Integrated Problem Resolution for Business Communications

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Abstract

AT&T has undertaken a concerted effort to improve customer service at the National Service Assistance Center (NSAC). The benefits have been realized through the use of advanced technologies for assistance in problem diagnosis and information retrieval, tightly coupled with automated customer information access and on-line text and graphic documentation facilities. This paper describes the Trouble Shooter component of the Expert Solutions Platform. The application is a unique approach to developing large case bases; utilizing a templating process which allows a non-technical means of reviewing the large case bases in an environment integrated with a fully functional text and graphic retrieval system. The Trouble Shooter component utilizes Case-Based Reasoning technology to resolve problems and provide information to the AT&T customer support agents for business communications systems. This component has been tightly integrated with the other modules of the ESP system to make the overall platform more user friendly, efficient and provide consistent diagnostic information to resolve the customer's problem. This enhanced system functionality enables a significant streamlining of the customer assistance process. The Trouble Shooter is currently being used by 150 associates, with deployment underway to additional users.

Background

The AT&T Global Business Communications Systems (GBCS) manufactures and markets business telephone systems. It offers multiple product lines with a full-service customer service center to provide assistance for their product lines. Merlin, Partner and Spirit are three of the product lines supported by the National Service Assistance Center (NSAC), and are typically used for small business offices.

The primary mission of the NSAC is to respond to and resolve customer requests and problems. The Merlin and Partner/Spirit support groups are available to their customers 24 hours per day, 365 days per year.

The ESP project is the result of a Business Process Reengineering (BPR) project which identified the need to transition from the mainframe to PCs on the user's desktop, employing a client-server architecture. The project is intended to enhance service to the customer in terms of speed, accuracy, consistency and depth of information, while gathering customer contact data not previously available through their mainframe application. A major goal of the ESP is to provide the customer support agents with a seamless desktop environment with an ability to perform problem resolution, retrieve on-line documentation and improved call management. Leveraging the best that each technology can bring, common off-the-shelf software tools were required and selected with a desire to minimize customization of each of the products selected. The ESP project is planned for deployment to the Merlin and Partner/Spirit product line support groups by February, 1994, with 150 users currently. ESP is also intended to be deployed to the remainder of the NSAC, and possibly to the Technical Service Center, which supports other product lines, by the end of 1995.

ESP Application purpose

The Expert Solutions Platform was specifically designed to address the following strategic business objectives:

- Implement state-of-the-art systems which provide GBCS with a distinctive, competitive advantage in the product maintenance market.
- Provide tools that enable GBCS associates to take actions and make decisions that completely satisfy customer needs.
- Expand the scope and utility of customer and product information as a corporate asset.
- Enhance the ability of GBCS to support new products and improve overall customer service quality while concurrently controlling operating expenses.

The majority of the calls received by the AT&T Account Service Representatives (ASR) can be separated into two major areas:

1. *Problems* associated with their phone system
2. *Information* requests on existing or new products

The *problem* calls are from users who are experiencing the problem, but may not know what equipment they have or what is causing the problem. The description of the problem provided by a customer varies considerably. For example, a phone which is not working could be described

by the inability to call out, or to be called. The symptoms may also be related to hearing, dialing, or ringing, or the customer may describe the problem as having no lights on the phone. The ASRs must ask procedural diagnostic questions to identify:

- Replaceable components; e.g. handset, phone, line module or cord, etc.
- Quick fixes to eliminate the problem or correct a system configuration
- Rapid identification of situations which require Field Service dispatch

The calls related to *information* requests include questions on how to install a FAX machine to their phone system, the best way to expand their existing system as their company grows, or a request for knowledge on how to use a specific feature available on their phone. The Trouble Shooter component of the ESP must satisfy both types of calls in an easy to access shared repository of problem resolution knowledge, while supporting each of the business objectives.

Trouble Shooter Objectives

There are four primary objectives of the Trouble Shooter component of the ESP:

1. Minimize call times and reduce the number of repeat calls with advanced diagnostics, improving the consistency and accuracy in the response provided by the agents.
2. Reduce the number of replacement parts that are unnecessarily sent to customers because of inadequate or improper diagnostics performed by the agents.
3. Reduce field service dispatches and reduce costs by providing more detailed information regarding diagnostic steps taken by the ASRs before dispatching the technician.
4. Reduce ASR formal training costs for new associates and part-time employees and reduce training for new products and features.

As a component of the ESP system, it is desired to meet each of these objectives using a commercially available software package, with minimal modifications, and provide an environment that is easy to maintain and extend.

Application Description

ESP architecture

The Expert Solutions Platform introduces a set of enhanced systems to the associates within the NSAC Merlin and Partner/Spirit Hotline work groups. Phase I of the ESP consists of five primary components:

1. *Trouble Shooter* for automated problem resolution through case-based reasoning technology. This component consists of a case base developed using CBR Express and deployed using CasePoint, both from Inference Corporation.
2. *On-line documentation* for text retrieval from their numerous technical manuals, and the ability to fax

