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Transforming Contact Center Processes to Facilitate Agent Efficiency and End-User Enablement

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Transforming Contact Center Processes to Facilitate Agent Efficiency and End-User Enablement

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Abstract

Contact centers are facilities in enterprises that handle inbound and outbound calls from end-users of various services such as information technology, insurance, banking, etc. Today's contact centers are human-intensive and knowledge-intensive, involving millions of contact center agents answering end-users' questions and solving their problems. As contact centers seek to increase efficiency and reduce cost, two big challenges are: a) to enable end-users to help themselves, reducing the number of calls; and b) increase the efficiency of agents in knowledge creation and updates. This paper introduces an end-user self-enablement portal that dynamically updates descriptions of commonly occurring problems and their associated solutions. We also present agent-facing tools for more efficiently targeting and handling solution documentation efforts. In effect, we transform today's contact center processes. We validate our approach through a pilot conducted in an enterprise help desk operation for IT support.

1. Introduction

A contact center is a facility or functional area within a company, which answers incoming contacts from or makes outgoing contacts to customers, typically providing help desk, customer support, lead generation, and telemarketing services. In 2006, there are an estimated 865,000 contact centers globally employing over 10 million contact center agents. This represents a significant portion of the cost of enterprises in delivering services to their customers.

In this paper, we focus on those contact centers that provide help desk operations for information technology (IT) support. The end-user typically calls the contact center and a remote agent works on resolving the problem. This often involves several iterations as the problem is transferred or escalated to different people until it is finally resolved, sometimes even requiring hands-on resolution by an agent at the user's desk. Each iteration and escalation increases cost of problem resolution, with desk side resolution costs typically being the highest.

Figure 1 shows some statistics from a contact center on the number of support iterations required on different incidents of one problem type. The challenge is to reduce/eliminate multiple iterations and also to reduce the number of contacts through self-help and automation. This challenge can be further expanded into the following:

- **First-contact resolution challenge:** Ensure that the problem is resolved at the first contact, minimizing escalations and iterations (Figure 1).
- **Agent efficiency challenge:** Reduce contact handling time, or the time needed by an agent to resolve a problem.
- **Agent training challenge:** Get agents quickly up to speed, so agents new on the job or to a problem are able to resolve problems like "experts".
- **Self-help challenge:** Help end-users help themselves, reducing the number of help desk contacts.
- **Automation challenge:** Automatically obtain problem descriptions, detect problem occurrences to avoid them, or solve them as they occur.

This paper addresses the *self-help* and *agent efficiency challenges* by transforming the current process of agent activity through a set of tools, which we describe next.

2. Self-Help through a Web Portal

Our approach is to provide end-users with self-help solutions to known problems via a web portal, as shown in Figure 2. Many web sites exist today with documented solutions. However, there are two issues: 1) Most of these sites require end-users to search for solutions "Google" style. Users enter keywords and retrieve a set of solution documents that correspond to those keywords. Many users lack the patience to search and go through retrieved documents to determine the solution to their problem. Hence, many such self-help web sites suffer from poor usage in spite of having a decent library of self-help solution documents. 2) Users respond more readily to

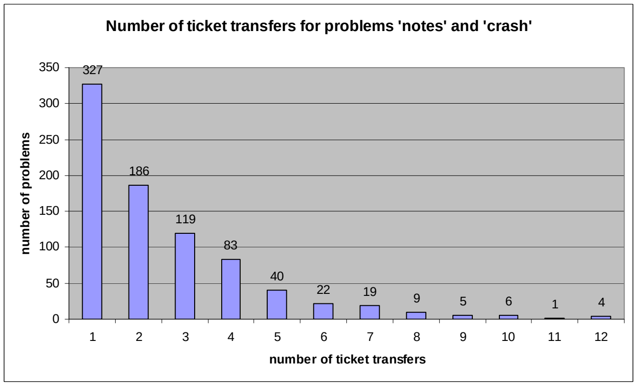
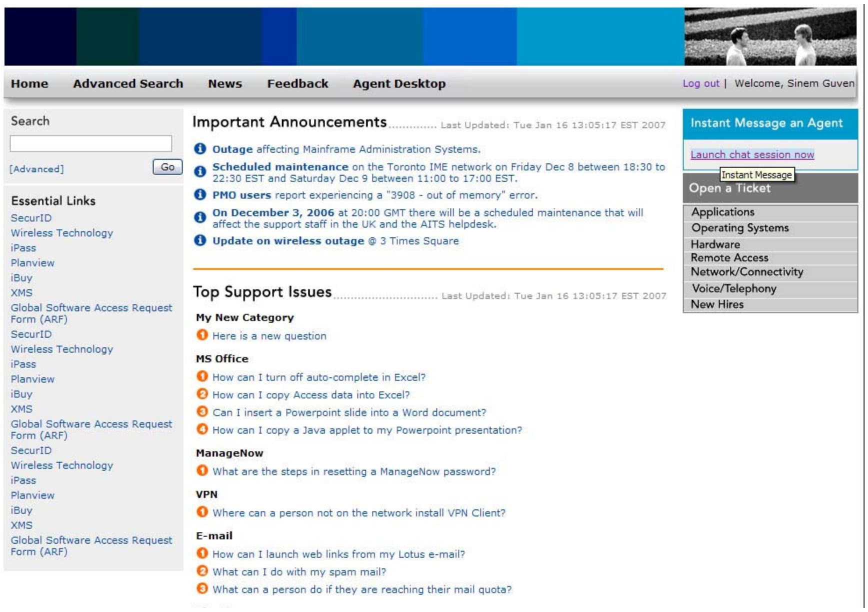


Figure 1 Number of iterations of support involved in resolving problems of a particular type. Note that 38% of the problems require more than 2 iterations and some require up to 12 iterations of support.



Important Announcements .... Last Updated: Tue Jan 16 13:05:17 EST 2007

- **Outage** affecting Mainframe Administration Systems.
- **Scheduled maintenance** on the Toronto IME network on Friday Dec 8 between 18:30 to 22:30 EST and Saturday Dec 9 between 11:00 to 17:00 EST.
- **PMO users** report experiencing a "3908 - out of memory" error.
- **On December 3, 2006** at 20:00 GMT there will be a scheduled maintenance that will affect the support staff in the UK and the AITS helpdesk.
- **Update on wireless outage** @ 3 Times Square

Top Support Issues .... Last Updated: Tue Jan 16 13:05:17 EST 2007

My New Category

1. Here is a new question

MS Office

1. How can I turn off auto-complete in Excel?
2. How can I copy Access data into Excel?
3. Can I insert a Powerpoint slide into a Word document?
4. How can I copy a Java applet to my Powerpoint presentation?

