.
- Goal: achieve high rate of application and technological availability, i.e. security, accessibility, reliability and flexibility.

- Goal: Continuously monitor minimization of the cost compared to economic and non-economic effects.

Spending money for IS/IT system is considered a necessity. However, it is often not measured and evaluated whether IT services bring the expected benefits for business processes and whether the investment to improvement really brought expected improvement [9]. It is, therefore, necessary that monitoring of a business process performance should include monitoring (and evaluation) of related IT services performance.

1 Statement of a problem

IT services should be prepared, adjusted and robust so that in case of a problem there could be a fast reaction in the sense of damage minimization as well as fast recovery of IT services provided or ideally, early problem prevention based on monitored indicators [15]. Further, it is necessary to take resources into account (similarly as for business processes) which are internal and external [19]. Internal resources are involved directly in the service production while external resources belong to their surroundings or have influence or interest in the service production.

Responsibility for IT service quality is held especially by the service provider and further by the owner of the supported business process [4]. The provider manages the service delivery and the process owner has to define requirements on IT services in accordance with the business process and its needs.

As a result of its improvement, the business process initiates requests for change of the supporting IT service. The options based on the change size of the IT service can be defined as:

- No change in the IT service: internal process reorganization without impact on the IT service or with impact on a different IT service which is not in scope of the enquiry,
- loss of the need to use the IT service: the process change does not need to use the particular IT service any more,
- change only in service parameters: change of internal parameters inside the application; the construction of the service is not changed in regards of architecture but an impact on performance is possible (e.g. repeating of calculation delays the result),
- demand for new IT service: a process change requires construction of a whole new IT service; at the same time this can impact the performance of current services (e.g. by the need to transfer information through a new interface).

The relation between a business process and an IT service is mostly not 1:1 (or 1:N) but usually it is an M:N relation. This means that one process uses more IT services while one IT service is used to support more business processes. At the same time it is necessary to take into account the influence of surrounding processes and related IT services. This means that when improving a business process, thanks to the influence of the surrounding (or impact on the surrounding) a situation can occur that the process change requires also changes in the IT service, but this change is questionable. There may be several reasons:

- Inability of other business processes to adapt to the modified IT service: i.e. the requested change of IT service has impact on other processes which utilize the same IT service; these processes might be unable to change or there are technological reasons why they cannot accept the change of the IT service. In such case it is necessary to prioritize processes by their benefits for the company and decide about further approach,
- too significant change in the IT service output: if the request for change induces e.g. a change of the type of IT service output, it might be necessary to implement a completely new IT service (which will indeed be a modification of the current service). This genesis of two (although similar) IT services needs to be recorded for the case of possible further development,
- economic unprofitability of the impact on the surrounding: even if surrounding processes are able to adapt to the modification in utilized IT service (the change of the IT service was requested by another business process), it is necessary to take the economic profitability of such a change into account. The cost should be bore by the modification project which initiates and realizes the change.

It is, therefore, obvious that an IT service cannot be considered only a separate object only in connection with related business process but it is also necessary to systematically evaluate surrounding processes and services. Thus monitoring of the service performance (for particular process) has to be broadened by contact with other customers of the IT service.

2 Methods

Process improvement is defined by time-proven methods and norms of quality management which include Six Sigma, Kaizen, CAF [3], [11], [18]. The processes consume/utilize human as well as material resources for performing their activities. These resources include IT services, i.e. supporting services provided based on information and communication technologies within company IT.

IT management is performed within a particular framework or model which include the ITIL standards (Information Technology Infrastructure Library) [2] or COBIT (Control Objectives for Information and Related Technology) [5]. ITIL is a framework mostly for company IT management which offers guidelines, musters, diagrams and other well-proven methods for management of IT services [2], [7]. COBIT is a framework for IT Governance [5], it is a strategic framework for management of IT environment with the aim to harmonize company IT management and the goals and company management. Mentioned approaches or frameworks solve mostly management of IT processes in relation with business process support to fulfil company goals.

ITIL defines IT service – “A service provided by an IT service provider. An IT service is made up of a combination of information technology, people and processes. A customer-facing IT service directly supports the business processes of one or more customers and its service level targets should be defined in a service level agreement.” [6]. ITIL further defines the provider and operator of IT services – A provider of IT services provides IT service to customer within their business; the IT service operator might be a part of the same company as the customer (internal service provider) or a part of another company (external service provider). Requirement for high-quality IT service is a part of the listed frameworks,

however, monitoring and evaluation is made mostly on the base of various recommendations. Further, current trend is not fully reflected in the frameworks, as current trend prefers transfer of attention from operating isolated applications to providing complex services.