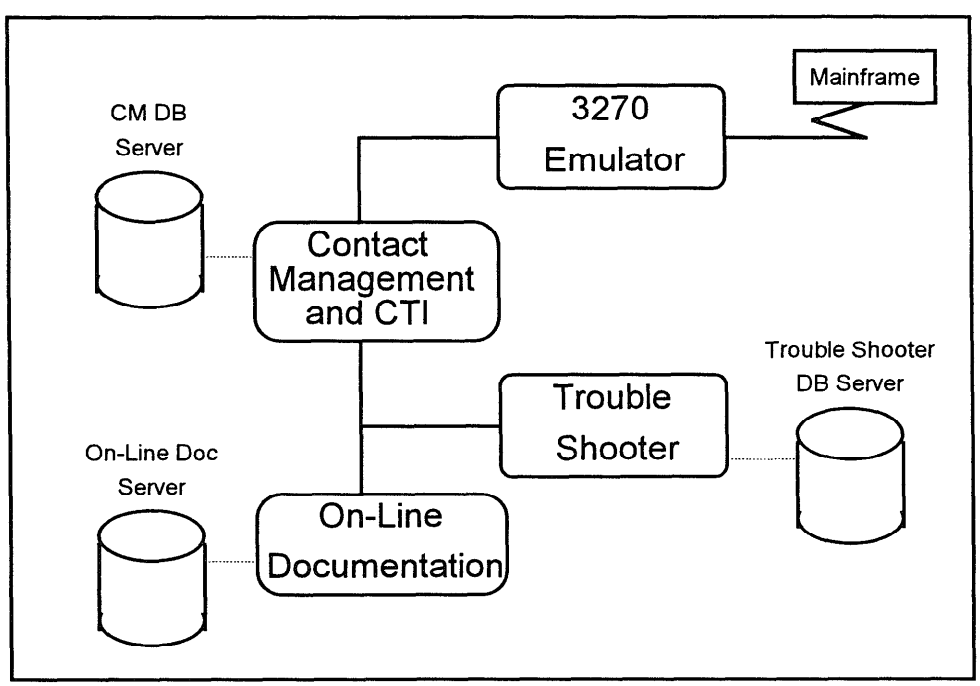

Figure 1. ESP System Architecture

selected pages of information to customers directly from the computer terminal, developed and deployed using Topic and PageView from Verity, Inc.

3. *Contact Management* (CM) for call tracking and MIS reporting, developed by AT&T using PowerBuilder and Microsoft C/C++.

4. *Computer Telephone Integration* (CTI) which will provide a "screen pop" when the caller's phone number has been identified and the associated customer information has been retrieved from the customer database.

5. *Terminal emulation* which allows a connection to the mainframe to support the trouble ticket and dispatch mechanisms and provide additional access to customer records. This emulator is provided using Rabbit Software's OAW3270.

Figure 1 demonstrates the interaction between the five major components of the ESP platform, along with the associated database servers and mainframe connection.

Hardware and software environment

The ESP project has been deployed to the users, replacing obsolete desktop terminals with NCR 486-33 MHz PC workstations with 17 inch monitors, providing both LAN and WAN connectivity. On-site database servers support local databases of customer records, installed equipment, contact information, knowledge bases to support product trouble shooting and on-line documentation. The servers for each of the application databases are:

1. Contact Management; Sun SPARCENTER 2000 with Informix

2. Trouble Shooter; Sun SPARC Classic Servers with Sybase

3. On-line documentation; Sun SPARC 10 Servers with Topic

Figure 2 details the hardware and software components for the ESP environment, including the network topology used.

Trouble Shooter architecture

The Trouble Shooter utilizes Case-Based Reasoning (CBR) technology to provide diagnostic actions to be performed to resolve customer's problems and information to support the many requests for detail information on phone operation. The types of cases in the case base can be broken down into two primary areas:

1. *Diagnostic cases* intended to provide a consistent means of determining the cause of the customer's problem including both hardware and programming problems

2. *Information cases* primarily aimed at feature programming and use, and adjunct or accessory installation, programming and operation.

A requirement of the design of the Trouble Shooter is to provide a consistent means of retrieving the correct resolution whether the caller is requesting information or is trying to resolve a problem with their phone system. This required a partitioning of the case base to provide a coexistence of both informational cases along with the hardware and programming diagnostic cases within the