ManageNow

1. What are the steps in resetting a ManageNow password?

VPN

1. Where can a person not on the network install VPN Client?

E-mail

1. How can I launch web links from my Lotus e-mail?
2. What can I do with my spam mail?
3. What can a person do if they are reaching their mail quota?

Figure 2 Self-help portal

lists of documented descriptions of issues/questions with their associated answers/solutions. However, long lists of issues become cumbersome to browse and keeping the descriptions/questions relevant and up-to-date requires significant effort by the contact center.

2.1 Dynamic Generation of Relevant Self-help Content: Problem Definition and Background

Our aim is to dynamically update a self-help portal with descriptions and associated solutions of commonly occurring problems while reducing, if not eliminating, the human effort involved. In order to keep this information up-to-date and focused on the most relevant issues, we propose to analyze the contact center problem ticket records and knowledge databases to determine frequently occurring problems and their associated solutions.

Whenever an agent receives a contact, they are required to open a problem ticket, which traces the history of contacts until the problem is resolved. Figure 3 shows some of the content in an example problem ticket. Notice that there is an unstructured description of the problem entered by the agent receiving the first contact, history of escalations of the problem, and a description of how the problem was resolved. These problem tickets are a valuable resource in determining the common and relevant problems of users, since millions of such records exist and are created for every contact. However annotations entered by agents are often terse and have spelling and grammatical errors, making them hard to analyze and re-use.

While we find problem tickets a valuable source of information for problem types, they are severely limited as a source of solution documentation. Especially, when the aim is to provide usable self-help for the end-user, we have to rely on more carefully authored knowledge/solution documentation. A valuable source of information in our

HD Problem Description: 04/19 9:21:52	Tried to configure Notes crashed. Cannot access his mail and calendar and looing his productivity
HD Action Notes: 04/19 9:23:35	Ticket escalated to MQC4
MQC4 Action Notes: 04/19 10:18:21	Sev 1. Ticket has been escalated. Queue coordinator has been contacted.
DS Action Notes: 04/20 04:00:15	Reconfigured Notes. Notes I was expired replace with one the user had was expired too. Contacted the nsa team work with then to resolve the cross-certificate problem id. Finally user is done

Figure 3 Illustration of content of problem ticket descriptions (typos are from the original ticket).

Displaying alarms when Notes is not running.
1. On the Start menu, select Programs, choose Lotus Applications, and click Notes Minder.
2. Enter to Lotus Notes password if prompted and click the OK button, in the password dialog box.
3. In the system tray on the Windows taskbar, right-click the Notes Minder icon and select Properties on the shortcut menu.
4. In the Options For Lotus Notes Minder dialog box, select the Show Missed Alarms checkbox in the Alert area.
5. Click the OK button.

Figure 4 Example of a solution document.

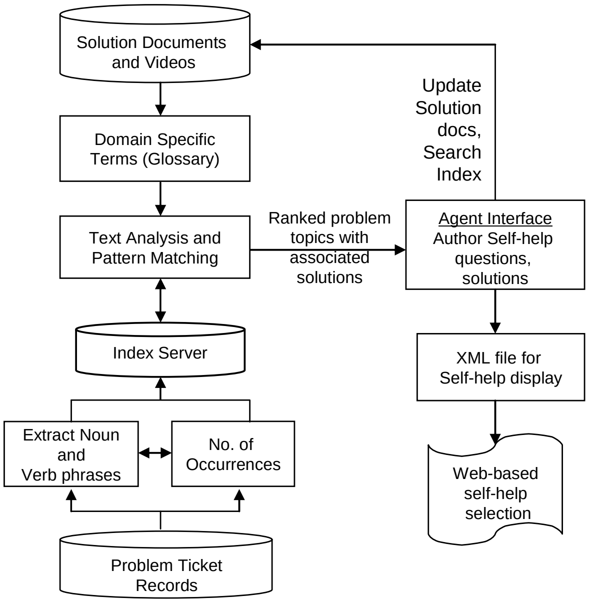

Solution Documents and Videos
Domain Specific Terms (Glossary)
Text Analysis and Pattern Matching
Index Server
Extract Noun and Verb phrases
No. of Occurrences
Problem Ticket Records
Ranked problem topics with associated solutions
Agent Interface
Author Self-help questions, solutions
Update Solution docs, Search Index
XML file for Self-help display
Web-based self-help selection

Figure 5 Overview of Problem Ticket mining and Self-Help Solution Retrieval.

application is a database of approximately 100,000 authored solution/knowledge documents. An example of such a document is shown in Figure 4. These typically outline procedures to follow for specific problems associated with different applications. Many of these text documents also have associated audio-visual clips.

The advantage of these documents are that they are well-written compared to problem resolution records and are readily searchable. As mentioned earlier, though, our experience has been that end-users do not typically search for these documents. Another issue is that it is not clear how many of these documents are actually relevant to problems faced by user and if the effort involved in authoring the content is justified by actual usage.

2.2 Identifying Relevant Solution Documents

In order to retrieve solution documents corresponding to those problems that occur frequently in problem ticket records, we mine the unstructured problem descriptions in the problem ticket records to find the most frequently occurring phrases. We then use these terms extracted from problem tickets as query terms to search and retrieve relevant solution documents. Figure 5 shows an overview of our approach. We analyze the unstructured text of problem descriptions to extract noun phrases and associated verb phrases. This approach extracts useful information from problem ticket records while not relying on grammatically sound descriptions. We also maintain the frequencies of extracted phrases over all problem records for any selected period of time and enable retrieval of these phrases along with their frequencies through an index server. We then use these extracted terms to retrieve relevant solution documents.

To improve this retrieval [3], we obtain a glossary of domain specific terms in the knowledge base. These can be easily matched with the noun and verb phrases extracted from problem tickets and are also more likely to appear in problem ticket records compared to non-domain specific terms. Following the approach in [2], we determine the domain specificity of each extracted term in terms of the ratio of probability of the term appearing in a general corpus to the probability of the term appearing in the domain-specific corpus. To further improve retrieval, we search on the original extracted terms as well as their synonyms, determined through Wordnet.

