

Université de Montréal

IIS: An Intelligent Interaction System that provides e-service, based on
interaction and case-based reasoning

par

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Université de Montréal
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Ce mémoire intitulé :
IIS: An Intelligent Interaction System that provides e-service, based on
interaction and case-based reasoning

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Résumé

Le changement rapide de la relation qui lie le consommateur au commerce a poussé la plupart des compagnies à dépendre de plus en plus de la technologie pour réduire leurs prix et améliorer leur performance. Par conséquent, la majorité des compagnies ont recours au service électronique pour introduire leurs produits ou services sur le marché ou pour offrir une assistance directe à leur clientèle à travers le web.

Le service électronique constitue l'ensemble des services fournis aux consommateurs par l'intermédiaire du web. Ainsi, les compagnies concernées par le service du consommateur peuvent collaborer et partager les connaissances et les documents à travers ce service électronique et peut de même faire du commerce et conclure des accords. De plus, l'amélioration des options du service électronique se reflètera dans l'amélioration des moyens de communication, et permettra de ce fait d'atteindre les consommateurs partout et à n'importe quel moment de manière rapide et efficace. Cependant, les nouveaux utilisateurs travaillant pour la première fois sur un site électronique multidisciplinaire non organisé ou vaste peuvent s'y perdre.

Ce présent mémoire introduira l'utilisation intelligente du service électronique pour assister les compagnies qui offrent ce genre de service. Ce projet fournira principalement des explications concernant les services de facturation, une correction automatique des erreurs de facturation, une remise à jour électronique régulière et des informations générales concernant les services fournis aux membres. Le service fourni par notre projet se traduit par l'accès à l'internet à travers le service de télétraitement ou le service à grande vitesse. Il utilisera le raisonnement à base de cas dans la correction des erreurs relatives aux factures en ayant recours à des démarches de correction qui ont été antérieurement utilisées dans des cas similaires ou en ayant recours à l'interaction entre les membres pour résoudre les nouveaux cas. Toutes ces interactions sont contrôlées et traitées à travers le système sans l'intervention d'un opérateur.

Mots Clés : service électronique, facturation sur le site internet, interaction intelligente, réduire le coût du soutien, raisonnement à base de cas

Abstract

The fast changing environment of customer-business relations has increased the dependency on intelligence technology by most companies to reduce costs and enhance performance. The majority of the companies are depending on e-service to introduce their products/services or assist their customers directly via the web.

E-service is the connection of many services provided electronically via the web. Through e-service, companies and customers can now collaborate, share documents and knowledge, as well as trade and close deals directly via the World Wide Web. Furthermore, improving e-service options reflect improvement in communications, and thus reach customers anywhere anytime in a fast and accurate way. However, working with an unorganized or huge multi-service web site can be very confusing for first time users.

This thesis introduces the use of intelligent interaction to provide support and help to any company that offers online billing and services updates. The project provides mainly online billing explanations, automatic correction of billing errors, online updates and general information on member accounts and services. Thus, it reduces the inbound calls of the company call centers. The service in our project is internet access through dial up or high-speed service. The application uses Case-Based Reasoning (CBR) in correcting bill errors by applying predefined correction steps for similar error cases or using member interaction in case of new ones. All these interactions are monitored and processed through the system without any operator involvement.

Keywords: E-service, online billing, intelligent interaction, reduce customer support costs, Case-Based Reasoning

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Chapter 1

CHAPTER 1: INTRODUCTION

An e-service is a service available via the Internet that completes tasks, solves problems, or conducts transactions. E-service provides a new business approach for organizations operating in an electronic environment. E-service has helped many companies meet/exceed customer expectations. With the help of e-service now, profitability is based on revenues driven by enhanced customer service and higher levels of customer satisfaction [16]. The approach of customer service has evolved remarkably during the last several years to make the customer experience exceptional. Now, services are provided through many electronic approaches like e-mail, text chat, internet telephony, and web self-service or, in other word e-service.

So, many companies rely on web self-service in order to offer a feasible communication channel to their members. The companies attract their clients to their web site for a one-time stop. Clients can order, view, track their orders or can access, update and retrieve their account information. One important feature that companies are offering to its clientele is online billing where members can open their monthly bill online and view it in detail. Even though members can view their bills online, we still face many opportunities where members are not able to perform online, like billing correction. The best thing to do would be to initiate an assistance -- *Intelligent Interaction Software (IIS)*, to provide online billing correction and additional features. This thesis is concerned with those online opportunities and features.

The IIS will rely on *Case-Based Reasoning (CBR)* [2] when correcting billing errors. The CBR technique is to use the solution of a problem that has been solved previously and apply it to a new problem. The detailed procedures of the CBR will be discussed in this thesis.

1.1 Problem Statement

Providing online billing or electronic billing has become necessary for many companies to enhance revenues by reducing costs related to sending paper bills. Members can simply log in online to their accounts, access, retrieve, update their information and simply view their bill online. However, many features like online billing corrections are still missing. One problem with online billing is that no automatic correction option is available. In other words, members have to call the company customer service and ask for a billing explanation or correction. Even though this feature can be developed and added to current online systems to diversify members' options from contacting customer service representative in order to correct the error. For example, many companies offer the option for the members to view their bills online or receive them by email. However, members can only view and pay their bills online without any billing correction option in case of billing errors that the system can validate and correct automatically with member help and interaction.

Here are the market solutions that are currently available:

1. Viewing the bill online through the company site or receiving it by email depending on members' request.
2. Traditional contact to report billing errors like email, text chat, phone calls, and internet telephony with human interaction all the time.
3. A frequently asked questions (FAQ) section on the company web site to assist members to understand their bills.