Another important category is represented by the methods of parameter values collection for monitoring (and consequent evaluation). The methods can be generalized into 3 groups [4]:

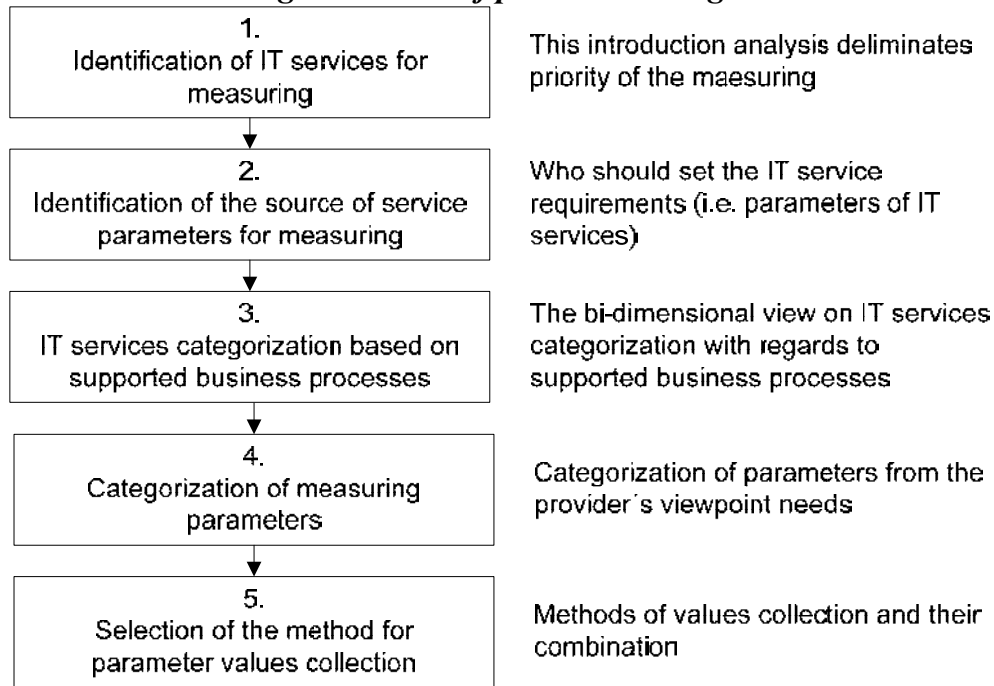
- Manual collection of values: lower quality and level as well as lower informative values of gained information can be expected (human factor involvement is the limiting factor [14]). The advantage is low financial requirement as the only cost is human work and a license for a backup tool (used for storing the values),
- general measurement tools: the advantage is availability of testing licenses (it is possible to try and decide whether the considered measuring system provides expected options and measurement outputs). Limiting factors may include price (for purchasing and operating the monitoring tool); another limit may be limited possibilities of adjusting the tool for specific own needs,
- proprietary methods of measuring: usually tailor made development of a special probe into IT services, creation of such a tool is closely linked to gained know-how within the particular process. Such measuring is most costly; however, it is not necessary to create robust structures for carrying out the measuring as the tools cover only the narrow topic.

Another important factor is decision about the priority and risk assessment of the business change and, therefore, also the change of IT service. Business processes are generally divided to product realization or core or key processes (they fulfil the company goal), management processes and supporting processes [10]. IT services are divided analogically according to which processes they belong to [20]. Bi-dimensional view at the problem is necessary, this means one dimension is the financial benefit (product realization processes vs. supporting processes), the other dimension is time-criticality of the provided service. Time criticality expresses the need to use the service in real time; that means fast response and minimum downtime. If the service is not time-critical, its utilization might be stopped for some time (hours or days) and necessary activities can be performed when the IT service is available again.

3 Problem solving

Proposed method for determination of monitoring parameters of an IT service consists of several phases (see Figure 1).