2.3 Exposing Identified Solutions to End-Users

Having extracted the most frequently occurring phrases (in problem tickets) and their associated solution documents, the next step is to convert them into readily accessible self-help solutions. To address this, we developed an Agent Desktop Authoring Tool for agents to create and publish self-help solutions to an end-user facing web portal, shown in Figure 2. Our web portal provides end-users with *search* capability to look up solution documents that can help them solve their problems, as well as a *live chat* feature [4], where end-users can connect with agents. In addition, our portal presents a dynamically updating list of *top support issues* and *important announcements*. Top questions refer to “most commonly occurring issues”, or “top call drivers” in contact centers. In our web portal, such top questions and their associated solution documents are listed for end-user enablement. Important announcements may also be posted on the portal to simply inform the end-users about issues like an outage, or a temporary shutdown at a certain location.

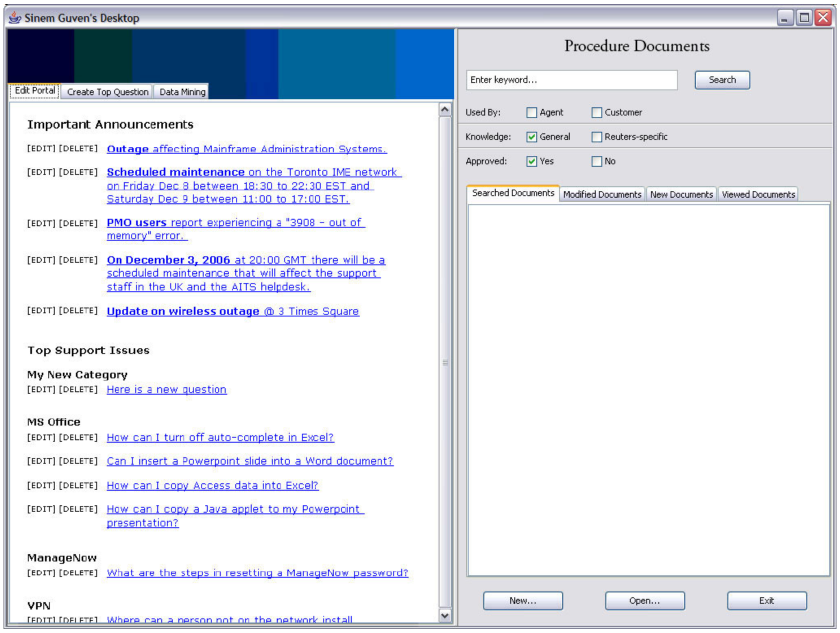
2.3.1 Authoring Portal Content: Top Questions

In order to create or edit portal content, the portal admin can launch the Agent Desktop Authoring Tool from the portal by clicking on the Agent Desktop link on the navigation bar, shown in Figure 2. (Note that this link is not active for end-users). The initial screen of the tool, shown in Figure 6, provides an administrative view of the portal content. The agent can add, remove or edit the existing content of the portal through the Authoring Tool, and the resulting updates are also reflected in the portal.

To publish a new top question, the agent first views the currently occurring top issues dynamically extracted from problem tickets to identify a question to author. As shown in Figure 7, our Authoring Tool allows an agent to view extracted noun phrases with their associated frequencies.

If the agent finds a particular phrase interesting, they can click on it to view its associated action verbs. Selecting a noun phrase-action verb pair retrieves and displays the relevant solution documents as well as the abstracts of the relevant problem tickets, along with their full descriptions (Figure 7). The agent can thus easily identify solutions for top issues and further verify the relevance of the solutions by going through problem tickets.

Having determined the top question to author, the agent formulates the question and chooses a category under which the question should appear, as shown in Figure 8. Our Authoring Tool also allows the agent to create new categories if the existing categories are not useful for the new content they are creating.



Important Announcements

[EDIT] [DELETE] **Outage** affecting Mainframe Administration Systems.

[EDIT] [DELETE] **Scheduled maintenance** on the Toronto IME network on Friday Dec 8 between 18:30 to 22:30 EST and Saturday Dec 9 between 11:00 to 17:00 EST.

[EDIT] [DELETE] **PMO users** report experiencing a "3908 - out of memory" error.

[EDIT] [DELETE] **On December 3, 2006** at 20:00 GMT there will be a scheduled maintenance that will affect the support staff in the UK and the AITS helpdesk.

[EDIT] [DELETE] **Update on wireless outage** @ 3 Times Square

Top Support Issues

My New Category
[EDIT] [DELETE] Here is a new question

MS Office
[EDIT] [DELETE] How can I turn off auto-complete in Excel?
[EDIT] [DELETE] Can I insert a Powerpoint slide into a Word document?
[EDIT] [DELETE] How can I copy Access data into Excel?
[EDIT] [DELETE] How can I copy a Java applet to my Powerpoint presentation?

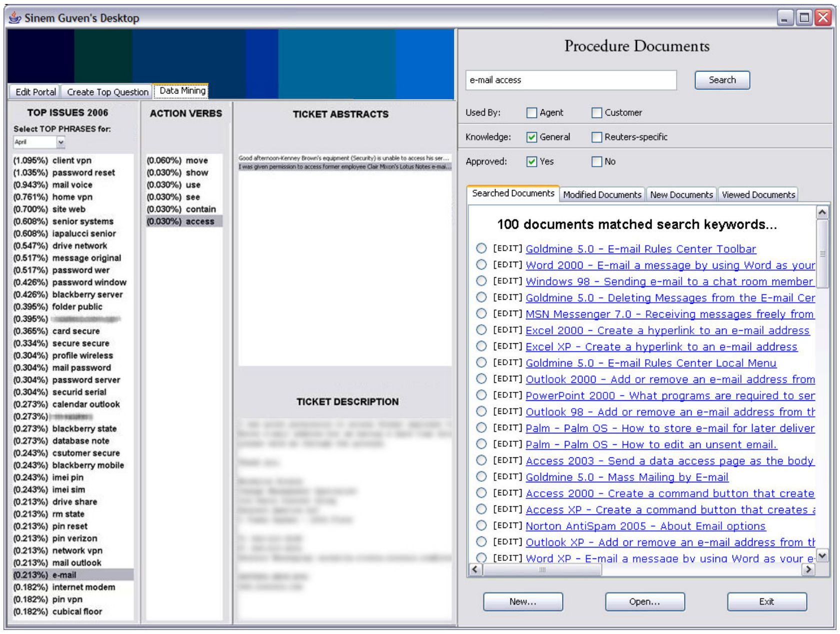
ManageNow
[EDIT] [DELETE] What are the steps in resetting a ManageNow password?

VPN
[EDIT] [DELETE] Where can a person not on the network install

Enter keyword...