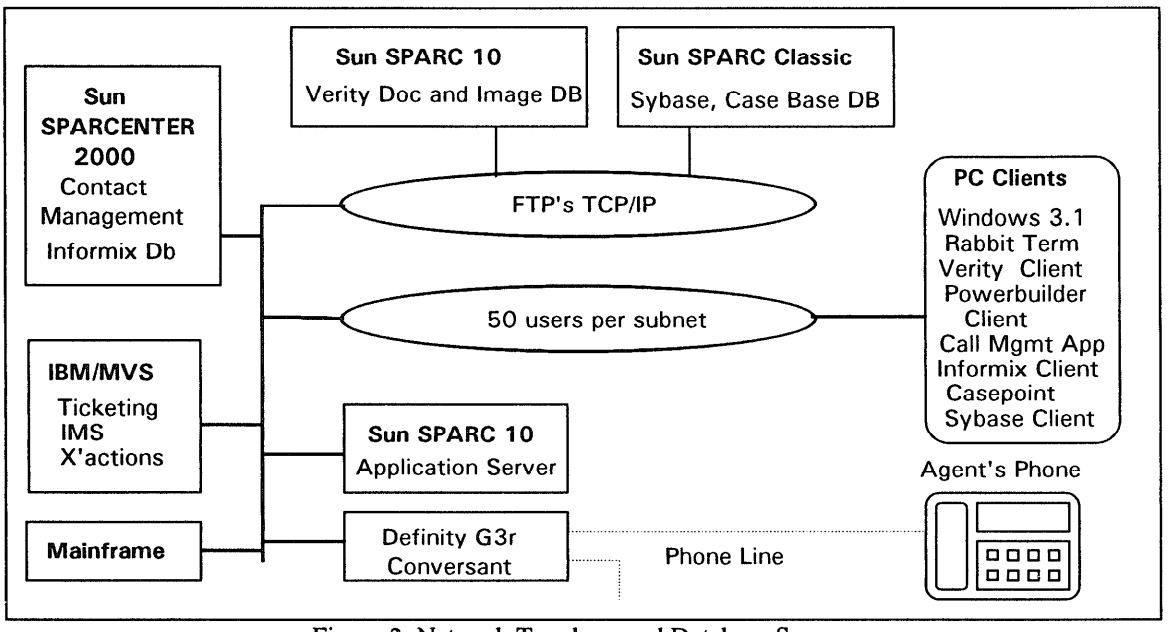

Figure 2. Network Topology and Database Servers

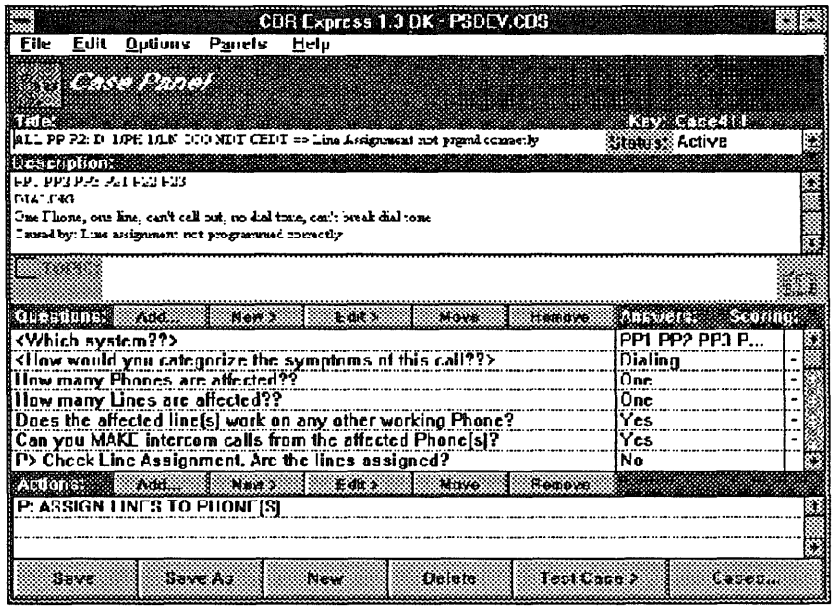

Figure 3. Example diagnostic case

same sub-partitions.

The system must also provide consistent results for both novice and experienced ASRs. The common denominator between experienced and novice agents is the symptoms of the problem. An experienced agent may narrow the problem to several potential causes, where a new agent knows little more than the symptoms until further diagnostic testing has been performed. For example, a customer may call in to report a strange ring when being called. An experienced user may recognize that the customer has Distinctive Ringing turned on, where a newer employee may not, and only know about the strange ring symptom. Consistency of the case base was a major driving factor in the design of the Trouble Shooter.

The diagnostic actions and information provided by the case base have been augmented by a tight coupling between the Trouble Shooter and the on-line documentation text and graphics retrieval engine. Rather than duplicate the information provided in the manuals, the actions provide the highlights of the solution and a reference to the detailed textual and graphic information contained in the manuals.

Case base architecture

The primary objective of a case base design is to focus the user toward the applicable case as quickly as possible. The initial focusing question of each case is to determine the type of system the customer owns. The type of system includes a primary product and an optional feature package or module. This question is implemented as essentially a multiple choice question with one or more correct answers since a single case may be valid for a single system, or it may be valid for all systems in the product line. The split in this validity is caused by the available features, programming steps required, and the hardware components available, all affecting the questions in the case. This information was provided automatically from Contact Management to the CBR search engine through Dynamic Data Exchange (DDE) during Trouble Shooter use.

The second focusing question determines the category of the symptoms of the call. The symptom category is also a multiple choice question, with only a single valid answer. The symptom categories and the typical associated symptoms provided by the customer are:

1. Dialing (can't call out, long distance, local calls)
2. Ringing (can't be called, rings constantly)
3. System/Hardware (can't be called and can't call out, totally out of service)
4. Hearing (can't hear, can't be heard)
5. Lights (no lights on the phone or control unit, flashing lights)
6. Features (programming, use and general information)
7. Adjuncts/Accessories (installation, programming and use)

Figure 3 demonstrates an example diagnostic case, while Figure 4 provides and example of an information only case, both shown in CBR Express.

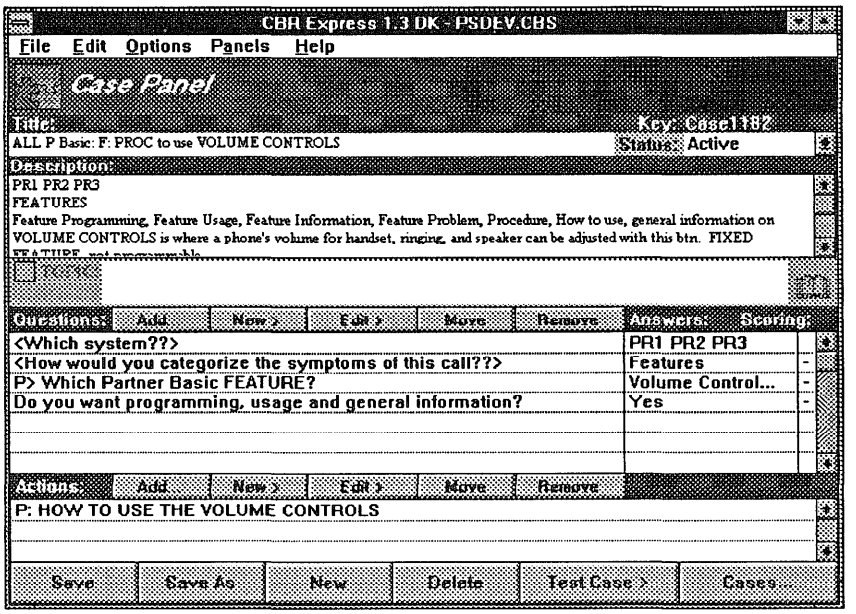

Figure 4. Example information case

Interaction with Problem Detail and On-line Documentation

One of the first components to be deployed provided on-line access to the documentation for the agents numerous manuals through their PC. Initial feedback to this module by ASRs was negative since the query mechanism provided required the agents to enter an exact match with the topic desired, and unless they knew where the information was located the results of a search returned too many matches to be useful. The alternative mechanism provided by Topic, that of handcrafting a Boolean query was equally difficult for the ASRs. Since CBR provided a guided search mechanism in the context of problem resolution exercise, the ASRs recognized that the cases could add value to the text and graphic retrieval engine if the appropriate queries were embedded in the