Fig. 1: Phases of problem solving



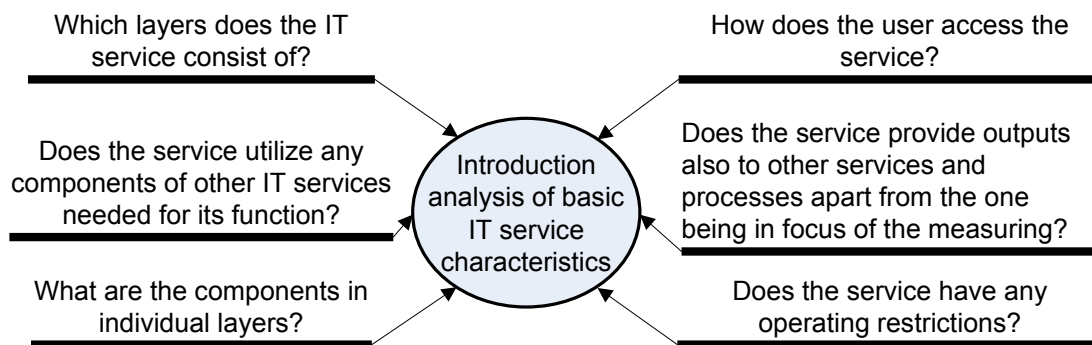
Source: own adaptation

3.1 Identification of IT Service for Measuring

The initial impulse for IT service measuring is usually creation of a new service or innovation of a service already running. Another impulse might be effort to improve the service by one of the stakeholders (either provider or operator of the service).

The introduction analysis of basic IT service characteristics is shown in Figure 2.

Fig. 2: The introduction analysis of basic IT service characteristics



Source: own adaptation

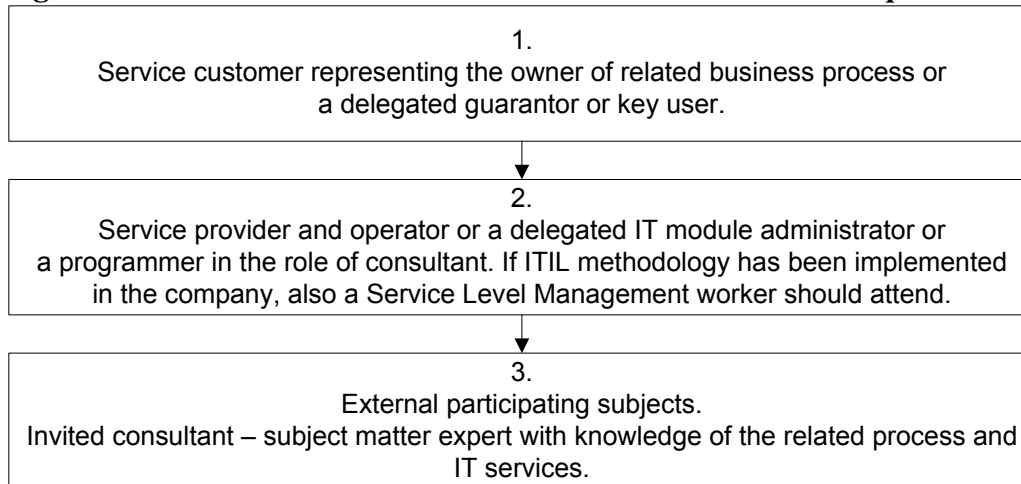
Identification of service components on individual layers provides a list of points which need to be further analyzed from the view of benefits and contains. These are the points which should be measured. This list of points should also include individual provided or user interfaces of the service as their existence might increase the importance of the service within the company. This introduction analysis delimitates priority of the measuring.

3.2 Identification of the Source of Service Parameters for Measuring

The views on performance are different based on whether the requirements are set by the service supplier or service customer. The service supplier might consider the service efficient based on profitability of providing the service. The service customer requires timely fulfillment and high quality of the output.

Thus, it is a question, who should set the IT service requirements (i.e. parameters of IT service). The response is a proposal of order in which all stakeholders should set their requirements (see Figure 3).

Fig. 3: The order in which all stakeholders should set their requirements



Source: own adaptation

This article takes into account the first two points of this list. Therefore, the customer's requirements will be identified first by their business owner; the service operator's requirements will follow. With regards to complexness, the attention is focused specially on the operator as it enables a wider range of measurable points.

