Automation of IT Service Management Using Information Integrated Techniques and Machine Learning of Various Processes in IT Service Management

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Abstract--- Automation of IT Service Management using Information Integrated techniques and machine learning of various processes in IT Service Management is used by Engineers to report IT issues in enterprise systems. ITSM knowledge management, which provides detailed design for function layers as data collection, information integration, knowledge processing and knowledge presentation, and is fully immersed with knowledge lifecycle management. ITIL is the most widely used IT service management framework. Domain experts are important clues to search for relevant documents in digital library information system. Most of these service requests are resolved by level-1 persons (service desk attendants) by providing information/quick-fix solutions to customers.

For each service request, level- 1 personnel identify important keywords and see if the incoming request is similar to any historic incident. Otherwise, an incident ticket is created and, with other related information, forwarded to incident's subject matter expert (SME) i.e. level-2 or level-3. Incident management process is used for managing the life cycle of all incidents. An organization spends lots of resources to keep its IT resources incident free and, therefore, timely resolution of incoming incident is required to attain that objective. Currently, the incident management process is largely manual, error prone and time consuming. In this paper, we use information integration techniques and machine learning to automate various processes in the incident management workflow.

Keywords: – ITSM (Incident Tool Service Management), SME (Subject Matter Expert). ITIL

I. INTRODUCTION

With the growing technology, service and support for technology is getting complex and in-efficient. Due to this reason organizations are spending lot and lot of money in support and services. The main reason behind complexity and in-efficiency is that, the support/service team will be spending lot of time in understanding and analysing the problem and doing rediscover of knowledge. Centralized Knowledge-Base Management application for Infrastructure Solutions and services is a solution for it.

Automation of IT Service Management using Information Integrated techniques and machine learning of various processes in IT Service Management aims to gather, analyse, store and share knowledge and information both technical and non-technical with entire organization. Hence the primary importance of this application is to improve the efficiency by reducing the need to rediscover the knowledge.

Centralized knowledge-Base Management application is designed primarily for Level1, Level2 and Level3 support engineers to access information of previously proven, tried solutions or work-around that can be used while working on incidents, problems and change requests.

The application is not only meant to provide the information about incident but also it provides the user with search document capability from various knowledge base portals. Hence engineers can empower with all the required know-how's and technical acumen required to effectively and efficiently engage while either troubleshooting or resolving customer issues. Along with Knowledge-Base services the tool also helps support/service team to debug the problems in very efficient manner and by this it saves the time of debugging and analysing the problems. The application provides a centralized incident search by a web-based user-interface that is developed to provide the user with an advanced search option, which opens up as a channel to a repository of previously resolved Ticket details along with the tickets' resolutions, summaries and notes. The user is free to exploit the wealth of information deposited herein to his advantage and use the steps that were followed from the previously resolved ticket histories while working on similar incidents.

Service desk is managed by a level-1(L1) person. Customers contact the service desk for various purposes such as information, configuration change, problem being faced by the customer, etc. Customers can report problems using various methods such as web based, e-mail or telephone. Usually a database of historic incidents and their corresponding resolutions are maintained at the service desk. The L1 person uses keyword search to see if the service request can be resolved using any of the previously reported incidents. If the incident cannot be resolved, an artifact of the incoming request is created in the form of an incident ticket which initiates the chain of various IT system management (ITSM) processes such as incident management, problem management, configuration management, change management and release management. Directly or indirectly, all these processes start with the incident management process. The incident management process provides most immediate and visible gains to service quality and cost reduction. Then the problem management process is used to find the root cause of incident(s) so that similar incidents can be avoided in the future. As part of the incident management process, an incident ticket is created and the ticket along with the relevant information is forwarded to a level-2 (L2) person who is subject matter expert (SME) for the incident. Then the SME tries to resolve the incident through her expertise. This whole process of incident resolution is largely manual; thus it is time consuming and error prone. This paper is

aimed at improving the incident management process so that it can be more automated thus reducing the incident processing time. An incident ticket contains information about the

In this paper, we propose to help the IT Support/Service Engineers to resolve the IT related issues by using the Centralized Knowledge-Based Management Application for Infrastructure Supports and Services. The tool preserves the solved incidents history in a centralized knowledge repository in an organized manner along with various technical and non-technical information's. Hence if in future IT Support/Service Engineer searches for a particular problem in the application, the application fetches the related answers from the solution history and guides her to resolve the solution efficiently.