Used By: ☐ Agent ☐ Customer
Knowledge: ☑ General ☐ Reuters-specific
Approved: ☑ Yes ☐ No

Figure 6 The Agent Desktop Authoring Tool.



TOP ISSUES 2006

Select TOP PHRASES for: April

(1.095%) client vpn
(1.035%) password reset
(0.943%) mail voice
(0.761%) home vpn
(0.700%) site web
(0.608%) senior systems
(0.608%) iapalucci senior
(0.547%) drive network
(0.517%) message original
(0.517%) password wer
(0.426%) password window
(0.426%) blackberry server
(0.395%) folder public
(0.395%) [redacted]
(0.365%) card secure
(0.334%) secure secure
(0.304%) profile wireless
(0.304%) mail password
(0.304%) password server
(0.304%) securid serial
(0.273%) calendar outlook
(0.273%) [redacted]
(0.273%) blackberry state
(0.273%) database note
(0.243%) csutomer secure
(0.243%) blackberry mobile
(0.243%) imei pin
(0.243%) imei sim
(0.213%) drive share
(0.213%) rm state
(0.213%) pin reset
(0.213%) pin verizon
(0.213%) network vpn
(0.213%) mail outlook
(0.213%) e-mail
(0.182%) internet modem
(0.182%) pin vpn
(0.182%) cubical floor

ACTION VERBS

(0.060%) move
(0.030%) show
(0.030%) use
(0.030%) see
(0.030%) contain
(0.030%) access

TICKET ABSTRACTS

Good afternoon-Kenney Brown's equipment (Security) is unable to access his ser...
I was given permission to access former employee Clair Mixon's Lotus Notes e-mai...

TICKET DESCRIPTION

[redacted]

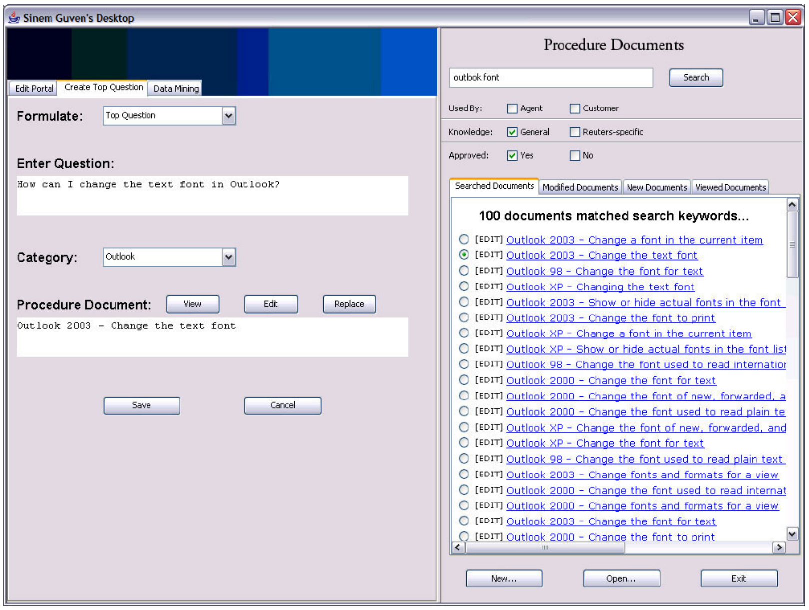
e-mail access

Used By: ☐ Agent ☐ Customer
Knowledge: ☑ General ☐ Reuters-specific
Approved: ☑ Yes ☐ No

100 documents matched search keywords...

○ [EDIT] Goldmine 5.0 - E-mail Rules Center Toolbar
○ [EDIT] Word 2000 - E-mail a message by using Word as your
○ [EDIT] Windows 98 - Sending e-mail to a chat room member
○ [EDIT] Goldmine 5.0 - Deleting Messages from the E-mail Cer
○ [EDIT] MSN Messenger 7.0 - Receiving messages freely from
○ [EDIT] Excel 2000 - Create a hyperlink to an e-mail address
○ [EDIT] Excel XP - Create a hyperlink to an e-mail address
○ [EDIT] Goldmine 5.0 - E-mail Rules Center Local Menu
○ [EDIT] Outlook 2000 - Add or remove an e-mail address from
○ [EDIT] PowerPoint 2000 - What programs are required to ser
○ [EDIT] Outlook 98 - Add or remove an e-mail address from tl
○ [EDIT] Palm - Palm OS - How to store e-mail for later deliver
○ [EDIT] Palm - Palm OS - How to edit an unsent email.
○ [EDIT] Access 2003 - Send a data access page as the body
○ [EDIT] Goldmine 5.0 - Mass Mailing by E-mail
○ [EDIT] Access 2000 - Create a command button that create
○ [EDIT] Access XP - Create a command button that creates a
○ [EDIT] Norton AntiSpam 2005 - About Email options
○ [EDIT] Outlook XP - Add or remove an e-mail address from tl
○ [EDIT] Word XP - E-mail a message by using Word as your e-

Figure 7 Viewing top issues determined by data mining problem tickets.



Formulate: Top Question

Enter Question:

How can I change the text font in Outlook?

Category: Outlook

Procedure Document:

Outlook 2003 - Change the text font

outlook font

Used By: □ Agent □ Customer

Knowledge: ☑ General □ Reuters-specific

Approved: ☑ Yes □ No

100 documents matched search keywords...

○ [EDIT] Outlook 2003 - Change a font in the current item
● [EDIT] Outlook 2003 - Change the text font
○ [EDIT] Outlook 98 - Change the font for text
○ [EDIT] Outlook XP - Changing the text font
○ [EDIT] Outlook 2003 - Show or hide actual fonts in the font
○ [EDIT] Outlook 2003 - Change the font to print
○ [EDIT] Outlook XP - Change a font in the current item
○ [EDIT] Outlook XP - Show or hide actual fonts in the font list
○ [EDIT] Outlook 98 - Change the font used to read internatior
○ [EDIT] Outlook 2000 - Change the font for text
○ [EDIT] Outlook 2000 - Change the font of new, forwarded, a
○ [EDIT] Outlook 2000 - Change the font used to read plain te
○ [EDIT] Outlook XP - Change the font of new, forwarded, and
○ [EDIT] Outlook XP - Change the font for text
○ [EDIT] Outlook 98 - Change the font used to read plain text
○ [EDIT] Outlook 2003 - Change fonts and formats for a view
○ [EDIT] Outlook 2000 - Change the font used to read internat
○ [EDIT] Outlook 2000 - Change fonts and formats for a view
○ [EDIT] Outlook 2003 - Change the font for text
○ [EDIT] Outlook 2000 - Change the font to print

Figure 8 Authoring a Top Question.