The principle problems that this thesis subject presents are:

1. Current online billing tools offer a standard format of the bill with no personalized interaction with the member.
2. There is no automatic billing correction option for the member to report billing errors even though he is able to perform most of the basic operations.
3. Current correction techniques do not work in real time since the member has to call the customer service representative back if it is not within their operation hours.

4. Current billing explanations are static and not personalized according to member services or customer service standards.

1.2 Objectives & Scope of this Thesis

The objective of this thesis is to present the Intelligent Interaction Software to assist members to understand and correct their online bills through a unique intelligent interactive approach. The billing represents the services provided by internet service providers in general, like high speed service or computer protection software. The research also discusses the different trends of e-services today and the new personalized interaction approach that we are proposing. Our work is based on the use of Case-Based Reasoning in the IIS prototype for billing correction. The IIS answers members' concerns in general and in particular the billing aspects, and acts as any regular customer service representative in a call center. Our goal is not to eliminate the need for call centers but rather to minimize the inbound calls handled by the center using an online intelligent interaction approach and thus reduce the costs attached to it. The member can simply interact with the system and report a billing error. The system verifies the bill, validates the error and reacts accordingly. If valid, the IIS corrects the error and informs the member.

This thesis will focus on the following solutions that we are intending to produce:

- 1- Analysis of the e-service approaches in general, and particularly in the companies that offers online billing or electronic bill, in order to illustrate the new interaction technique to help the members using the self-service.
- 2- Develop the IIS prototype in order to illustrate its interactive approach that provides personalized billing explanations based on human interaction in dynamic content required in e-service.
- 3- Real time billing correction for the members with valid billing errors.
- 4- Reduce calls to company call centers by redirecting the member to a self-service web site, thus reducing associated calling costs and enhancing revenues.

- 5- Adopt CBR technology for billing corrections, which is focused on case representation, indexing, similarity measures, case retrieval and adaptation.

A further analysis of the human aspect will be dealt with through the system using a combination of techniques to clearly understand users' queries and proceed with the appropriate steps to answer them. A breakdown of the online procedures and trends is also implemented in the research in order to explain the customer service approach used. Analysis of call processes and best practices are discussed in detail to add a human aspect to the IIS application. Adopting this approach contributes to the prototype success and encourages members to interact with it as they do with real representatives. Despite this tremendous e-service growth, many people remain reluctant to complete a web transaction without first talking to a live agent.

1.3 Organization of this Thesis

The content of this thesis is organized as follows:

Chapter 2 gives a general and brief description of customer service; it illustrates the importance of keeping the human aspect in mind while developing the IIS. It also emphasizes the importance of providing personalized customer service to encourage the use of such a technique. A Comparison between the IIS prototype and other contact alternatives like email are given to reflect its characteristics.

Chapter 3 consists of a literature review of current market e-services approaches and CBR; it also shows examples of e-service solution software and online billing provided by different companies. The examples present current online billing features and their underlying techniques that can use intelligent interaction to complement their existing systems.

The IIS management approach and its effect on the company, before and after applying it, are discussed in chapter 4. The chapter also discusses the call process, its steps, the way it is developed and shows a few examples on call processes to

compare it with traditional online services. In addition, an illustration of the bill structure is presented with all its elements, in order to demonstrate how the IIS explains the bill to the member.

Chapter 5 describes CBR procedure and features used in problem solving; it also describes the system architecture and the CBR algorithm used for billing correction. The intelligent and non-intelligent phases are also described in full. Also, the case representation, similarity measure, case retrieval, indexing and adaptation are presented in this chapter.

Chapter 6 presents the Intelligent Interactive Software, and describes how the prototype works. We introduce its features like menus, windows and how it operates. The chapter illustrates a billing example where the application shows the billing explanation and the correction of errors in detail.

Chapter 7 describes the experiment used to evaluate the IIS prototype and discusses the results according to many aspects that satisfy member and company needs. The results were based on the collection of the users' feedback. Also, the chapter illustrates the experiment phases and the different groups who participated in experiment.

Finally, chapter 8 concludes with a review of the IIS features and the contribution of our work. It discusses future work and continuous improvements that can be added to the IIS with a reminder of the restrictions.

Chapter 2

CHAPTER 2: CUSTOMER SERVICE

In today's definition, effective customer service is about finding the right answers for customers in a satisfactory and swift manner. The way the information is stored, structured and organized determines how effective customer service efforts will be. Customer service is part of an approach known as customer relationship management, or CRM. CRM is an approach that recognizes customers as the core of the business, and that a company's success depends on effectively managing their relationship with the customers [22]. This chapter emphasizes the importance of having excellent customer service in mind while developing an e-service application.

2.1 Knowledgebase & E-service

Knowledgebase is a structured, connected collection of information. The optimal knowledgebase, for an e-service application, would be one that allows the users to interact in a flexible environment, access required information in a faster way, improve the level of service, and decrease the customer service representative's workload and tasks and thus reduce costs [U01]. Furthermore, the open and free competition in the markets in addition to the changing environment empowered customers to become any organization's best assets. An effective internet interactive knowledgebase enables customers to find the answers to their own queries via a company web site, specially once an effective and efficient interaction exists to assist users with their queries and solve their billing issues in a fast and more reliable way. This will minimize the number of phone calls made to the call centers since members can find their answers on the company site.

Here are some of the advantages of applying e-service with an optimal knowledgebase [18].

Increased service capabilities – directing questions to an interactive knowledgebase would help free more resources and make it available to handle complicated customer inquiries requiring human involvement.

Decreased inbound calls / text chat / e-mails – decreasing the number of incoming calls / text chat / e-mails not only allows the customer service representatives to give more attention to unique customer issues, but it also means that your customers are finding answers to their questions on your web site.

Increased customer satisfaction – customers get answers faster and without waiting in queue for a live agent to assist them, which will enhance certain aspects of customer values indexes.

