



Towards better help desk planning: Predicting incidents and required effort



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ARTICLE INFO

Article history:

Received 20 May 2015

Revised 1 March 2016

Accepted 23 March 2016

Available online 9 April 2016

Keywords:

Cost model

IT operations

Help desk

Principal components analysis

Cluster analysis

Software reliability growth model

ABSTRACT

In this case study, a cost model for help desk operations is developed. The cost model relates predicted incidents to labor costs. Since incident estimation for hundreds of products is time-consuming, we use cluster analysis to group similarly behaving products in clusters, for which we then estimate incidents based on the representative product in the cluster. Incidents are predicted using software reliability growth models. The cost to resolve the incidents is predicted using historical labor data for the resolution of incidents. Cluster analysis is used to group products with similar help desk incident characteristics. We use Principal Components Analysis to determine one product per cluster for the prediction of incidents for all members of the cluster, so as to reduce estimation cost. We were able to predict incidents for a cluster based on this product alone and do so successfully for all clusters with accuracy comparable to making predictions for each product in the portfolio. Linear regression is used with cost data for the resolution of incidents to relate incident predictions to help desk labor costs. The cost model is then validated by successfully demonstrating cost prediction accuracy for one month prediction intervals over a 22 month period.

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1. Introduction

Help Desk operations at a large company can be expensive. In 2010, the average cost to resolve a help desk incident was \$48 US dollars at North American companies (Rumburg). In this case study, approximately 123,000 incidents were submitted over a four and a half year period to resolve issues with 156 products. Approximately 41,000 labor hours were spent to resolve these incidents, therefore costs incurred for incident resolution were significant. The average hourly rate used in this case study is \$50 US dollars. This results in approximately two million dollars spent to resolve incidents. Software down time causes revenue loss (Stoker and Bechta Dugan, 2003), costs associated with IT operations on the other hand reduce profit. Minimizing software failures in an operational environment is important to customer experience, but more practically to the cost model for offering IT services. Two costs are associated with software failures. First, short-term losses are realized through missed commitments in daily business rhythms when software resources become nonfunctional or inaccessible to employees. Longer term effects are unmet contractual obligations

which can lead to financial penalties or contract loss. Secondly, there are costs associated with the effort to resolve problems by help desk technicians and to manage resolution processes by help desk managers.

Workloads at the help desk are dynamic. There is a need for efficient resolution to minimize employee wait time for help desk personnel to begin to work on problems. Employing a sufficiently large team of help desk technicians to handle surges in problems addresses the demand but results in idle staff during periods of nominal help desk operations. Excess staff results in unnecessary costs when there is no backlog of problems to resolve. Conversely, employing too few technicians results in delays with problem resolution due to backlogs. This drives the cost of unproductive employees while problems are being resolved. It would thus be helpful to find a way to predict incidents and the cost to resolve them. Help desk managers need a way to plan staffing levels so that labor costs are minimized while problems are resolved efficiently. An incident prediction method would be useful to help desk managers for planning staffing levels. The potential value of a solution to this problem is important to an IT service provider since software failures are inevitable and their timing is difficult to predict manually. In addition to assisting with labor predictions for existing operations, a cost prediction model would be a valuable tool in the preparation of bids for additional business through

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demonstration of management efficiency by presenting evidence of historically accurate labor predictions.

This paper presents a cost model that is derived from incident reports and labor data from a large help desk operation in an industrial setting. The approach uses real help desk incident data and actual labor costs collected over a four and a half year period. We present a cost model derived from a database of resolved incidents submitted against the full scope of problem types encountered by the help desk in this case study. Through the development and validation of our technique, we address the following research questions:

- RQ1 Can desktop software product reliability data obtained from help desk incidents be used to predict future incident volume?
- RQ2 Can incident prediction accuracy be obtained through the selection of product clusters vs. analyzing a full product portfolio in a prediction model? Doing so would reduce estimation effort.
- RQ3 Can incident resolution labor data be used to develop a help desk cost prediction model?