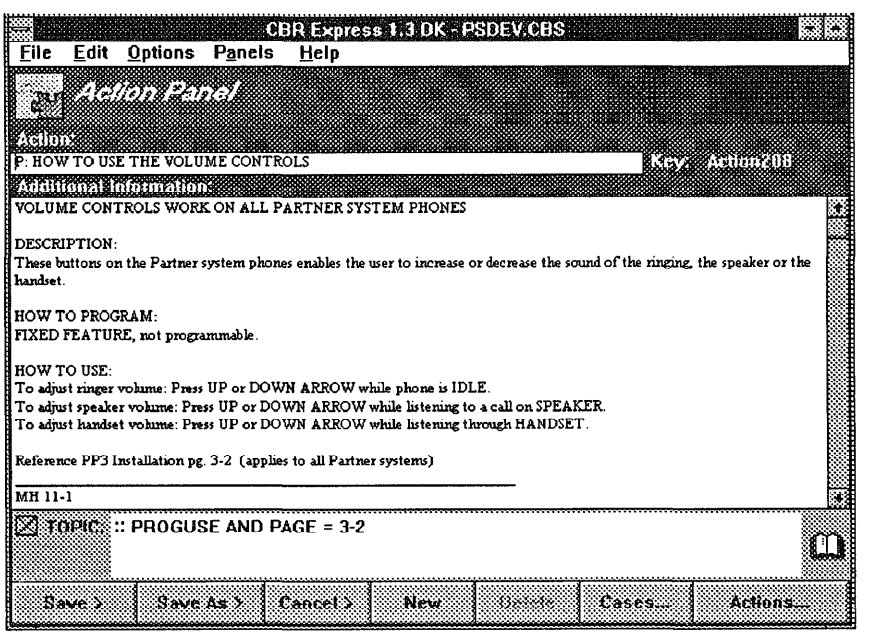

Figure 5. Example case base action with a Topic query

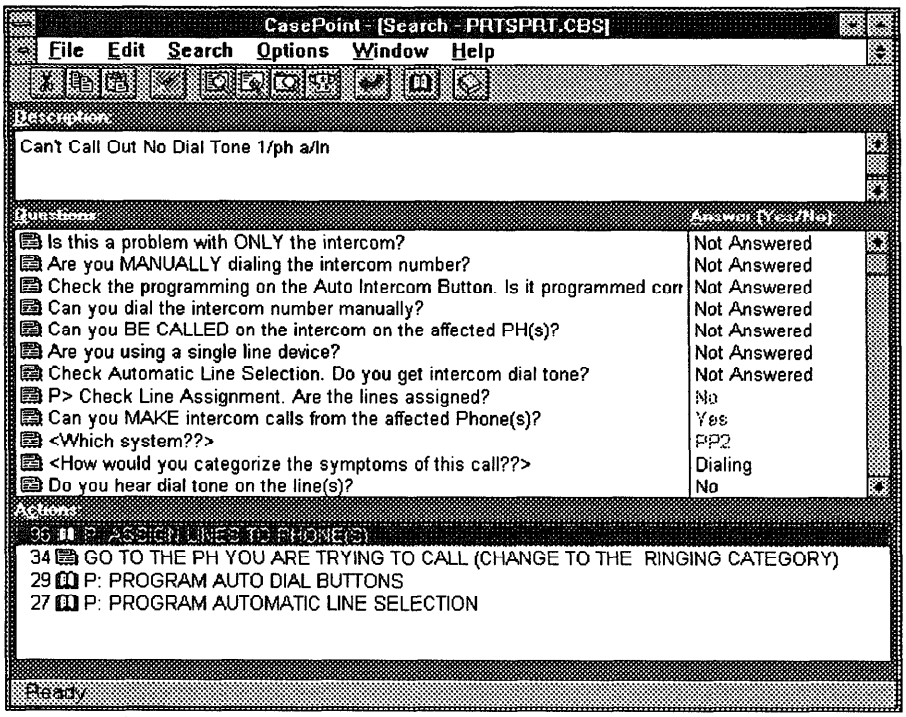

Figure 6. Example with CasePoint showing action to be selected

cases and readily accessible to the users. Therefore, to improve the usability of the on-line documentation text retrieval component, topic queries were added to each of the applicable actions referenced within the cases.

To reduce the number of documents returned from a query, the case base queries were specialized at run time to improve document retrieval results. A symbol was placed at the beginning of the Topic query for the case base to indicate that the string should be preceded with the answer to the case base question: *Which type of System?*