Reduced operating costs - a simple financial analysis shows that the cost of delivering intelligence interactions service on the internet is significantly less than a human answering e-mails, text chat or phone calls.

2.2 Human Aspect / Technology Relationship

E-service is a practical and logical extension of existing customer service approaches. It provides focus and meaningful direction for many users. Still the challenge remains to overcome users' fears and confusion from using modern applications [6]. Many books discuss how to use information technology to get closer to the customer, and how to make money through an excellent level of online customer service, yet many companies have been blind for not applying it. Companies that manage to have exceptional customer service through their web site will attract more customers and thus improve their sales and revenues. However, several articles show very few companies have really taken advantage of effective customer service on their sites. So, firms should focus on providing added value to customers rather than up-sell or cross-sell him additional products. Most companies' e-service is a list of FAQs that they post on their web sites. Visitors go on your site when they need general and

specific information about services and/or products. Many FAQs are very static, which is even more confusing for first time users who have no cross-referencing abilities. The questions and answers are just listed regardless of its order of importance. Customers request exceptional customer service, so companies must try to understand customer intentions and objectives at the site in order to develop them into technology choices and mechanisms that support them. This enhances member's experience accessing sites and helps enterprises to operate globally and reach its customers anywhere, anytime as illustrated in figure 2.1, due to E-service applications.

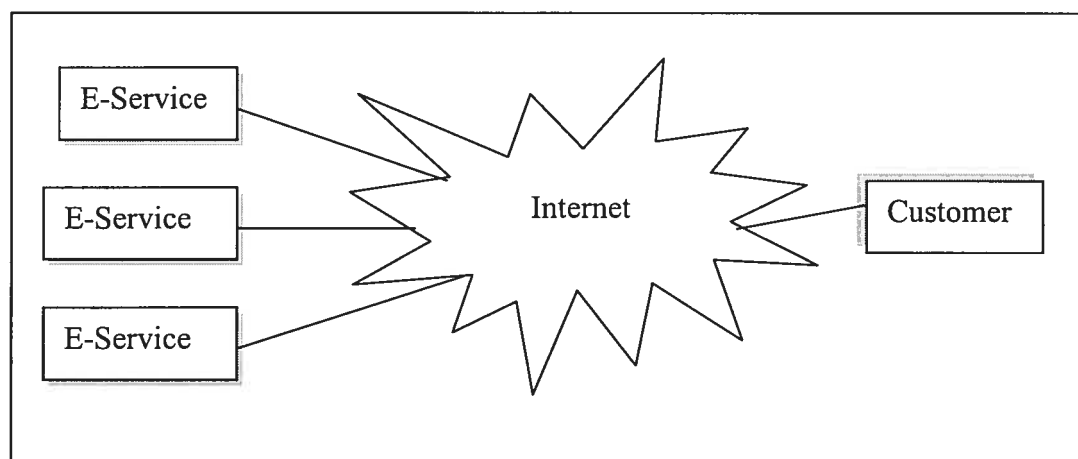


Figure 2.1 - E-service Accessibility

E-service is a combination of highly integrated technology and service. Each database query triggered by the customers is a gold mine of integrated data [5]. So, to achieve excellent customer service we need to keep the human aspect in mind while developing an application. A good example of a more developed approach would be Webhelp [U02]; this company has developed a personalized customer service. They offer help regarding any subject through direct online chatting with their members. Still, human interaction is needed at all times which makes the response time depend on the number of representatives available to take online chats. In other words, the response time will be high when the number of representatives is low. As already

mentioned, their service still requires the presence of a human being at all times; something that a complete intelligent interaction application would solve. E-service is exactly the missing link for companies with online services. E-service helps companies maintain its customers and serve them with minimum human interaction and maximum independent electronic contact.

The human aspect of the e-service application is very important for its success. In general, members prefer to speak to live customer service representatives instead of finding the information themselves on the company site or before completing an online transaction. This can be due to their limited computer skills, answers on the net are not very clear and self-explanatory enough, or simply because they want a real person to serve them. Members expect online applications to find their queries in a faster, effective and reliable way; otherwise, they prefer to use the traditional way; even if the latter is more time consuming due to the wait in the queue for the next representative and more frustrating. Using the traditional method, members have to go through Interactive Voice Response (IVR) system to reach customer representatives [U14], which is the member's major complaint. In general, IVR are confusing due to various factors like: different unnecessary available options, advertisement of new products, need for member interaction all the time, and waiting in queue to be answered; and during peak hours this could take several minutes.

Being served by a customer service representative online trigger security and privacy concerns for many members. For example, many members feel uncomfortable when representatives view their billing information, promotion, or personal information. So, security and privacy concerns have a critical impact on the consumer's perceived control in online situations, which in turn determines the consumer's perceived e-service quality [26]. The IIS respects member confidentiality and privacy due to the fact that only members can access their account information, and first line agents do not monitor the interaction. In other words, the IIS is a simple computer software with no bad intention to steal or abuse member personal information.

2.3 Personalized Service

Breaking down current call center processes and identifying the best practices help in the design and creation of personalized service in the IIS. Our proposed prototype acts similar to live agents in any call center by assisting members in their billing and general questions. Customer representatives follow call guidelines to help them finish the call in a successful and satisfactory way. Call guidelines are adopted in most call centres, which offer support for their customers in order to ensure member satisfaction. The IIS reproduces similar guidelines and applies them through its interaction with the members in a customized creative way. A full description of these guidelines and steps will be discussed in chapter 4.