3.3 IT Services Categorization Based on Supported Business Processes

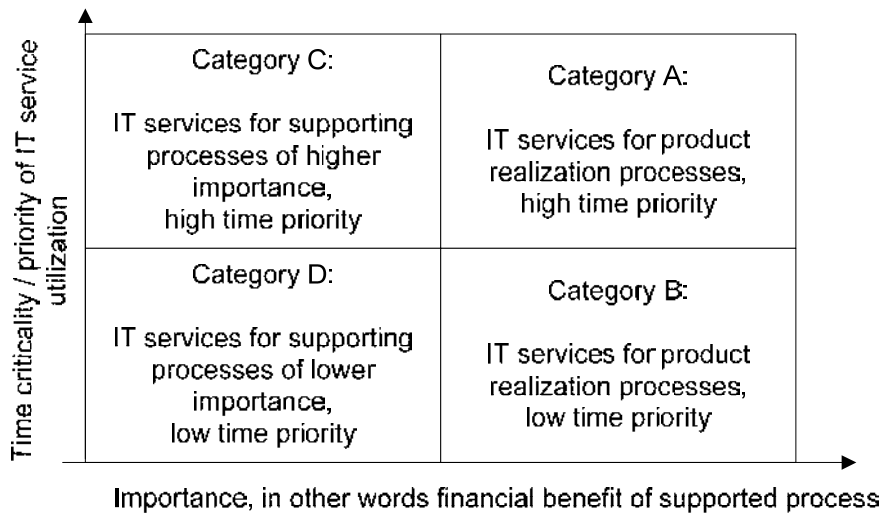
Another level is a bi-dimensional view on IT services categorization with regards to supported business processes. The first dimension expresses the importance of the supported process while the other represents time requirement or time risk (see Figure 4).

Category A is a group of IT services which support core processes and at the same time are time-critical for company functions. The product could not be delivered in requested time without these services and there is no mid-term backup plan. As an example it is possible to mention a mass outage of communication layer services at a company which does electronics trade with equities. Another example could be core-systems at banks which keep information about financial transactions on accounts. Outage of a service enabling access and operations of the main bank system can irreversibly threaten the reputation of a bank.

Category B is a group of IT services which support core processes, however, their time risk / demand is lower. With regards to company operations these are especially services the outage of which in hours is acceptable without a significant loss (there is no risk of loss of customer reputation, breaking legislation norms, financial loss is acceptable). Such an example is support of phone sales. System outage means financial loss, nevertheless,

there is no risk of loss of customer reputation (customers do not know they were supposed to be contacted).

Fig. 4: The Categorization of IT services based on financial benefit and time-criticality of the service



Source: [4], own adaptation

Category C is a group of IT services which are related to supporting processes of relatively higher importance; at the same time they have time significance for company operations (time viewpoint usually predominates financial as the direct financial profit is mostly not quantifiable). As an example, a system for employee attendance can be given. Outage of such a system is usually unpleasant but its process solution (temporary replacement solution) is usually simple and does not bring significant loss to the company.

Category D is a group of IT services which are related to supporting processes of relatively lower importance and the time risk of the service is also low. This is the lowest category of services. Outage of such services does not directly endanger company operations and sometimes the outage is not even visible at first sight. An example of such service is data backup on servers. The outage brings significant increase of operational risk; however, no service for realization and operational processes is stopped. At the same time, although this is only a supporting service with low priority, the significance should never be underestimated.

The customer expresses IT service priority by classification of the IT service to the appropriate category. This is crucial for metrics determination as the measuring itself brings costs which need to be considered in connection with every service. Now categorization from the provider's viewpoint needs to follow.

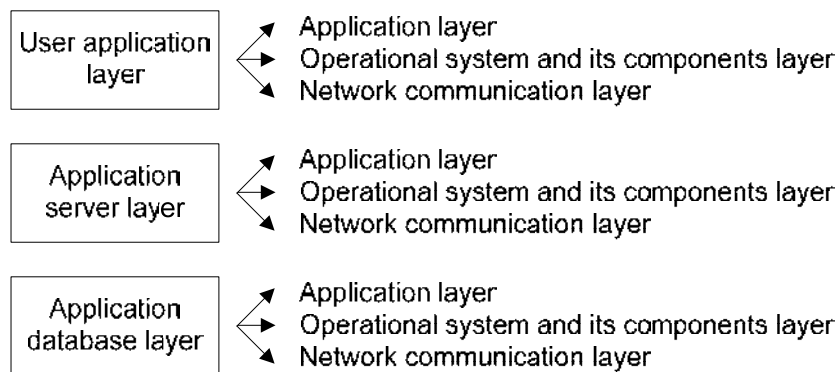
3.4 Categorization of Measuring Parameters

In order to determine parameters, it is possible to obtain inspiration from available sources such as:

- ICT expert communities' recommendations [13], [17] or
- Software producers' descriptions [12], [21].