Finally, the agent selects the most relevant retrieved solution document and associates it with the question before it is published to the portal. Alternatively, the agent can perform a keyword search on the existing solution document DB, view potential solution documents, and link them to the top question being authored (Figure 8). Thus, when a newly authored top question appears on the portal, end-users interested in that particular question can click on it and view its linked solution document.

Sometimes, help desk agents may not be able to find relevant solution documents for top issues, or more generally, they may not have solution documents that would address their customer's problem. In such cases, the Agent Desktop Authoring Tool allows agents to create new solution documents and publish them to the solution document DB, as further explained in Section 3.

2.3.2 Authoring Portal Content: Important Announcements

Important announcements are similar to top questions in the way they are authored. One difference is that an important announcement does not need to be linked to a solution document. It may be posted on the portal to simply inform the customers about issues like an outage, or a temporary shutdown at a certain location. The new entries published to the portal always appear at the top until they are dynamically reordered by our sorting algorithm.

2.4 Dynamic Re-ranking of Portal Content

Whenever a user interacts with the web portal, their activity is logged in a database – this includes every search performed, every link accessed via the portal, tickets opened, chat sessions, and user feedback.

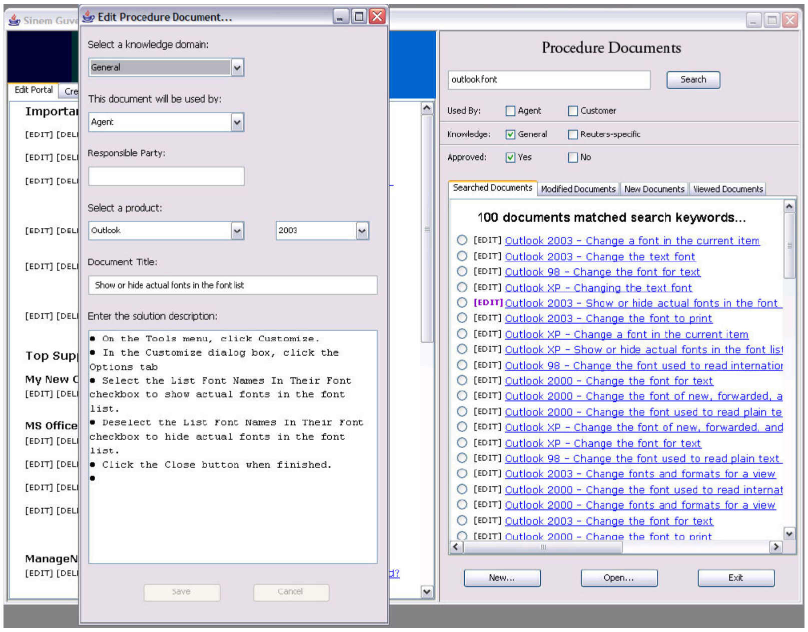
In order to keep portal content up-to-date and relevant for the end-users, we designed an algorithm (Figure 9) that dynamically rearranges and updates the portal content based on the following three sources:

- **Ranking from Data Mining** (i.e., how frequently the phrase + action verb pair (e.g., "password"+"reset") that led to the formulation of the top question appear in the problem tickets.)
- **Occurrence in search logs / portal history** (i.e., when an end-user searches for a particular keyword, they receive some hits or potentially useful solution documents). Any "click" on a solution document to view it is logged and if that solution document is later associated with a top question, that top question is ranked higher than other questions, whose solution documents are not yet "clicked" on.
- **Usage** (i.e., if the end-user clicks on a top question, it is rendered more important than other top questions.)

In Figure 9, the values of x, y, z define different weights that can be assigned for each contributor. The algorithm ensures that outdated portal content is eventually phased out without any explicit agent intervention.

```
Top Question Rank (x,y,z) =
(((Percentage of this Top Question's Phrase and Action Verb from the Discovery Tool returned data)/100)
+((100*(# of document sources pointed by the top q is searched) / (total # of searches for other documents)*z/100)
+((100*(# of clicks for this top question)) / (total # of clicks for All top questions)*x/100))
```

Figure 9 Formula for question rankings.



Edit Procedure Document...

Select a knowledge domain: General

This document will be used by: Agent

Responsible Party:

Select a product: Outlook 2003

Document Title: Show or hide actual fonts in the font list

Enter the solution description:

- On the Tools menu, click Customize.
- In the Customize dialog box, click the Options tab
- Select the List Font Names In Their Font checkbox to show actual fonts in the font list.
- Deselect the List Font Names In Their Font checkbox to hide actual fonts in the font list.
- Click the Close button when finished.
-

Procedure Documents

outlook font

Used By: ☐ Agent ☐ Customer

Knowledge: ☑ General ☐ Reuters-specific

Approved: ☑ Yes ☐ No

100 documents matched search keywords...

○ [EDIT] Outlook 2003 - Change a font in the current item
○ [EDIT] Outlook 2003 - Change the text font
○ [EDIT] Outlook 98 - Change the font for text
○ [EDIT] Outlook XP - Changing the text font
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○ [EDIT] Outlook XP - Change the font for text
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○ [EDIT] Outlook 2003 - Change fonts and formats for a view
○ [EDIT] Outlook 2000 - Change the font used to read internat
○ [EDIT] Outlook 2000 - Change fonts and formats for a view
○ [EDIT] Outlook 2003 - Change the font for text
○ [EDIT] Outlook 2000 - Change the font to print

Figure 10 Editing an Existing Solution Document.

3. Efficient Authoring of Solution Documents

Another important problem that needs to be addressed in the contact center domain is the *authoring* of solution documents themselves, and improving the efficiency of the authoring process. Current approaches to authoring solution documents often rely on a dedicated agent, using dedicated software. These dedicated agents determine which solution documents need to be authored based on information and feedback from their *team lead*, *customer*, *management*, or *other agent colleagues*. In other words, agents do not have:

a) dynamic and up-to-date information about the top issues that the customers are currently facing.

b) a dynamic, informative view of which problems lack associated solution documents.

When authoring a solution document, agents typically exchange several e-mails with the party requesting the document to make sure that the document addresses all relevant issues. In addition to content to author, the agent also needs to know all relevant information such as document title, requesting party information, who the document is intended for (end-users or agents), whether it is a customer-specific document or a general purpose document.