If we take a closer look at the procedures that covers organization mission processes, and customer service representatives; many call steps include the attributes for each category of serving their members and clarifying questions asked and providing answers about the call process. This would help the application to provide a consistent, flexible and reliable service. This application opens a connection to retrieve member information from the database, provides billing explanations to the members, corrects billing defects if required, updates the database if needed and closes the connection. So it provides personalized services to the members. Once the members log in to the system, the prototype assesses their profiles and analyzes it. It views the members' history file to check his service, and additional services to verify any opportunities to up-sell or cross-sell-him. For example, IIS verifies if the member has regular speed and offers high speed, or if the member never tried the company's antivirus feature, the system offers him a one month free trial. This process is presented to the member in a creative, fast and real time manner.

Using e-service, members can avoid delayed responses like e-mails, agent call back and get answers and actions right away. The IIS application is available twenty-four hours a day, seven days a week for the members to access it, in contrast to live agents in many companies who are only available during business hours. In addition, the response time to members' queries will significantly improve with the e-service

application. It requires less time to find, analyse, process and present the information than real agents do, since it uses the case-based reasoning to validate and correct member billing.

The comparison among the IIS and other contact alternatives is summarized in table 2.1, to reflect members' concern and companies' objectives with respect to response time, privacy concerns and operating costs.

Table 2.1 - Comparison between the IIS and other contact alternatives

	E-mail	Text Chat	Agent callback	Internet telephony	IIS
Real-time	No	Yes	No	Yes	Yes
Privacy concern	Yes	Yes	Yes	Yes	No
Reduce cost	No	No	No	No	Yes

2.4 Conclusion

This chapter reviewed customer service in general and the importance of introducing the human aspect in the IIS application to ensure its success. The human aspect is discussed to elaborate its importance for the success of the prototype. It also emphasized the importance of keeping in mind that the IIS provides exceptional customer service similar to real agents but in a faster and more reliable way. The chapter also touched the privacy concerns of such system. Members want a secure and private interaction with the application. E-service advantages were also discussed and compared to other contacts alternatives like e-mails and text chat, in order to show its effects on performance and costs.

Chapter 3

CHAPTER 3: E-SERVICE & CBR STATE OF ART

As businesses' objectives and approaches differ according to products and services, firms try to attract customer through different e-services styles. All successful e-services approaches play a very important role in transforming the customer experience from a static functional experience to emotionally enhanced interaction behaviour [15]. In order to accomplish this transition, e-service providers need to address rational and irrational customers concerns regarding the adoption of new e-services that replace traditional processes [8]. The following chapter discusses e-service approaches and its uses, examples of the e-service solutions offered by companies in general, current market online billing approaches, the technologies used and Case-Based reasoning.

3.1 Current E-service Approaches

Searching the web and documentations on companies uses and approaches to e-service, shows a variety of styles and methods to assist users with the best services. To make customer-focused e-service successful, it is necessary to take several actions [22]. Many companies are using the e-service concepts to assist them to reach their customers anywhere. Many e-service approaches have been evolved through out the years with the evolvement of technology. So, understanding those trends will assist in understanding current approaches in order to compare it with what we are proposing in our project. The current e-service approaches vary with the companies' objectives and services as illustrated hereunder:

- *Deliver personalized service* such as Globeinvestorgold site [U03], where the company approaches users, in a unique way, to provide personalized services. Members can create their stock profiles according to their needs and interests. Members can manipulate their portfolios online and instant alert messages according

to the member choice. The service provided, varies from user to user depending on member profile, as illustrated in Figure 3.1. The interactions with members enable the company to build customer loyalty since customers receive excellent services and thus, it increases customer satisfaction and the business grow. The members are able to subscribe online for the service with a fourteen-day free trial. The member is not able to view his bill online and the application uses no-intelligent interaction at all. The service provided is based on collecting information from the member when subscribing to the service and creating his profile. The e-service offered is based on information retrieval from the company database.



Figure 3.1 - Screen shot of GlobeinvestorGold site

- *Target the right customer;* such as National site [U04] since it focuses on its specific technology market niche. The company is a pioneer in analog-based semiconductor products, which include stand-alone devices and subsystems in the areas of power management, imaging, display drivers, audio, amplifiers and data conversion, as illustrated in Figure 3.2. The company targets key markets such as

wireless, displays, information infrastructure and a broad range of portable applications. The company site allows new users and member to search for their products directly online and check the product specification. The site contains a lot of information and it is very well organized for first time users. For example, the orders can be tracked so members can verify the status of their products online.

