Deriving the Employee-perceived Application Quality in Enterprise IT Infrastructures using Information from Ticketing Systems

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The need for a less complex maintenance of applications and the IT infrastructure for huge enterprises lead to the centralization of applications and services within data centers. Employees at sites and branches are connect to data centers via the Internet using a thin-client architectures resulting in additional failure sources beside the end devices, namely the transport network and hardware components in the data centers. To provide a good application quality to the employers using a multitude of different applications and access networks has thus become a complex task [3].

In order to evaluate the quality of an application, subjective metrics like Quality of Experience (QoE) [1] are often used. Ongoing research in the field of QoE typically tries to understand the impact of technical systems on the subjective perception of specific applications. Main influence factors are deduced and appropriate models allowing an estimation of the QoE for varying parameters like bandwidth, packet loss, or jitter are developed. The QoE for applications like web browsing, video streaming, VoIP, and office products are well understood. This, however, does not hold for enterprise applications like resource planning and management or data warehouse applications, which are not covered by current research. Time-consuming user surveys in the employers working environment highly affect the day-to-day business and thus are not practicable. Nevertheless, a profound knowledge of the application quality and availability is required to enable good conditions of work and a high working efficiency. For that, enterprises may rely on support systems like a hotline or a ticketing system. Particular the latter is a huge database collecting complaints and problems of the users over a long period of time and thus are an interesting starting point to identify performance problems.

Using this data source, we propose an approach to automatically identify tickets indicating problematic applications and reflecting the user experience. To this end, our approach first groups similar tickets and afterwards tags the resulting groups with adequate keywords. For the grouping process, we rely on the information from the free-text fields of the tickets, which include a summary and a detailed description of the reported issue, and calculate the lexicographical distance between the tickets using the Jaccard index [2]. The keywords for the groups are based on word frequencies within the groups. The tagged groups can finally be evaluated further to identify issues in the IT system.

We evaluate the accuracy of our approach using 12,000 tickets accumulated in June 2013 at the ticketing system of a company. These tickets were manually
categorized in tickets covering application performance issues (303 performance
tickets), respectively tickets addressing other issues and serve as gold standard
data for the categorization results. The performance of the approach is measured
by two different metrics, (1) the overall share of correctly classified tickets and
(2) the share of performance relevant tickets in groups tagged as performance
relevant. A parameter study was conducted to investigate the impact of different
Jaccard similarity thresholds on the misclassification rate (Type I and Type II errors).
Based on the specific threshold, the ratio of correctly classified performance
tickets varied between 44 % and 57 %, whereas, the number of false
classified non-performance tickets was between 55 and 325. Hence, a higher hit
ratio also results in more manual overhead for checking the tickets within the
performance ticket groups and removing the wrongly classified tickets.

Even though not all performance tickets can be detected by our algorithm,
the number of correctly classified tickets is sufficient to draw conclusions about
temporal performance problems. To this end, we compared the number of actual
performance tickets per day with the correctly classified number of performance
tickets per day identified using our approach. Both time series show similar
trends, although the identified number of performance tickets per day is always
lower than the actual number. Nevertheless, daily trends are preserved and pre-
tsented approach detected at minimum 20% of the daily performance tickets.
Consequently, the algorithm cannot be used if the exact number of tickets is re-
quired, however, it is possible to identify trends temporal occurring performance
problems. The root course of the issue can then be evaluated further by technical
staff using the tickets in the performance ticket groups.

The preliminary results of the proposed algorithm are promising, but a lot of
optimization potential remains. In the next steps, the impact of other similarity
metrics, e.g., the Cosine-measure, will be evaluated. Further, more sophisticated
methods for evaluating ticket similarity will be integrated, e.g., considering n-grams
or content-based evaluations.

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References

   European Network on Quality of Experience in Multimedia Systems and Services
   (COST Action IC 1003), March 2013.
   metrics for name-matching tasks. In Proc. Workshop on Information Integration on
   the Web, Acapulco, Mexico, August 2003.
   for Cloud Applications. IEEE Communications Magazine, April 2012.