After several iterations, the document is eventually finalized and submitted for approval. Until the document is approved (which can take up to weeks depending on the process), it is not available to end-users, or other agents. This is a major bottleneck, which prevents agents from sharing a newly authored document with other agents trying to solve the same problem; or perhaps just as important, sharing them with end-users before the document is approved. As a result, the process of authoring solution documents is not very effective, and is often limited to being performed by a dedicated agent.

3.1 Using Top Issues to Identify Missing Documents

In addition to automatically retrieving existing solution documents relevant to agents' context, the value of our Authoring Tool also lies in identifying top issues that have no documented solutions in the knowledge database. In other words, our Authoring Tool allows:

a) agents to spend their time wisely authoring solution documents that reflect the current needs of the customers.

b) any agent, who realizes the need for creating or editing a solution document, to author preliminary documents (using tools built in to their environment) to be approved by the dedicated agent.

3.2 Authoring Solution Documents

Agents can author solution documents from scratch by using our document template, or they can search and view existing solution documents to update documents' content. To create a new solution document, the agent clicks on the "New" button in the Procedure Documents panel of our Authoring Tool (Figure 10), and brings up the authoring window. Here, the agent can specify whether this solution document is:

a) General vs. customer specific

b) Agent-facing vs. customer-facing

The agent can also indicate the group who is responsible for authoring this document. Next, the agent selects a product name from the list of products, and finally enters a title for the document. Once the agent enters the solution description, they can save the newly authored solution document in the solution DB and start publishing its content to the portal, if needed. Thus, the newly created document is immediately available for end-users as well as

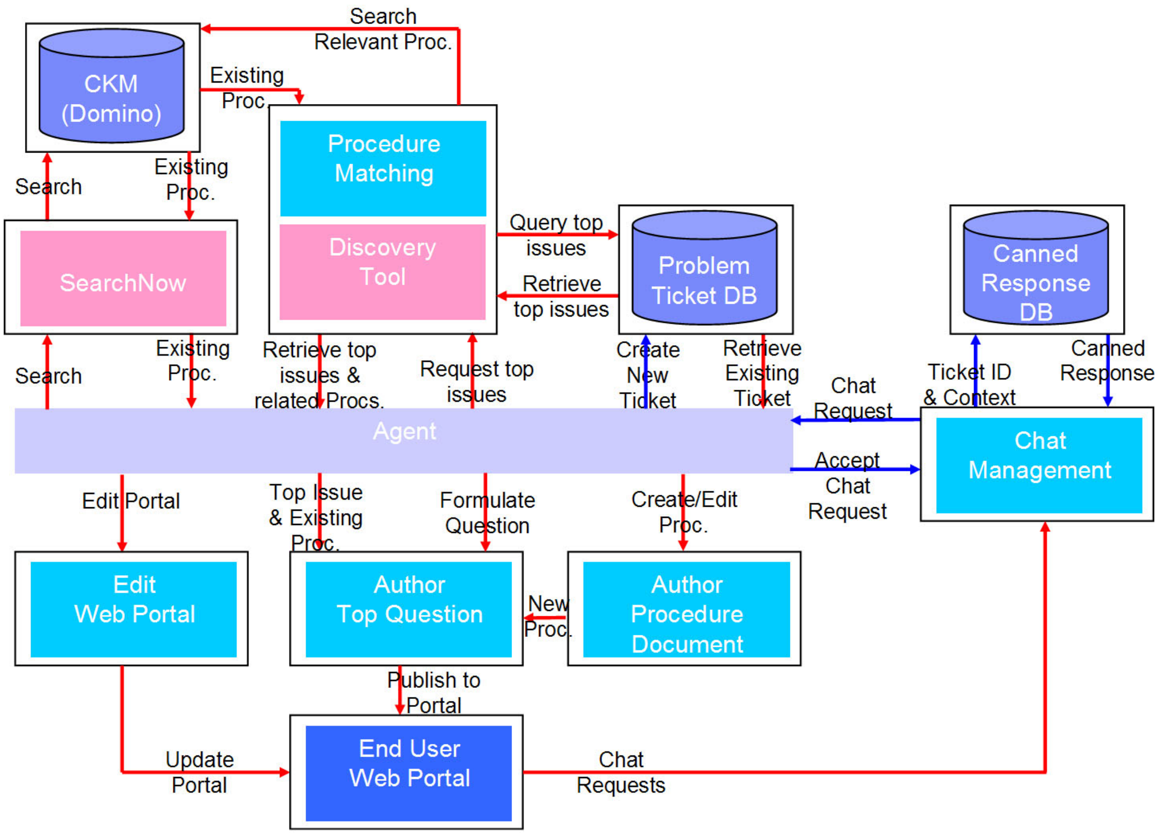


Figure 11 The Agent Desktop Authoring Tool Architecture.

other agents, without waiting for the approval process.

To use existing solution documents, first, the agent performs a keyword search, and matching documents to this query are displayed in the Agent Desktop Authoring Tool (Figure 10). The agent can then click on the [EDIT] menu item of the relevant document, which gets parsed in the background, and its content is displayed in the authoring window. The agent can then edit the content of this document, which then gets automatically submitted to solution document DB administrators for viewing and approval. In the mean time, the document is marked *pending* and is saved as a modified document in a temporary solution database. Just like newly authored documents, such modified documents also become immediately searchable and publishable by agents without having to wait for the approval process.

4. System Architecture & Process Transformation Summary

As shown in the system architecture in Figure 11, the Authoring Tool interfaces with a solution document DB through eSearch web service for document querying and retrieval. The Discovery Tool [1] provides the data mining capabilities described in Section 2, and the problem ticket DB integration enables problem ticket retrieval. The chat management module [4] and functionality marked with blue arrows are work in progress at the time of writing. The idea is to integrate most frequently used tools in a unified architecture and interface so as to minimize the amount of time agents spend switching between different tools and platforms to perform their task.

4.1 Process Transformation

In this section, we summarize the process transformations introduced by our tools.

4.1.1 Current Process

Document Authoring & Dedicated Agent Requirement

As shown in Figure 12, contact center agents, management, and customers being supported typically rely on a dedicated authoring agent to create and update solution documents. The main form of communication is over e-mail where each agent, customer, or management personnel sends a request for a new document to be created, or an existing document to be updated. Because there is no template used in the process, typically several e-mails need to be exchanged back and forth until the document content is finalized. Finally, due to lack of a platform to gather, organize and address the incoming requests, the document authoring process is fairly inefficient and cannot be performed by multiple agents.