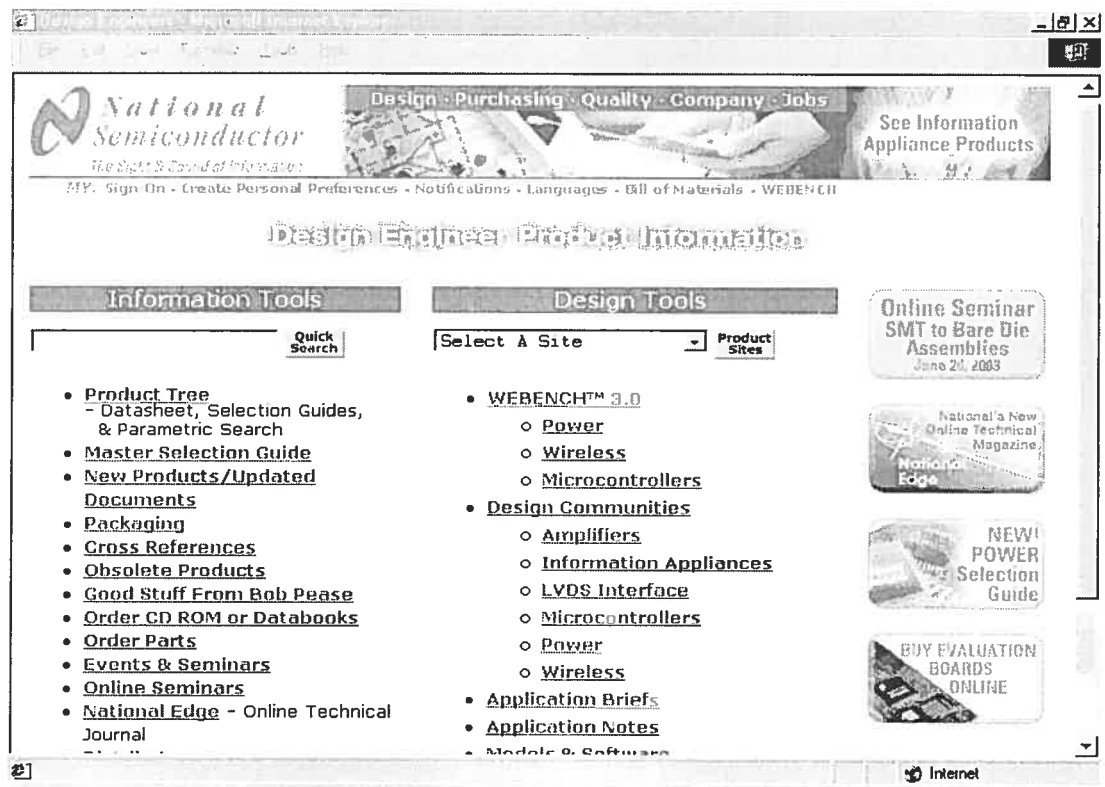


Figure 3.2 - Screen shot of National site

- *Assist in job or goal* such as Canadapost [U05]; Canada Post is a world leader, providing innovative physical and electronic delivery solutions, creating value for its customers and new ways to communicate that are bold, innovative and effective. For example, it can assist their employees and users to track their packages any time from anywhere, as illustrated in Figure 3.3. The e-services provided on the sites are simple and basic. The member can track their packages, search for a postal code or find an outlet location. However, there is no intelligent interaction or personalized service according to member profile. The member has no guidance on

how to use the site. The approach used in developing the site is based on information retrieval where member enter the tracking code and the system displays the tracking information with the status of the delivery. Member can not interact with the system in any intelligent way at all.

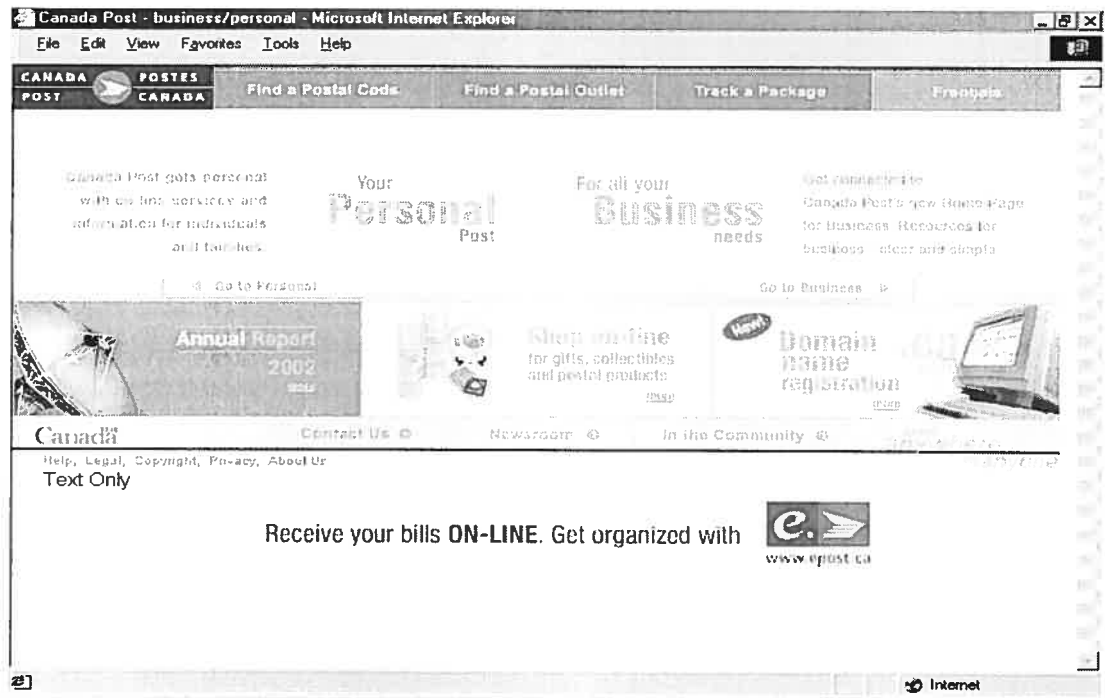


Figure 3.3 - Screen shot of Canadapost site

- *Self-services* like Iprint e [U06], where the sites give you the freedom to select, design, or modify existing template products according to your needs and tastes, as illustrated in Figure 3.4. The application personalizes the process and involves in the production steps. The self-services approach requires your interaction with the site in order for you to complete the design and the order of the products. The self-service approach involves the member in the process. The interaction part of the application is very effective. For example, members can use samples can use to help him recommend or design the product. The site relies on member interaction and available samples that member can view and use.