II. PREFACE

In this paper we introduce how the incident can be resolved with different categories.

A. Organizing and Storing Solution History

- Application tracks an incident or a problem is raised by the IT user.
- When the incidents or problem resolved by IT Service Engineer then application asks Engineer to enter the detailed information about the solution.
- Organize the solution information and then store into a secured database.
- Application also provides a centralized knowledge-base for entire organization by periodically fetching the documents from various localities.
- As previously mentioned, the application follows agile methodology and hence the knowledge level is built in an iterative manner.

B. Searching Solution

- Once the IT Service Engineer gets a new incident or a problem, he/she has to search for an appropriate keyword in the tool.
- The tool then searches for the keyword in the pre-stored organized solutions and provides all possible solution for the problem based on previous history.
- If the solution is not present in the past history then it directs the IT Service Engineer to find the IT solution for the incident and update the Solution knowledge level.
- The application also provides the end user with the facility to access organization technical and non-technical documents with the help of centralized knowledge-base.

C. Debugging Solution

- The application runs series of script over failure components and analyses the result.
- Application generates an appropriate view for the analysed result and helps support/service team to debug the issue within short span of time.

III. AUTOMATION OF IT SERVICE MANAGEMENT USING INFORMATION INTEGRATED TECHNIQUES AND MACHINE LEARNING OF VARIOUS PROCESSES IN IT SERVICE MANAGEMENT

A. Architecture

In this pilot project, Meta Database stores configuration items which represent systems, software's and people in enterprise infrastructure. Fig 1 shows a typical enterprise infrastructure represented using configuration items and relationships between them. We describe a method of automatically extracting relevant keywords from incident description. Incident tickets are usually managed using with web-based interface. Thus first step of the incident processing is to extract the incident description using HTTP parser. As information entered in the incident description may be unclean, we need to clean that unstructured data

The ITSM-MS was constructed for the internal use of the case organization and its employees. The system was targeted to process managers, product managers and project managers to work as a real-time measurement tool that is connected to every IT service support process. From the technical point of view, the ITSM-MS was implemented using Microsoft .NET environment, Microsoft Visual Studio, C# programming language and Oracle database. The ITSM-MS uses the database of the incident management tool. Microsoft Visual Studio was used to implement the user interface and the system functions while Oracle database stores all the data from the IT service support processes. Figure 1 shows the general system architecture of the ITSM-MS. The service desk (SD) of the case organization receives an incident from the customer, a ticket is entered into the incident management tool and a new case is opened.

The case organization uses ITIL-based IT service support processes for resolving the case and all the data that is Used during these processes is documented into the incident Management tool. When the case is resolved, it is sent back to the customer and the case is closed.

The ITSM-MS uses the data that is documented in the incident management tool. The user can use the system from the case organization's Intranet and make real-time graphs about different cases. The user's input is transformed into an SQL-query which returns a result from the database. Based onto this result, the ITSM-MS draws a graph of the metric into the user's computer screen in the Intranet.

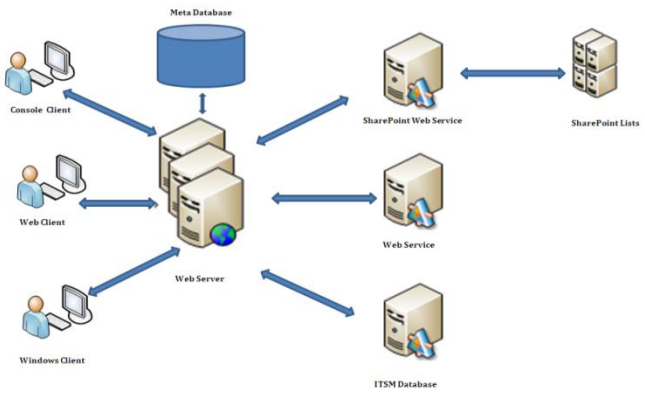

Fig. 1: Architecture Centralized Knowledge-Base Management Application for Infrastructure Solutions and Services

B. Incident Management Process

The aim of the incident management process is quickly resolving incidents that affect the normal running of an Organization's IT services. An incident is an intimation of some error or failure of some component in IT systems. Figure 1 show the incident management workflow which can be used for resolving an incident. In a typical service desk, incident is either reported by the customer or automatically generated by system monitoring/event generation system. Customer report incidents by describing the system condition using natural language text. In this section, we introduce how the incident can be resolved with different categories.