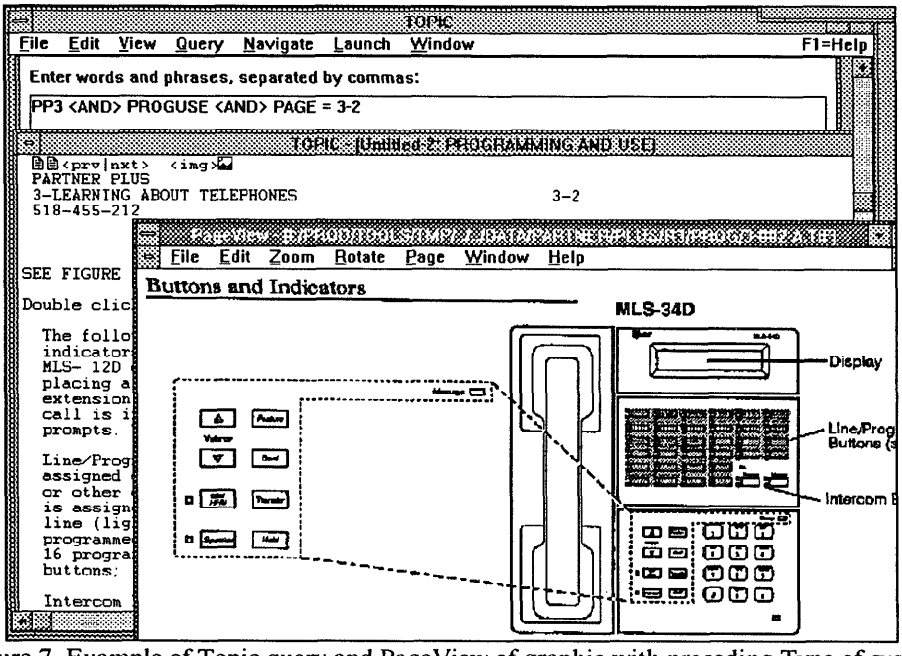

Figure 7. Example of Topic query and PageView of graphic with preceding Type of system

Integration with on-line documentation was a problem since Topic does not support DDE. Verity's solution was to use a Windows Macro to interface with Topic. This was rejected because of the potential instability of using the Macro Recorder. The solution we selected was to use the Windows SendKeys functionality to propagate the query string into Topic.

This integration allowed the agents to review the information in the action, and if necessary, select an icon in the CasePoint icon toolbar to retrieve on-line information in the manuals or examine a diagram of the associated component. If the customer was unable to locate their manuals or did not have a particular supplementary manual available, selected pages could be faxed to the customer through the on-line documentation mechanism. This provided significant value to both the case base and to the text and graphic retrieval application.

Auto-answering of Questions

Automatic question answering was required to satisfy the user's desire to not replicate information provided to Contact Management or previously provided through the description of the symptoms of the problem. A methodology was devised to allow Contact Management to supply question answers through a DDE connection between Contact Management and CasePoint. The questions were answered based on information in the customer's records and items selected in the Contact Management user interface. For example:

If the customer's installation location hardware list includes model : XXXX-YYZ
then

The type of system is: Partner Plus Release 1®

The system also provides auto-answering inferencing rules which reason over the data provided by the user in the form of the problem description or based on previously answered questions. As an example:

If the description includes: Totally out of service
then
The Symptom category is: System/Hardware
The number of affected phones is: ALL
The number of affected lines is: ALL

The combination of these two auto-answering schemes and the CBR capabilities provides the users with very close matching cases and actions based on a minimal input, and focuses the user's search by answering related questions determined from the description input by the user and the answers to other questions. This significantly streamlines the problem resolution process, providing customers faster response with reduced errors.

Trouble Shooter Development

Project plan and phases

The Trouble Shooter case base development began in March 1993, with a detailed scope analysis to determine the size, complexity and structure of the case base. This was followed by a detailed design to specify the following:

- Programmatic interfaces to Contact Management
- Programmatic interface to on-line documentation and the effects on the case base design
- Define explicit protocols and flow of information for intermodule communication
- Detailed design of customizations required and impacts on other system components

Coinciding with this phase, the case base design was developed, including a prototype demonstration, and a determination of CBR Express question scoring methods and a definition of all focusing and partitioning questions.

Case base implementation began in June 1993. The Merlin product line case base was the first to be developed, with initial deployment to a test group of ten agents beginning in August. After reviewing the results of the trial period, the case base was refined and an additional ten agents were added to the test group. Deployment to the Merlin product line support group began in September. Development of the Partner/Spirit product line case base began in October 1993, with deployment beginning in December.

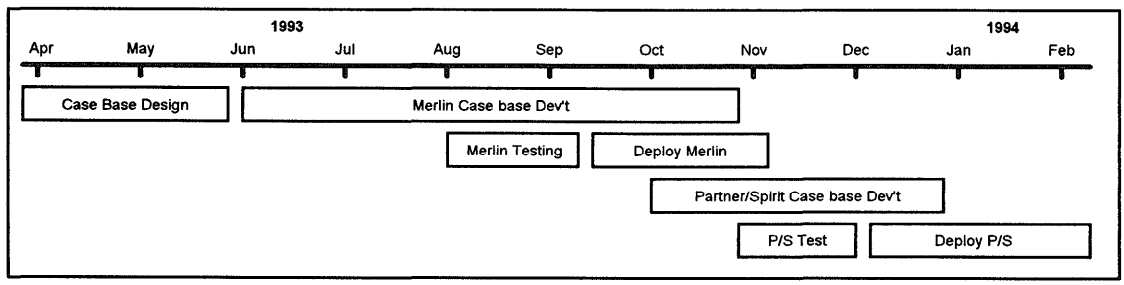

Figure 8. Project Development Timeline

Development effort

The Merlin case base was developed using one knowledge engineer, two case base specialists, three Subject Matter Expert (SME) ASRs and two engineers working on the case base part-time. The Partner/Spirit case base was developed using one knowledge engineer, one case base specialist, three SME ASRs and the same two engineers. In addition to the above resources, there was one systems engineer to configure the database, make the required program modifications and develop the interface to the other ESP components, and one project manager.

Development process

The initial phase of the project involved determining the scope and generating the initial design and structure of the case bases. This was accomplished together with the SMEs and engineers by collecting case documentation forms completed by selected, experienced ASRs on the hot-line and identifying the high level domain segmentation. Using this partitioning scheme, we built an initial demonstration case base of about one hundred cases to evaluate the structure.