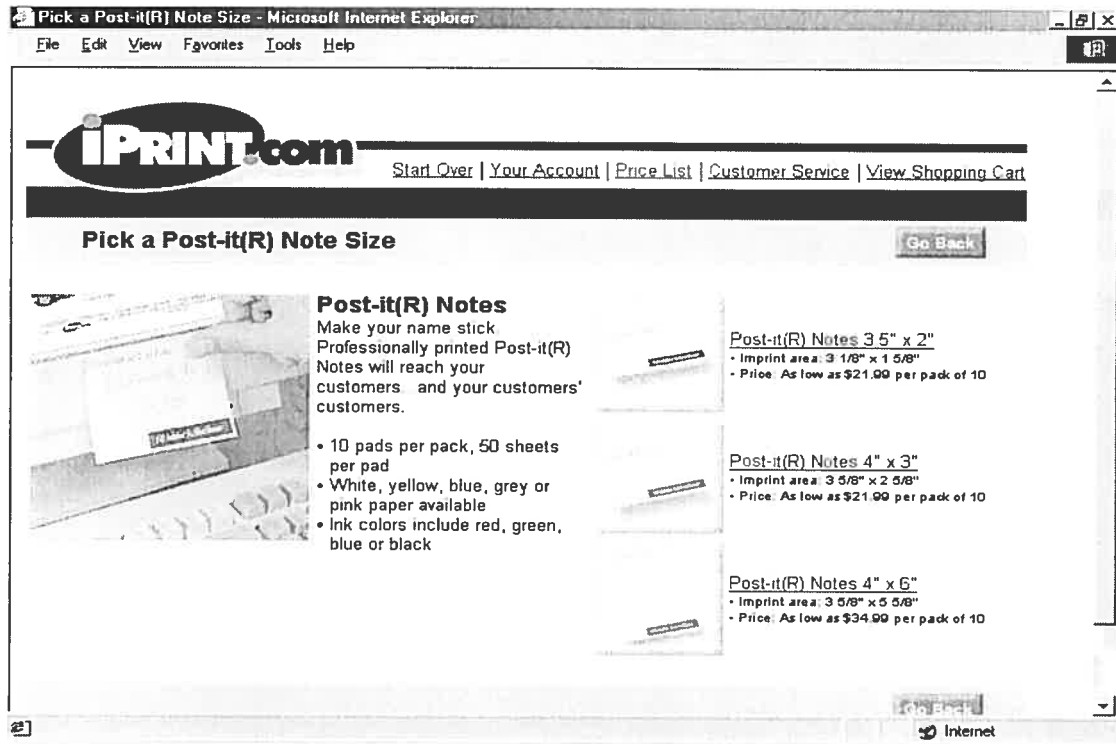


Figure 3.4 - Screen shot of Iprint site

- *Shopping or selling* on Ebay site [U07], like most of the web sites that offer products online for millions of consumers that can be reached anywhere any time. Users can find unique things online, everything from chintz china to chairs, teddy bears to trains, and furniture to figurines, as illustrated in Figure 3.5. This is convenient, for users since efforts can be minimized to a mouse click and the site attracts millions of users [21]. Many companies are relying on the e-service to market their products and offer their members the luxury of shopping online. Case-Based Reasoning approaches are already applied in many online shopping sites, this help the CBR algorithm to check member profile and view the trends of similar profiles in order for the application to recommend a complementary service. This leads to intelligent sale system based on CBR. Such a system would not only satisfy the customer but also help the manufacturer and the broker to sell products and act as a consultant to the members.



Figure 3.5 - Screen shot of Ebay site

- *Human interface chatting, the Gateway site [U08]*; the site offer the option to chat with an online sale or technical representative. This helps a gateway client to get a faster response than talking to a customer service representative on the phone since there is no long wait in queue for the agent to answer the call. The chat conversation can be saved or copied by the members for future reference, as illustrated in Figure 3.6. The service representative can personalize the contact according to the members profile, and can recommend complimentary products to help the company with its sales and thus increase revenues. However, human resources are needed at all times and since the representatives manage all the chat sessions, the response time is directly related to the number of agents assisting the members. This application does not rely on any application intelligence since the information is simply gathered by the representative and displayed to the member.