In this paper we are considering customer reported incidents only. For such incidents, L1 person does a quick "keyword based search" from a database of historic incidents. If any matching incident is found, its solution may be used to resolve the incoming incident. If the L1 person cannot provide any resolution, an incident record is created. This incident record is classified for various purposes such as assigning priority based on urgency and impact, selecting the appropriate SME, etc. Information about these configuration items (CIs) is maintained in a Configuration management database which is also used by other ITSM processes as an underlying data storage framework. L1 person uses keyword

Search along with human intelligence to *guess* the possibly responsible CIs. Then the incident ticket is forwarded to L2 support to diagnose the problem in the Selected CI. For diagnosis the CI is monitored and various probes [3] may be used. If the identified CI is wrong ticket is bounced back and forth between L1 and L2 support. If any code change is required external support (L3) is contacted. After resolving the problem customer is informed and incident ticket is closed. In this paper we propose techniques to automate and improve various stages of the incident management workflow

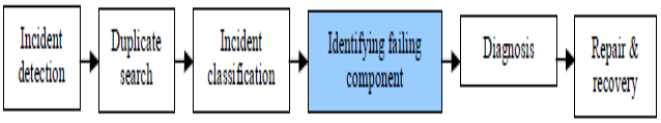

Fig. 2: Incident Management Workflow.

C. The Information Integration Layer

The information integration layer provides basic management to those ITSM data collected: store them effectively into the ITSM knowledge base, and organize and manage them through a unified enterprise ITSM knowledge system. After being integrated, the ITSM knowledge object enters its growth stage, corresponding to information. The basic knowledge management functions provided here includes:

- Knowledge Classification Management: maintain the knowledge according to a structured scheme combining integrated and distributed modes. And the knowledge classification is periodically evaluated and updated according to enterprise's service demands.
- Knowledge View Management: different knowledge views for different user roles and ITSM functions are defined and managed.
- Knowledge Maintenance Management: basic maintenance operations of ITSM knowledge, including adding, modifying, deleting and searching, with knowledge version control involved.
- Content Filtering: monitor and filter the content of ITSM knowledge.
- Knowledge Asset Management: manage the enterprise's knowledge assets, and combine them into the unified enterprise IT assets category.
- Knowledge Processing: provide primary processing functions to ITSM knowledge, according to algorithms and regulations set beforehand

All ITSM knowledge objects are stored in an ITSM Knowledge base, which supports distributed deployment mode. Different ITSM KMS sub-systems will be grouped together to form a global knowledge view through the knowledge map function. And knowledge index and search services are provided to users to accelerate the location and query for the desired knowledge objects.
ITSM KMS also provides the physical storage management of the knowledge base, mapping from the logical knowledge object to physical storage nodes, and also provides knowledge access control.

IV. Configuration Management Data Base

ITSM, as it claimed above, includes several processes with CM as a core within this group. CM is a process that keeps all required information about services, service components, relationships, and other items accurate and up to date. Database contains all relevant information about the components of the information system used in an IT organization services and the relationships between those components [7]. A database provides an organized view of data and a means of examining data from different perspectives. In this context, components of information system are referred to as Configuration Items (CI). A CI can be any conceivable IT component, including software, hardware, document and personnel as well as any combination of them. In this paper, the main focus is on software asset and their relation.

There are four approaches to implement database:

A. Top-down approach

Top-down approach means that the analyzer should start by identifying its most critical software's and then concentrate on defining only the key performance enablers for the delivery of those services.