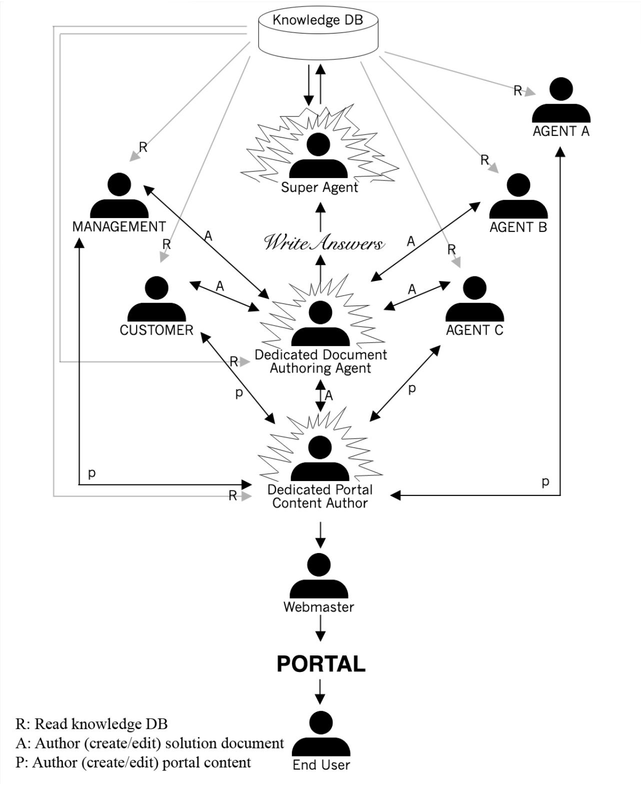

Knowledge DB
R
AGENT A
R
Super Agent
R
MANAGEMENT
AGENT B
R
A
WriteAnswers
A
R
A
A
CUSTOMER
AGENT C
Dedicated Document Authoring Agent
R
p
A
p
p
R
Dedicated Portal Content Author
p
Webmaster
PORTAL
End User
R: Read knowledge DB
A: Author (create/edit) solution document
P: Author (create/edit) portal content

Figure 12 Current Agent Processes

Approval Process

Newly authored documents, whether created or edited, need to go through an approval process before they can be published in a solution database. The approval process entails several steps, and depending on the nature of the required approval, it may take several weeks to have a newly authored document published in a solution database. In the mean time, the authored documents are neither searchable nor sharable by agents. This means that, agents can easily waste time creating already existing content, which is stuck in the approval pipeline.

Context-Switching

During the document authoring process, the agent has to switch between several tools to create/edit a document:

a) *E-mail:* to receive document authoring requests, and agree on content.
b) *Solution DB:* to check whether a similar document already exists in the DB (if a new document is being created), or retrieve the document to be edited (if an existing document is being updated).
c) *Authoring Platform:* to author the document
d) *Approval Tool:* to submit the new/edited document for approval

The problem with this approach is that agent needs to constantly switch context to use different tools, which breaks the continuity of the authoring experience, and introduces errors and inefficiency.

Authoring Portal Content

When it comes to authoring portal content, the process is very similar. Again, there is the context-switching problem as well as the dedicated agent author requirement. All communication is again happening over e-mail, where customer, agents, management or team leads suggest top questions and announcements to be posted on the portal.

Determining Missing Documents

In the process of authoring portal content, the agent needs to manually search the solution database to identify a relevant solution document (or determine the lack thereof) that addresses a top question. If a relevant solution document exists, they proceed to the publishing step; otherwise, the agent needs to author a new solution document by going through the steps described earlier. This means that a top question may not be posted until its associated solution document is authored and approved.

Updating Portal Content

Finally, having determined the top question, or the important announcement, and its relevant solution document, the agent passes these to a web master to be posted on the portal. Depending on web master's availability, this is almost never immediate. In effect, this makes it impossible for agents to post urgent portal content without having to go through the web master's queue.

Similarly, when portal content needs to be edited, the agent again has to go through the same process of gathering the required changes and passing them to the web master. Portal content authoring is thus a highly inefficient task.

4.1.2 Transformed Process

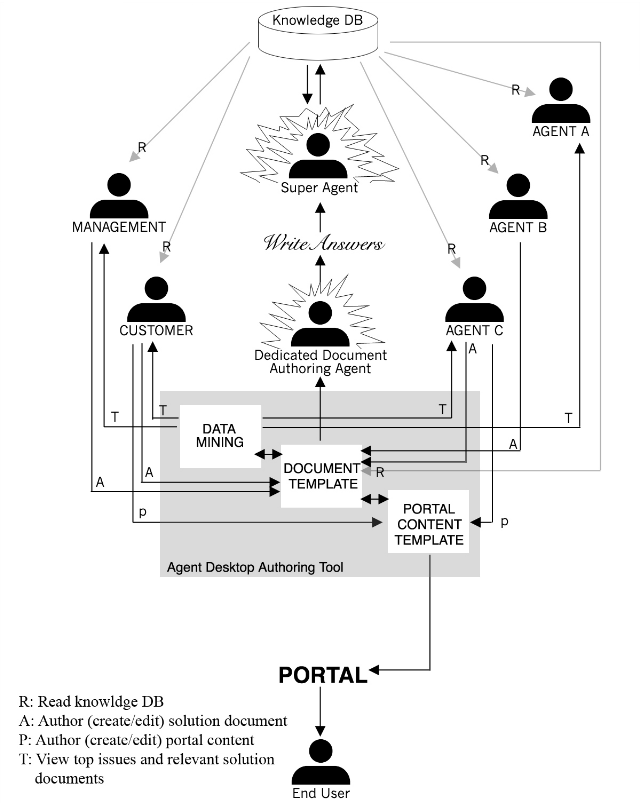
Figure 13 shows a summary of the transformed agent process using our tools.

Approval Process

Using our Agent Desktop Authoring Tool, agents can publish newly authored documents (which are pending approval) to our web portal, thereby immediately exposing them to other agents, as well as end-users. While the amount of time it takes to have a document approved remains the same, the approval process is no longer a bottleneck for making the documents searchable and sharable by other agents; therefore, no time and effort is wasted duplicating existing content. Further, end-users can benefit from pending documents via the portal until the approved versions become available.

Context-Switching

The unified user interface our Authoring Tool provides makes it possible for agents to search for existing documents, create and edit new ones, post top questions and important announcements, all using the same tool. This way, the amount of context-switching is minimized, thereby increasing the efficiency of the authoring process.