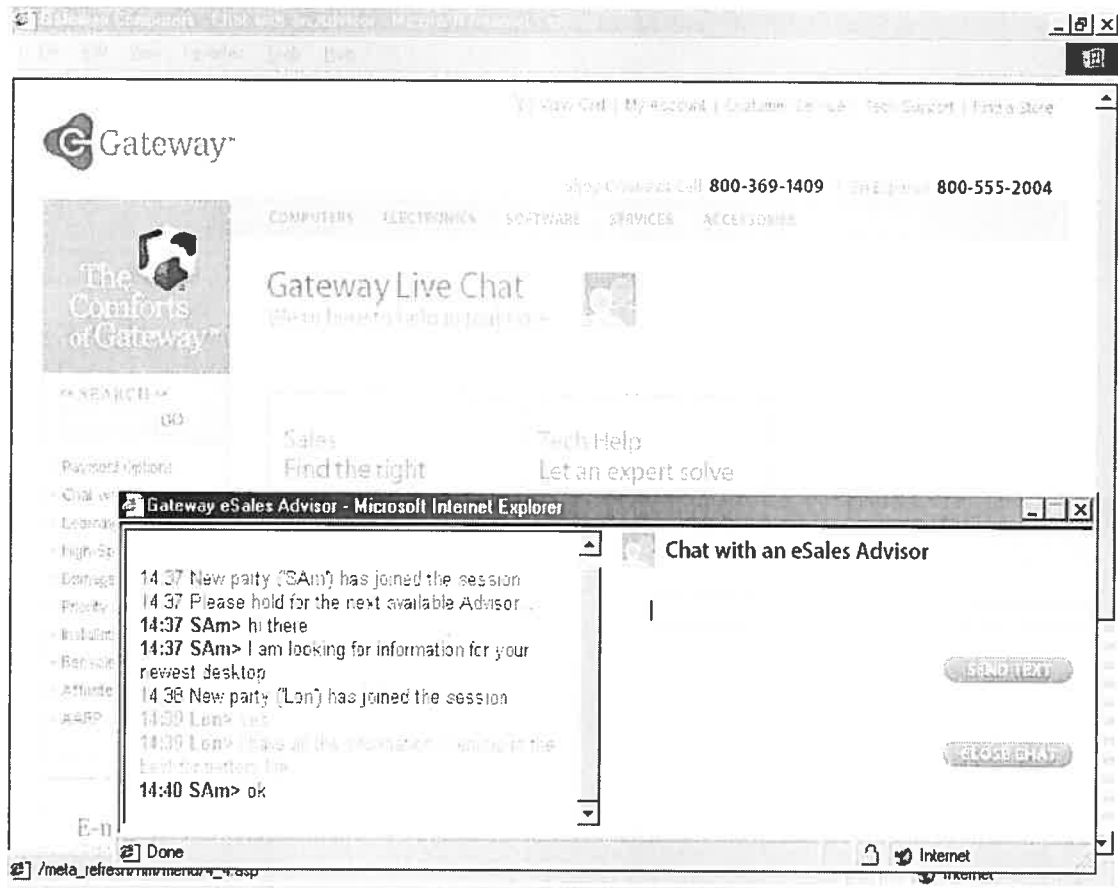


Figure 3.6 - Screen shot of Gateway site

As we have noticed from the different e-service uses and approaches, companies are relying more on providing their service through their company site. With the help of e-service, companies can develop online intelligent application to assist the member with their queries. Many technologies are being developed depending on the application, the members and their products. The approach varies from simple information retrieval methods to advanced interactive applications. Companies choose their approach based on their service type, time needed for the implementation, costs and profit analysis.

3.2 E-service Solutions Software Examples

In the following section, we present examples of two companies in the e-service technology world, Rightnow technologies and Firepond. Both companies provide e-services solutions to call centers and have already helped hundreds of customers all around the world. Using e-service enhances customer services options, which in turn enhances customers' satisfaction, reduces cost and helps companies to concentrate on their client as a unique client and not as a number who simply generates profit. The e-service solution describes the application the company can adopt to enhance its support to clients.

- *Rightnow Technologies*

Rightnow [U09] has had a breakthrough in the field of e-service by integrating direct email and chat into customer support. The company's goal was to provide the customers with answers to inquiries immediately, with customer representatives handling only inquiries where human interaction is required, as illustrated in Figure 3.7. This would lead to a reduction in the load of redundant questions and give the customer service representatives more time to focus efforts on top customers or priority issues.



Figure 3.7 - Interaction between customers and CSR

There are different levels of technology that customers interact with. Simply, the application provides several channels of communication within the self-service support site. Members can easily drill down and pinpoint specific information by typing a question in the Search box, while Browse presents customers with a tree structure of all the Answers. Members can choose the most appropriate self-service path for their queries. “RightNow's SmartAssistant™ technology predicts what information customers desire and leads them to that information by clustering and matching suggested solutions, and thus enhancing their ability to effectively find information” [U09].

According to the RightNow site, the software is a major development in the field of e-service and the benefits entailed with it are immediately felt as commented on by the companies that used it. A care rack company based in the US, THULE, had the system up and running in just 12 days and results started almost immediately according to management. The website enabled customers to find answers to their own queries within minutes by browsing the company site. Within one month, emails coming from site visitors were reduced by 20% - despite a significant increase in site traffic. Clearly, e-service was a smart decision made by the company's management. One year later, self-service volume had risen to 8,460 sessions – for a success rate of over 97% [U09]. Incoming phone call volume also dropped appreciably and the quality of the calls increased significantly.

Unfortunately, most of the options provided by the Rightnow application require agent intervention through chat and email support; there is no independent system interaction with the member. On the contrary, using the IIS application, the agents no longer need to interact with the system neither take part in the process.

- *Firepond*

Firepond implemented Firepond's eServicePerformer software [U10], a similar application to Rightnow software. The program increases the efficiency of all internet activities to be able to provide exceptional customer satisfaction and improve company retention of its clientele, without increasing customer service representatives.

The following are some of the software's benefits as elaborated on the company website:

- Provide, a cost efficient manner, expert end-to-end online service.
- Allow users to write their queries using their own words and be guided directly to the information needed.
- Provide priority service levels according to customer accounts value.
- Provide economies of scale by managing one, unified knowledge base to support all channels of online queries.

eServicePerformer consists of three integrated multi-channel communication applications to help support the member:

1. Automated email,
2. Self-service web pages, and
3. Instant messaging.

All three applications are managed through a completely integrated contact center and response library database as indicated by the company website. We should also pinpoint the intelligent touch of the software since it analyse members' natural languages, processes it and provides the requested information. This intelligent touch of the Firepond application distinguishes it from other software and adds a unique feature for this application.

Additional features of the Firepond application solution have been created to add more value to the e-service application. The features are:

- Automated email and messaging applications are unified by a common Contact Center to help customer service agents respond rapidly and consistently.
- Artificial intelligence combined with natural language processing allows customers to ask questions in their own words and automatically be directed
- To the right resource – a response email, an existing Web page, or real time
- Chat with a customer service representative.
- Customer value-based routing determines the best response channel.

Both companies' e-service applications rely mainly on traditional methods like email response, real-time chat and refer the member to a web page. The IIS application differs from this current approach since it can explain and correct the online billing automatically by itself with out any customer service representative interaction and is able to personalize the contact. The IIS application can lead the member from the beginning of the contact until the end of the call.

3.3 E-service Online billing examples

In the following section we are going to present two companies that provide online billing and general queries for their members. The companies are Bell-Sympatico and Wisconsin Public Service Corporation. The companies' website allow members to access their account online, view their bills, update their account information. The sites include also FAQ and several static operations similar to hundreds of websites on the internet. In other words, the sites offer no intelligent functions like automatic error correction to facilitate members' options, and ensure their understanding and satisfaction.