B. Bottom-up approach

This approach involves cataloguing every device and application plugged into infrastructure. This process starts with collecting small software assets and then merging them in upper level till the route which is software.

C. Iterative approach

It is an initial loose strategy firmed up via gaining experience.

	Planning	Challenges
Top down approach	• Objectives and benefits • Organizational and responsibilities • Design and scooping • Metrics for success	• General understanding of what database is and what it offers • How and where to apply it • Securing the support of senior management
Bottom up approach	• Granularity of CIs(if choosing all approaches may lead to potentially risk	• General understanding of database concept and its offer • Enabling technologies Staff efforts

Table. 1: Comparison challenges of two Approaches

D. Ad-hoc approach

This approach involves making decisions explicitly on project basis [8]. However, the most applicable and usable Approaches are top down and bottom up approaches. The planning considerations and challenges of these approaches are shown in Table 1. Every approach has its own strengths and weaknesses. Basically, it depends on some reasons.

A. The best Database implementation approach for software maintenance.

As it already stated there are four different approaches which are Top-down, Bottom-up, Iterative and Ad-hoc approaches to implement Database in the organizations that the most commons of them are Top down, Bottom-up approaches. Implementation process of Top-down approach in the Database essentially starts with breaking down the whole assets to gain insight into its compositional sub-sets. So, at first, an overview of the assets will be formulated and specificities but not any detailing about first-level subsets. This process continues until achieve base elements. The tracking in this approach is like a tree tracking. Fig 3 shows a sample of this approach.

In a bottom-up approach the individual base items of the assets are first specified in great detail. These items are then linked together to form larger subsets, until a complete top-level set is formed. Fig 4 shows a sample of this approach.

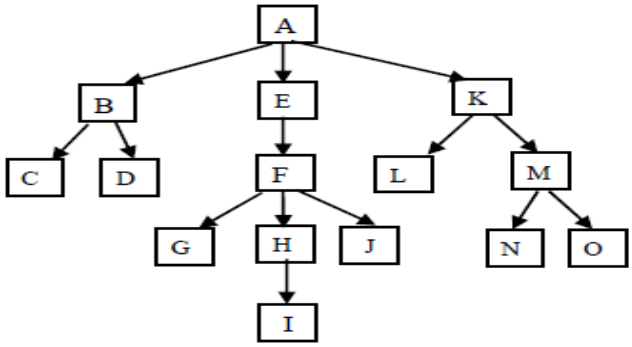

Fig. 3: Top down Approach

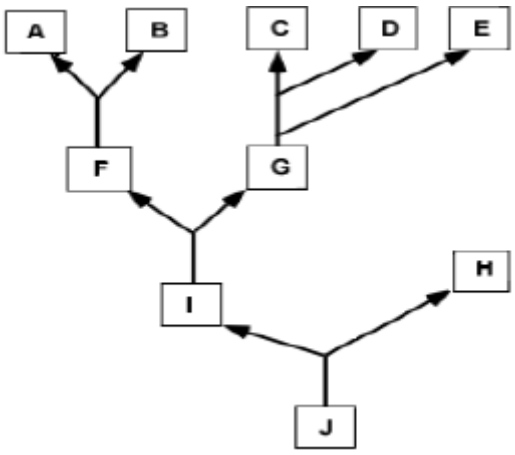

Fig. 4: Bottom up Approach

V. CONCLUSION

In this paper we presented a technique to identify failing component by integrating text specified in the problem ticket with structured data stored in database along with incident classification. In our system, improvement in incident management process occurs due to two main reasons: automated identification of keywords, search over database using search context, and limiting search scope using Directed navigation.

Software asset maintenance is becoming an important consideration due to huge numbers of different software and embedded tools in the businesses. Managers of organizations face to some challenges on software asset maintenance which one of the most important of them is software tracking. Also, ITSM is a framework which tries to improve quality of services in the organizations. The core of this framework is CM that the main aim of it is to record, update and retrieve the IT assets and there are four different approaches to implement this database in the organizations. It proposed that the best approach to implement database in the organizations is Top-down approach due to nature of software assets and it brings the advantages like less price, clear structure and easy to use for DB administrators.

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