Figure 5 suggests IT service breakdown into layers and sub-layers of these layers (each of the sub-layers is important for reaching the whole and one without another cannot ensure delivery of the requested IT service in needed quality).

Fig. 5: IT service breakdown into layers and sub-layers



Source: own adaptation

For further analysis, two layers were selected – application server layer and application database layer. Following parameters were proposed for monitoring:

- | | |
|--|---|
| <ul style="list-style-type: none"> • Server: ping • Server: UpTime • Logical disk accessibility • Free space on disk • Logical disk fragmentation • Free RAM volume • Committed Memory Size • DHCP client service functionality • DNS client service functionality • Window Event Log service functionality • Corrupted or unreadable records in Windows Event Log • Ability to process Windows Event Log • Expiration of account and passwords for Run As profiles • Authorization of Run As accounts • Ability of Run As accounts to log in • AS: running application process N • AS: available application port of service N | <ul style="list-style-type: none"> • AS: process utilization by process N • AS: available port 3389 • AS: overall processor utilization • Event Log – presence of a record with a particular number • Existence of a file • Folder size in MB • Output of VB script • Printed availability • User is in a user group • MSSQL: sqlserver.exe • MSSQL: port 1433 • Apache: Apache.exe • HTTP: ports 80 / 443 and 8080 / 8443 • Apache: page /serves status available • SMTP: port 25 availability • e-mail • LDAP • DB-ODBC • SNMP – value of selected parameter |
|--|---|

With regards to the size of the composition of proposed parameters, only samples of parameter descriptions (see Table 1).

Tab. 1: Description of proposed parameters (note: partial list only)

Parameter	Description
Server – ping	Validates whether the server responds to ICMP Ping. A sample of ten attempts and threshold value for unanswered attempt are assumed. It is useful for every operational system, it is presumed that the ping attempt will be refused neither by a firewall on the way nor by the server.
Server – UpTime	The value of a running time counter is used, in other words how long the server has been running since last start up. Measured in days.
Logical disc accessibility	It is enquired whether all defined discs remain connected. In other case the service might not work, e.g. it might not be able to write log into a file.
Free space on every disc > 30%	Percentual free capacity of logical discs is examined. Various sources recommend (e.g. [1], [12]) that for smooth system running it is suitable to keep the disc full up to 70%. Risk of file fragmentation which slows down the system is thus kept lower. It is also recommended to monitor the absolute value in MB according to the experience with the system – how fast the disc space is consumed, possibly a combination of these two values (which comes first).
Free RAM memory size	The size of available operational memory on the server is monitored in MB.
% size of Committed Memory size	Percentual utilization of Committed memory in the system is monitored.
DHCP client service functionality	Functioning of DHCP client service which is necessary for server functioning in network is monitored.
DNS client service functionality	Functioning of DNS client service which is necessary for server functioning in network is monitored.
Corrupted or unreadable records in Windows Event Log	It is enquired whether Window Event Log contains any corrupted or illegible records.

Source: own adaptation

For every parameter it was taken into account which category the IT service was classified into (Category A, B, C or D). A reactive (error) and proactive (warning) value are defined for every parameter and category.

With regards to the size of the composition of proposed parameters, only samples of value definitions (see Table 2 and Table 3) are included in this text.

Tab. 2: Proposed parameters for groups of service from the viewpoint of service provider – category A and category B (sample of value definitions)

Parameter	Category A IT services for core processes, high time priority			Category B IT services for core processes, low time priority		
	<i>value for warning</i>	<i>value for error</i>	<i>measuring period</i>	<i>value for warning</i>	<i>value for error</i>	<i>measuring period</i>
Server – ping	1/10	2/10	2 min	1/10	3/10	5 min
Server – UpTime	40 d	60 d	1 d	40 d	60 d	1 d
Free space on every disc > 30%	<40%	<30%	15 min	<35%	<30%	1 hour
Free RAM memory size	500 MB	200 MB	5 min	500 MB	200 MB	5 min
% size of Committed Memory size	>70%	>80%	5 min	>70%	>80%	5 min

Source: own adaptation

Tab. 3: Proposed parameters for groups of service from the viewpoint of service provider – category C and category D (sample of value definitions)