After analyzing the initial case base, the formalized case base high level design was completed. The first draft of the case base style guide was then developed. The style guide is an evolving document, constantly changing to reflect modifications to the case base structure and procedures required to develop the cases, actions and questions. A training class was held to teach the process of case building to the ASRs involved in developing the case bases.

The initial design was based on the experiences with the Compaq SMART system (Acorn & Walden, 1992), developed for Compaq's Customer Support Center, and QuickSource (Nguyen, Czerwinski and Lee, 1993) an electronic information system for Compaq's line of networked printers. Innovative extensions to the design of these applications were necessary due to the requirement of a integrated information and problem diagnostic case base with very complicated diagnosis procedures. These procedures were implemented in the form of sophisticated cases and were provided to the users through the same mechanism as the information-only cases. The design was also extended with an integration with the on-line text and graphic retrieval mechanism, providing users with reference pages from their manuals or supporting documents through the click of a button.

How cases were built and validated

The *information cases* were developed first, since their structure was very shallow and consistent. The extensive knowledge of the ASR SMEs was used to develop the information contained in the actions which are provided as a resolution is selected by the users during operation of the Trouble Shooter. This was augmented with information contained in the text and graphic retrieval on-line documentation tool, through the tight integration between CasePoint and Topic as described earlier.

The *diagnostic cases* were more difficult to develop. The rigorous diagnostic steps necessary to resolve complicated problems had to be combined with a methodology of associative retrieval, which allows actions to be presented to users which are accurate, complete and coincide with the considerable variation in the description of the problem as presented by the customer. This was achieved using several techniques. The first decision was to base the design of the cases on the symptoms of the problem as provided by the customer. This ensured that the case base provided consistent results and was equally usable by novice and experienced users since the symptoms are always the same for both classes of users.

The next technique of focusing the symptom of the calls was to integrate the Trouble Shooter with the Contact Management application, providing pre-answered questions and allowing the user to select from of a list of the most common symptom descriptions. As seen in Figures 10 and 11, the initial focusing questions are answered in the Problem Detail window of CM, and this information is transferred to CasePoint through DDE. Combined with the auto-answering rules developed, the user is well on their way to a resolution to the problem while gathering general information from the customer.

The initial prototype case base was developed mostly one or several cases at a time, with small groups of knowledge engineers and ASRs, and the cases were then reviewed by the engineers. As the case base grew, it became difficult for the case builders to determine precisely where to add new cases, and laborious for the engineers to comprehend the interaction between cases and symptom categories as they were reviewing the cases built. A methodology was developed to improve the process of building a case base of this size, complexity, and interrelationship between symptoms and causes, while retaining the benefits of CBR technology. The third technique developed, which is a tremendous assistance in developing and maintaining these large case bases is the concept of templating the cells of cases. Templating refers to a drawing technique which takes subdomains or cells and draws them to show the interrelationship among cases and shared questions and actions.

The benefits of using the templating technique were seen immediately. The templating process:

1. Is readily understandable to ASRs and engineers
2. Graphically shows interrelationships among cases

3. Easily identifies "holes" in case coverage for diagnostic cases

4. Minimizes the case base development and maintenance effort

As the templating process began, a list of valid questions and actions to be used in the diagnostic cases was developed. The ASRs used their extensive knowledge to document additional information for these questions and actions. The templates were developed in working sessions with the ASRs, engineers and the Inference knowledge engineers and case building specialists. Each specific symptom category was addressed, and the potential causes of those symptoms were identified. From the causes, the questions and actions were identified which would confirm and solve the problem respectively. During the templating sessions and unresolved case review, new questions and actions were developed and released as necessary. Cases were then generated from the templates and added to the case base.

The templating process allows the case builders to develop a directed acyclical graph (DAG) of the decision process. For example, a common solution technique used in the diagnosis process is performed. Based on the outcome of this test the diagnosis can go in multiple directions. This diagnostic procedure, performed using several questions as shown in Figure 9, and the diagnosis which follows, may be performed at any step in diagnosing the problem, and depends on the symptoms of the call and conditions such as the number of lines or phones affected. Templating also allows the case base developer to utilize the same answer to a question to follow multiple paths since specific state information is contained in the templates. CBR technology allows us to have cases which utilize this procedure, with variations appropriate to the description of the problem. Associative retrieval providing flexible, guided search is still used.

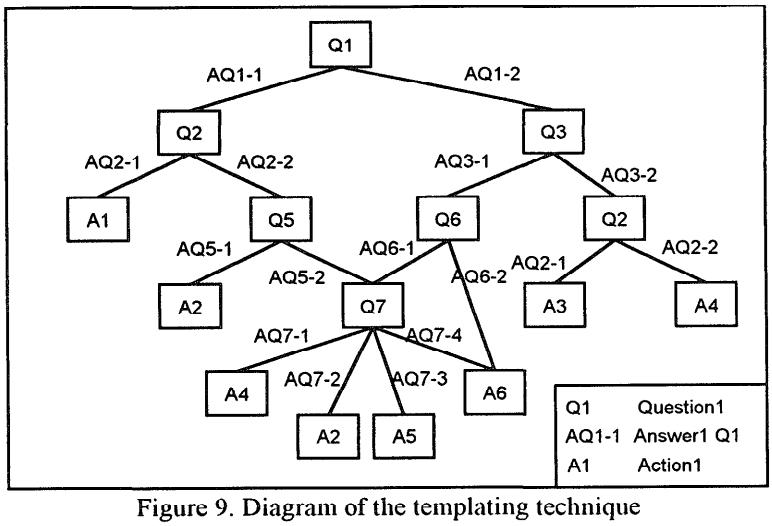

Figure 9. Diagram of the templating technique

The templating technique also streamlined the review process with the engineers since they were very active in the development of the templates. The cases to be reviewed were built from the templates. This caused case development productivity to significantly increase. The Merlin case base development team reconstruct the majority of the diagnostic case base in several weeks once the templates, questions and actions had been developed. There was also minimal rework of cases to get consistency with the entire case base, and case accuracy and coverage were improved. This significantly improved user acceptance of the case base, which was in the initial stages of usability testing.