The remainder of this paper is organized as follows. In Section 2 we present existing work in the context of our research questions. Section 3 explains our approach to predict both incident volume and labor costs. The cost model is validated in Section 4. Threats to validity in our case study are presented in Section 5. We draw conclusions and lessons learned through a discussion of our results in Section 6 and discuss opportunities for future work.

2. Background and related work

2.1. Help desk operations

The primary goal of the help desk is to provide cost effective IT services to an organization. Amongst a wide variety of services the help desk resolves problems that occur when using products in the desktop software portfolio. Each help desk request is recorded in an incident record. Help desk labor is managed through resource planning, tracking planned labor costs to actual costs, and adjusting staffing levels to balance service delivery commitments with labor budget targets. The basis of estimate for staffing levels is driven primarily by service delivery metrics rather than through help desk workload predictions. Help desk managers are expected to find ways to improve problem resolution efficiency to reduce costs.

Standard methods for help desk operations facilitate efficiency. ISO 20000 is an international standard for information technology

service management (ISO 20000). ISO 20000 includes a formalization of IT Service Management (ITSM) through the Information Technology Standard Library (ITIL). Over 850 companies around the world are ISO 20000 certified, as is the organization investigated in this case study. ITSM includes an operational framework for help desks. By complying with ITSM standards, operations described in this case study are similar to many other IT companies.

There are three categories of incidents managed by the help desk of the organization in this case study. The categories are shown in Fig. 1. The first category consists of incidents submitted to report software product specific issues. For example, an employee contacts the help desk to report an error message produced by Adobe Reader. Help desk technician labor is spent resolving this category of incidents through a body of knowledge comprised of technician experience and scripted solutions. This case study focuses on incidents in the first category.

A second major category of incidents relates to defective hardware such as broken keyboards, crashed hard drives and problems that are not specific to any particular installed software product. This category also includes incidents associated with general operating system errors and computer performance problems. These types of issues are usually not resolved by addressing the functionality of any product other than the operating system itself or an underlying component such as the .Net framework.

A third major category of incidents is designed to address issues for well-defined situations, through dedicated resolution mechanisms. Incidents in this category are typically routed to dedicated help desk team members through interactive voice prompts that ensure a trained help desk technician is assigned to the incident. Dedicated effort can be directed to products with high call volume through standard scripts or known resolution methods to achieve resolution efficiency.

Table 1 lists seventeen incident attributes that are recorded for each incident with their unique identifier, description, numerical range of values and their role as an input or output during incident processing. All seventeen attributes are mandatory fields in the help desk database. Attributes A1, A2 and A3 are categorical attributes whose range of values consists of four discrete levels for incident urgency, impact and priority. Urgency is assigned by the help desk technician based on standard guidance which describes the amount of time by which resolution is expected based on general problem types. Impact is assigned through discussion with the employee who reports the problem based on the number of employees or devices affected by the unresolved issue. Incident priority is automatically determined through a mapping of the combination of Urgency and Impact to one of fourteen levels

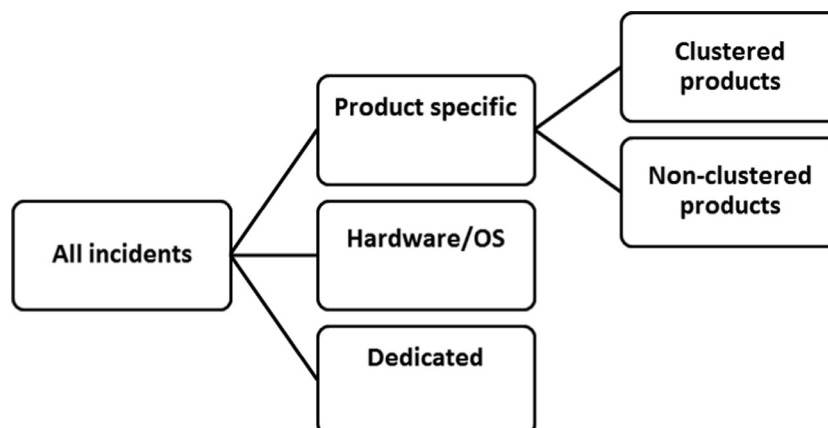


Fig. 1. Help desk incident resolution labor categories.

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