Parameter	Category C IT services for supporting processes of higher importance, high time priority			Category D IT services for supporting processes of lower importance, low time priority		
	<i>value for warning</i>	<i>value for error</i>	<i>measuring period</i>	<i>value for warning</i>	<i>value for error</i>	<i>measuring period</i>
Server – ping	1/10	3/10	5 min	1/10	4/10	15 min
Server – UpTime	40 d	60 d	1 d	40 d	60 d	1 d
Free space on every disc > 30%	<35%	<30%	1 hour	<35%	<30%	1 hour
Free RAM memory size	300 MB	100 MB	15 min	300 MB	100 MB	15 min
% size of Committed Memory size	--	>80%	15 min	--	>80%	15 min

Source: own adaptation

3.5 Selection of the Method for Parameter Values Collection

Three groups of methods were considered – manual data collection, general measuring tools and proprietary methods of measuring. Within practical evaluation of these methods it has been shown that each of them provides a different type of value and has different informative value.

A combination of all methods, i.e. of their outputs, seems optimal. The method of general measuring with focus on selected parameters should be used as the corner stone of service quality evaluation. These parameters should include those which have a direct connection to application services and they should be included in the evaluation of reached service level. This evaluation should be carried out also based on agreed availability time for the users, i.e. in the usual working hours. Other monitored parameters are beneficial for the system administrator and for active service care but are not beneficial for service quality evaluation.

The manual method, e.g. in the form of Application Log, can provide explanation to some outputs which result from the automatic measuring by a general tool and thus can be a helpful supplement for the whole picture of the system activities (and for service quality evaluation). It, however, means evaluation of two measurements which is made even more difficult by setting two time axes against each other.

The proprietary method contributes to completing the picture of the quality and is thus another suitable way of quality measuring above the framework set by automatic measuring. Its use, nevertheless, brings additional workload. It is a question of assessing each situation whether the additional workload is an adequate price for a complete picture on the quality.

4 Discussion

As it has been mentioned, listed parameters for performance monitoring are focused mostly on the server (on which the applications are run) characteristics and their availability through network infrastructure. It is necessary to take into account that in order to ensure informative value out measuring it is necessary to locate the monitoring infrastructure into the same segment as the IT service users.

In order to ensure complexness of the measuring it would be necessary to take into account two more viewpoints. The first is the performance of the devices required on the user's side and also specific performance requirements on the service from the owner's viewpoint. This means the user application layer and its sub-layers. In the case of service user's equipment, it will most likely be an office PC which has standard parameters across the organization. Measuring can be carried out either on one time basis (at set time spot, usually when testing new version of the application) or continuously (during operating time of the application). For this monitoring, following parameters could be proposed – CPU utilization in %, Free RAM size, Number of I/O operations per second, I/O operations queue length, Ping to server, Utilization of the processes by the application process in %, Utilization of memory by the application process in MB. Such measuring has to be combined with running a concrete client application (which ensures utilization of the service) so that its impact on the parameters of the user interface is visible; it is necessary to take into account how using the application influences computer performance and performance of other applications.

Conclusion

Quality management of provided IT services corresponds to ensuring quality of other services. The quality of such IT services is still more current topic, especially thanks to growing importance of IT systems and IT services for company operations. The text focused on design of a system approach to setting the composition of IT service monitoring parameters. The approach includes bi-dimensional view on IT service categorization

in regards to business processes, further it includes a proposal of parameters composition and their description for each category, while also methods of measuring parameter values are discussed. The identified composition of parameters and proposed method were verified in a real company where monitoring and evaluation was carried out within three months (documentation of outputs is out of scope for this text). The undertaken measurements have proven that value and parameter standardization according to service category is utilizable and the output will bring enough information for IT service quality evaluation. Higher-quality IT service is a contribution for increasing the quality of supported business process.

Acknowledgement

This contribution was supported by the University Pardubice grant No SGFES02/2012.