Templating was developed as a visualization tool primarily for the diagnostic cases and is fully compatible with the informational type cases. It has been used to display the unresolved cases and determine a relationship or clustering of problems not found in the case base. This helps to automate the process of resolving cases and extend the knowledge contained in the case base. Utilizing a graphical templating tool, a case base developer could:

- Analyze cells for coverage, number of cases, questions, etc.
- Visualize the case interactions and view the relationship to unresolved cases.
- Restructure existing case bases based on the information within the case base and based on run-time information
- Insert, remove and reorder questions in the existing cases or add or remove cases
- Learn case base structure and enforce consistency

Deployment process

The Merlin product line case base was the first to be deployed, with usability testing beginning in August, 1993. After reviewing the results of the trial period, the case base was refined and full deployment to the Merlin product line support group began in September. The users had previously been provided an NCR PC workstation with the 3270 emulator to communicate with the mainframe, and Verity's Topic for on-line documentation. Network connections to the Sun servers was also provided to retrieve the documents. Deployment of the case base to new users involved a short training course on how to use CasePoint to retrieve the diagnostic and informational cases and additional text and graphics contained in the on-line documentation tool which are directly linked to the actions.

As each new application was delivered to the users, the AT&T ITS group placed one or more icons onto the user's Windows desktop

corresponding to the application deployed. This happened automatically when the user started their PC, using a script process developed for this purpose. As users received the Trouble Shooter application, it became available on their desktop using this process, and the appropriate connection to one of the four Sybase case base servers was installed, also through this scripting process. The script allowed the flexibility to connect the user to a backup case base server should one or more servers fail for any reason.

The Merlin case base was deployed to approximately 20 users per week, limited by the ability to take the agents off-line for the training class. The case base is an evolutionary system, being expanded through the maintenance process described in this document.

After the agents have been using the Trouble Shooter, they are given training for, and then begin using the Contact Management application. This group of applications have been tightly integrated to provide call tracking, problem resolution and on-line documentation to the users in a seamless environment.

The Partner/Spirit case base began usability testing in December, to an initial ten users. After reviewing the results of the test period, the Trouble Shooter was deployed to the Partner/Spirit product line support group using the same process as the Merlin group. The case base will be completely deployed to the users in this product group by the end of February, 1994. The Partner/Spirit case base will also be extended with the unresolved and future release cases through the maintenance process.

Trouble Shooter Use and Maintenance

How Trouble Shooter is used

The contact with a customer is initiated when a caller, dialing an 800 number for support, is routed to the appropriate group for their product line. As the call is connected to the ASR's phone, the CTI component will utilize the automatic number identification (ANI) to populate the initial CM screen with the customer's information retrieved from the CM database. As the symptoms of the problem are being acquired through conversation, they are entered into the Problem Detail screen (see Figure 10.) The user then selects **Suggest** to send the data collected to Trouble Shooter through a DDE interface to CasePoint. By selecting the Trouble Shooter icon in CM, CasePoint is activated, and additional questions to determine the solution are provided to the user, as shown in Figure 11.

When the questions have been answered and the case describing the symptoms and problem is determined, the solution is presented in the form of the action to perform to resolve the problem. The action consists of a title, additional information and a Topic query. By double-clicking on the action, a browse window is activated containing the additional information, describing the steps to perform, or programming, use or installation information. The user may also select an icon in the toolbar to activate Topic and send the query to retrieve textual or graphic data contained in the manuals.

When the solution has been transcribed to the customer, the call is completed by collecting the resolution action and code and the problem type and status. The user may

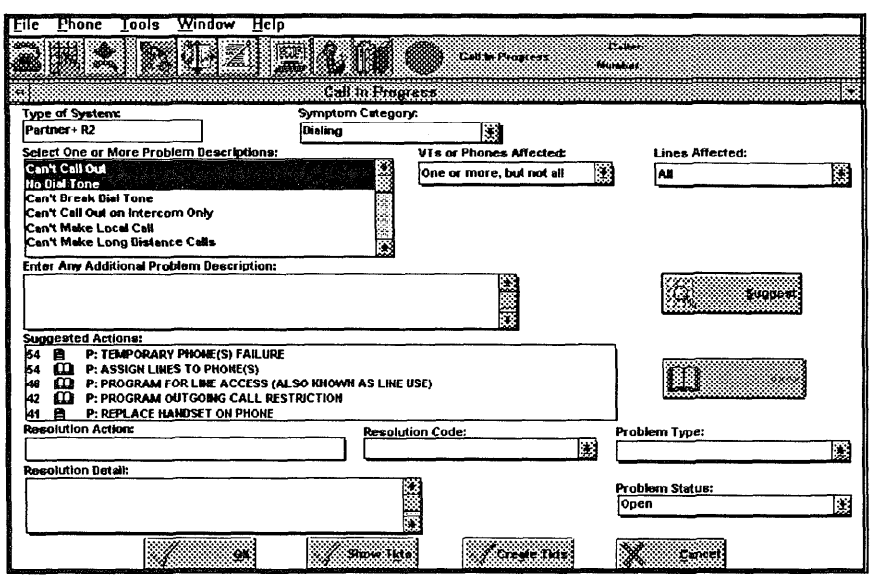

Figure 10. Example CM with the symptom category and problem descriptions selected