Knowledge DB
R
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AGENT A
Super Agent
MANAGEMENT
AGENT B
WriteAnswers
CUSTOMER
AGENT C
Dedicated Document Authoring Agent
A
T
T
T
T
DATA MINING
DOCUMENT TEMPLATE
R
A
A
A
p
PORTAL CONTENT TEMPLATE
p
Agent Desktop Authoring Tool
PORTAL
R: Read knowldge DB
A: Author (create/edit) solution document
P: Author (create/edit) portal content
T: View top issues and relevant solution documents
End User

Figure 13 Transformed Agent Processes

Authoring Portal Content

Our Agent Desktop Authoring Tool provides a dynamically updated set of top issues (extracted from problem tickets), and automatically discovers and displays relevant solution documents. Thus, any agent can easily create portal content, without having to manually identify top issues and their relevant solutions.

Determining Missing Documents

Another important feature of the Agent Desktop Authoring Tool is that, it automatically reveals the lack of relevant solution documents, in addition to providing means of authoring them. As a result, agent does not have to spend any time performing manual searches to see what solution documents are missing / need to be authored.

Updating Portal Content

Our Agent Desktop Authoring Tool enables agents to directly post and update portal content. The improvement over the current process is that portal content updates can now be done by several agents, where a dedicated agent monitors and edits the postings, if needed. Another important feature the Agent Desktop Authoring Tool provides is the dynamic re-ranking of portal content (described in Section 2.4). Thus, top questions on the portal are automatically ranked/removed based on data mining of problem tickets, as well as user interaction, keeping portal content up-to-date without any explicit agent intervention.

Inclination to ***search for solutions*** on portal	0%
Inclination to look at ***top questions*** on portal	75%
Inclination to look at ***important announcements*** on portal	100%
Inclination to provide ***feedback*** on positive portal experience	50%
Inclination to provide ***feedback*** on negative portal experience	100%

Table 1 Summary of User Interviews on Portal Usage

With the transformed process, agents can perform their tasks much more effectively and efficiently.

5. User Validation

In this work, we engaged with an enterprise contact center organization that has 8000 contact center agents receiving over 3 million contacts a month from end-users in several hundred companies. We have implemented the system and initially piloted it in one company with a total of 3000 end-users, serviced by 6 agents. During our engagement with this contact center, we conducted qualitative interviews with selected pilot end-users as well as help desk agents, as summarized below.

5.1 End-User Validation

Our end-user subject pool ranged from non-technical users, such as personal assistants, to technically savvy IT support staff. During the interview, subjects were shown the search functionality of the portal and asked whether they would use this capability to look up solution documents for self-help. As seen in Table 1, none of the subjects showed interest in the search capability, and reasons listed were little confidence that the search would return the appropriate solution; and lack of patience to sift though search results to find relevant solutions. Some users said they simply did not have time to search for solutions.

While all subjects thought important announcements were helpful and useful, only 75% of the subjects said they would scan the top questions. The remaining 25% said they would rather call or send an e-mail to the help desk during the time it would take to look at top questions.

Finally, in terms of submitting feedback regarding portal usage, 50% said they may provide feedback on a positive experience, while all subjects reported inclination to submit feedback in case of a negative experience.

5.2 Agent Validation

Table 2 summarizes the changes made to the initial Authoring Tool interface and functionality set to better support agents in their tasks. In our initial user interface, the agent needed to press a button and switch to another window to display and edit the current portal content. Instead, agents wanted to be able to view current portal content up front for easier access and editing. Also, when creating a new document, the agent needed to interact with

	Initial Prototype	Current Prototype
Portal Content	Displayed through a button press	Displayed up front
New Document Authoring	Through retrieved document list	Through a dedicated button
Document Template	Product name, Title, Content	Product name, Title, Content, Responsible Party, Intended User (end-user vs. agent), Document Type (general vs. customer specific)
Document Access	Browse new documents only	Search and browse new and old documents

Table 2 Summary of Changes to Agent Desktop Authoring Prototype based on Agent Interviews

the retrieved document list to bring up the authoring template. This was very confusing for agents; some of them spent minutes tying to locate this functionality. To address these issues, we made modifications in our user interface to display the portal content in the front panel of the Authoring Tool, and also introduced a simple button for the agents to easily get to the document authoring template.

Our initial solution document template consisted of a product name, document title and solution content. When super agents evaluated the usefulness of this template, they requested additional fields such as *responsible party*, *target user* (end-user vs. agent) as well as *document type* (general vs. customer specific) so that all necessary information is present for the solution document to be submitted for approval. These changes are incorporated into the second iteration of the document template.

Our earlier prototype provided only a browsing mechanism for agents to be able to view newly authored solution documents that are not currently in the official knowledge database. Agent feedback revealed that it was equally important to provide a search mechanism for agents to be able to retrieve both new and existing approved documents. To address this issue, we integrated a document search capability into the Authoring Tool.

5.3 Additional Feedback

In general, agents found our Authoring Tool intuitive to use both in terms of creating solution documents and portal content. Agents also reported that the Authoring Tool functionality correctly targets and addresses several pain points in the current help desk processes. In addition to changes agents requested, they also provided additional feedback regarding how our Authoring Tool could help them with their task beyond what we had already anticipated. For example, some agents wanted to be able to view the top phrases and action verbs associated with the tickets *they* worked on (instead of the entire customer account). They said that they would use the data mining feature to get to a problem ticket they previously handled (as well as to a relevant solution document) much faster compared to the traditional way of explicitly searching for it. This would, for example, be useful when agents want to look up how they solved a similar case previously, to help with a new ticket they are working on.

Agents also said that the ability to view top issues and search newly created documents would help them find out whether other agents already solved a given frequently occurring problem they might currently be facing. Finally, when searching for a solution document, some agents said they would use the data mining functionality to retrieve relevant solution documents rather than plain keyword search since it is likely to produce more relevant and context-specific results.

As a result of the pilot, the company is in the process of rolling out our web portal and Agent Desktop Authoring Tool to all their users as a standard offering.

6. Conclusions

This paper presented our work on providing dynamically updated self-help content on a web portal as well as agent facing tools for efficient creation and update of content. We have successfully piloted these tools in an enterprise contact center environment and thereby achieved a transformation of contact center processes. Our approach has been user centric and refined based on ongoing feedback from end-users and agents. Future work will focus on further unification of agent facing tools and associated processes with complementary functions such as chat.

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