References

- [1] BAUMAN, A. J. *IBM Lotus Domino Server performance: Hard disk fragmentation*. [online] [cit. 2012-04-10]. Available from WWW: <<http://www-10.lotus.com/ldd/dominowiki.nsf/dx/01152009062114PMWEBVDT.htm>>
- [2] CARTLIDGE, A. a kol. (překlad HUDEC, J.). *Úvodní přehled ITIL V3*. Praha: Hewlett-Packard s.r.o., 2007. 56 s. ISBN 0-95551245-8-1.
- [3] EIPA. *CAF – Common Assessment Framework* [online]. [cit. 2012-05-26]. Available from WWW: <<http://www.eipa.eu/en/topic/show/&tid=191>>
- [4] HELCELET, I. *Měření kvality IT služeb v organizaci*. Pardubice: Univerzita Pardubice, 2012. 96 p.
- [5] IT Governance Institute. *COBIT 4.1. USA*: IT Governance Institute, 2007. 213 p. ISBN 1-933284-72-2.
- [6] ITIL - Official Sites. *ITIL Glossaries Terms and Conditions; ITIL výkladový slovník v češtině*, [online]. [cit. 2012-05-20] Available from WWW: <http://www.ital-officialsite.com/InternationalActivities/ITILGlossaries_2.aspx>.
- [7] ITIL - *IT Infrastructure Library* [online]. [cit. 2012-04-21]. Available from WWW: <<http://www.ital-officialsite.com/AboutITIL/WhatisITIL.asp>>.
- [8] GÁLA, L. et al. *Podniková informatika*. Praha: Grada Publishing, 2006. ISBN 80-247-1278-4, 480 s.
- [9] KEŘKOVSKÝ, M. et. al. *Strategické řízení firemních informací: teorie pro praxi*. Praha: C. H. Beck, 2006. ISBN 80-7179-730-8, 206 s.
- [10] MADISON, D. *Process Mapping, Process Improvement, and Process Management*. Paton Press, 2005, 320 p. ISBN-13 978-1-932828-04-7.
- [11] MASSAKI, I. *Gemba Kaizen*. Brno: Computer Press, 2005. ISBN 80-251-0850-3, 314
- [12] Microsoft Corp. *Examining and Tuning Disk Performance. Examining and Tuning Disk Performance* (Microsoft Technet) [online] [cit. 2012-04-10]. Available from WWW: <<http://technet.microsoft.com/en-us/library/cc938959.aspx>>
- [13] MonitorTools.com. *Service Level Monitoring* [online] [cit. 2012-04-10]. Available from WWW: <<http://www.monitortools.com/servicelevel/>>

- [14] NENADÁL, J. a kol. *Moderní management jakosti*. Praha: Management Press, 2011. ISBN 978-80-7261-186-7, 380 s.
- [15] ŠPRYNC, O. et al. Proactive IT / IS Monitoring for Business Continuity Planning. In *E+M Ekonomie a Management*, 2011, Volume. XIV, Issue. 3, p. 57-65. ISSN 1212-3609.
- [16] SIMONOVA, S. et al. Klasifikace procesních změn v podmínkách diverzifikovaných kompetencí. In *Scientific Papers of the University of Pardubice Series D*. Pardubice: Univerzita Pardubice, 2010. Series D, Faculty of Economics and Administration, 16 (2010), ISSN 1211-555X, s. 297-306.
- [17] TETZLAFF, R. *ITIL Monitoring and Planning Processes. Monitoring and Planning ITIL* [online] [cit. 2012-04-10]. Available from WWW: <http://www.brighthub.com/office/project-management/articles/72688.aspx#secn_3>.
- [18] TOPFER, A. et al. *Six sigma Koncepce a příklady pro řízení bez chyb*. Brno: Computer Press, 2008. ISBN 978-80-251-1766-8, 508 p.
- [19] WAGNER, J. *Měření výkonnosti*. Praha: Grada Publishing, 2009. ISBN 978-80-247-2924-4, 256 s.
- [20] WEILL, P. et al. *IT Governance*. McGraw-Hill Professional, 2004. ISBN-13 9781591392538, 267 p.
- [21] ZYRION Inc. Traverse for Applications. *Datasheet: Traverse Application Monitoring* [online] [cit. 2012-04-10]. Available from WWW: <<http://www.zyrion.com/products/datasheets/application.php>>

Contact Address

Ing. Stanislava Šimonová, Ph.D., Bc. Ivan Helcelet

University of Pardubice, Faculty of Economics and Administration

Institute of System Engineering and Informatics

Studentská 84, 532 10 Pardubice

E-mail: Stanislava.Simonova@upce.cz, st14745@student.upce.cz

Phone number: 466 036 009

Received: 28. 06. 2012

Reviewed: 14. 02. 2013

Approved for publication: 04. 04. 2013