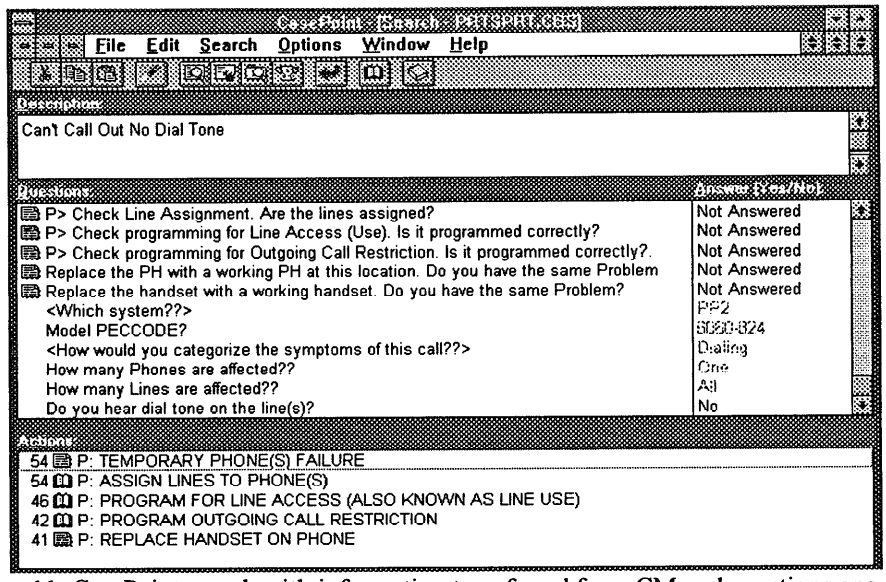

Figure 11. CasePoint search with information transferred from CM and questions answered

also enter detailed information into the resolution detail field. Each of these fields is retained in the CM database to assist customers on future calls, and for analysis through an MIS reporting capability.

Maintenance

The case base is maintained by the Case Base Administrator (CBA), who's function is to ensure that the case base provides the Trouble Shooter information in a form that is accurate, complete and accessible to the end users on the hotline. The CBA's responsibilities also include ensuring that the overall performance of the ESP from the Trouble Shooter perspective is optimal. In addition to making modifications to the existing cases, actions and questions to support this, there are several sources of new cases to extend the case base, including:

- Unresolved cases saved by the users as problems are encountered which were previously not addressed in the case base. These are a result of new causes or symptoms reported by the customer.
- New AT&T product hardware or software release offerings, including information for new features, adjuncts or accessories, and modifications to the problem diagnostics due to the new features and programming available in the new release.

It is the CBA's responsibility to incorporate the unresolved and new product cases into the existing templates. This will help to determine how the cases fit into the current structure of the case base, and allow a smooth integration of the new cases. The CBA is also responsible for maintaining the integration between the actions and questions and the Topic queries which provide the on-line text or graphics describing the solution to the problem.

Integration of technologies

The Trouble Shooter component of the ESP application provides a unique combination of CBR and rule processing technology integrated with a fully functional text and graphic retrieval on-line documentation mechanism and a sophisticated call tracking application. This provides the AT&T customer support agents a seamless environment which streamlines the problem resolution process and improves customer satisfaction. This integration of the ESP components was key to user acceptance, and greatly improves the usefulness and speed of operation of the entire system.

Techniques critical for the development, deployment and maintenance of large case bases have been created and utilized, including the use of graphical templates for building and maintaining the large number of cases. These techniques allowed the case base developers to produce the case bases which combine both informational and problem diagnostic cases into an application that provides consistent results to both novice and experienced agents.

Benefits

To explore the benefits provided by the Trouble Shooter, we can evaluate the benefits in relation to the main objectives as previously stated:

1. Improve agents' response. The repository of information provided by the case bases provides consistent

and accurate diagnostic procedures and information to the customers. The ability to add new cases allows the system to learn additional solutions as they are discovered. Solving the problem correctly the first time eliminates the need for repeat calls. As multiple problems are encountered, a consistent means of diagnosing the problem by each agent significantly improves customer satisfaction.

2. Reduce replacement part costs. The diagnostic procedures have been specifically developed to prevent programming problems from escalating to the replacement of a phone when it is not necessary, and if the hardware is faulty, to determine the lowest cost hardware component to replace to solve the customer's problem.

3. Reduce field service costs. Placing more advanced diagnostic procedures in the hands of the agents reduces the number of unnecessary field service dispatches. Since the problem is determined correctly while on the phone with the customer, a technician dispatch is not needed.

4. Reduce training requirements. The availability of an integrated platform of problem resolution diagnosis, on-line documentation and call tracking and recording reduces the formal training requirements for new employees, and agents moving to new product line support groups. This integrated package has allowed new employees to perform their job with added confidence, since the case base provides the steps necessary, or the information desired, to solve the customer's problems. Trouble Shooter also allows the NSAC support groups to perform load balancing across the product lines supported.

Summary

Through the use of CBR and rule processing technology, two case bases have been developed to support the Merlin and Partner/Spirit product lines. Through a close union with a text and graphic retrieval mechanism and an event-based call tracking application, the AT&T associates have been provided the tools necessary to significantly improve customer support operations at the GBCS NSAC, enhancing the ability to support new products and improve overall customer service quality.

The extensive repository of problem resolution knowledge provides the associates with consistent and accurate results more quickly, without resorting to an escalation of the problem. Once a problem has been resolved, it can be added to the case base and will become available to all users. As new product offerings are made available, such as a new voice mail capability, the CBA along with the subject matter experts, can develop the necessary cases to support the information and diagnostic calls related to the product without providing training to each agent.

Innovative techniques, such as the graphical templating of the decision process undertaken to diagnose the problem, have been developed to construct these large case bases, providing a seamless means of extracting the appropriate case based on a considerably varied description of the problem.

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