- *Bell-Sympatico*

Bell-Sympatico is one of the most popular Canadian Internet online service provider and Web site featuring news, weather, games, Canada411 phone directory, health information, entertainment, sports, computers and travel information for families [U11]. Sympatico offers dial up, high-speed internet services and additional internet related services for Canadian members. Additional services can vary from protection software to home networking services. Naturally, this industry depends on customer service satisfaction rather than on pricing strategies.

Currently Bell-Sympatico employs thousands of people to provide support and assistance mainly through call centers. The centers receive thousands of calls every week and each call takes several minutes to be completed. The management has already developed a web site to assist members to access their accounts online. Sympatico offers their members the possibility to check their accounts online, where members can check their emails, updates their personal information, create additional emails, and many other features related to their account. In addition, members can access their bills online, in case they want to print or view it in details. So, the management relies on the company website to assist its agents in the call centers as shown in figure 3.8. Using the website, the company can reduce the call volume forwarded to its call centers since members can find their answers online. However,

sympatico offers only static operations based on member accessing, retrieving, viewing, updating information. There is no interaction with the system or intelligent function to personalize or satisfy member needs in case of billing errors or just a simple inquiry.

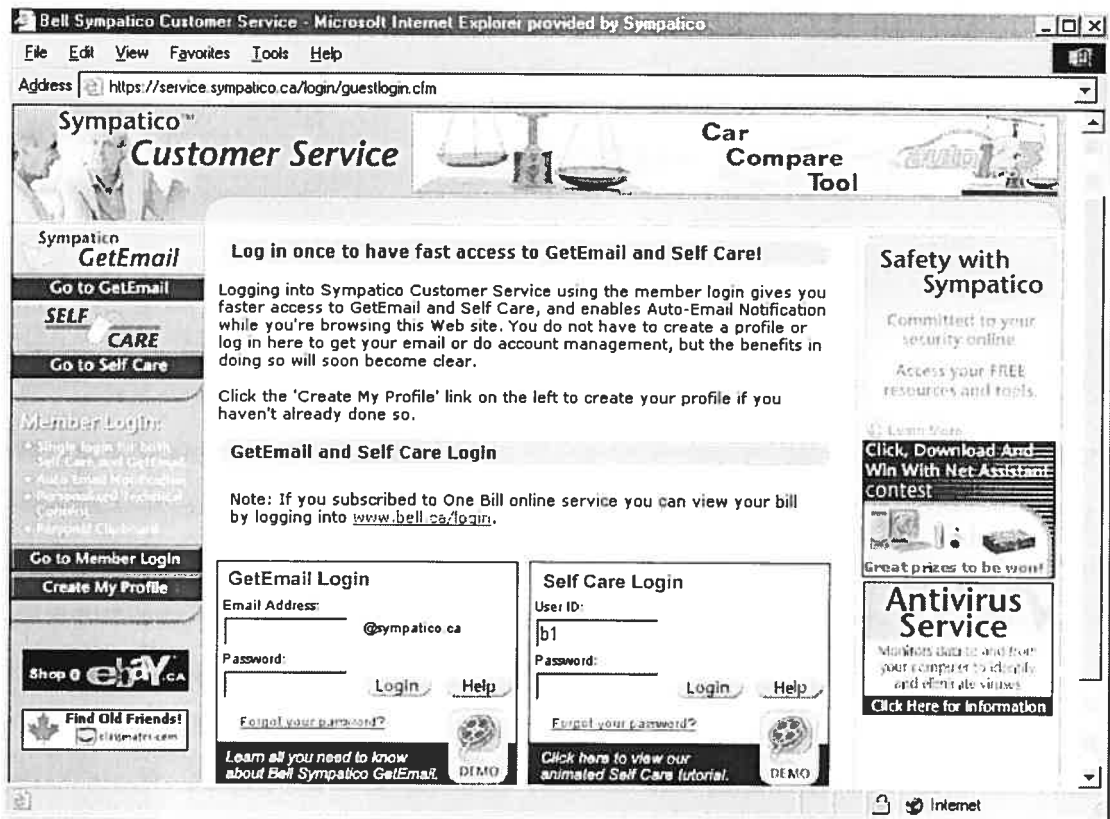


Figure 3.8 - Screen shot of Sympatico site

However, our prototype can address all of the current system shortcomings by introducing an interactive environment for the members and providing them with clear and adequate information. The interactive environment is not limited to answering questions by a simple yes/no, or simple billing amounts. The interactive environment is able to provide answers and propose solutions to help members understand their inquiry. Furthermore, the system is able to get member feedback after each response and react accordingly, to ensure the member is satisfied

- *Wisconsin Public Service Corporation*

Wisconsin Public Service Corporation is a natural gas and electric utility serving north eastern and central Wisconsin and an adjacent portion of Upper Michigan [U16]. Similar to Bell-sympatico, the company offers its members the options to log in and view their E-bill online. In addition, members can update their profile information in case they are moving to a different address or comparing costs with other firms, and many other features regarding members' profile. Unfortunately, the company system has no intelligence in it. In general, the preliminary feedback from users show that many customers try to get their answers from the company's website by accessing their accounts. However, members often experience some confusion using the online support and end up calling the call centers for further assistance and demanding customer service help.

Diverting members from the company's website to call the center could be related to several factors, mainly:

- Overwhelming information on the website.
- Missing analyst approach on the customers behalf.
- Little patience on the customers part to explore the website.
- Some browsing knowledge required by the user.
- Billing errors not clear for the untrained eye (representatives receive formal training on billing aspects).
- Web self-service availability.
- Behavior, members can be irate and want a person to take care of their problems right away.
- No feedback from the system. Therefore, some customers still call the center to confirm information found on the website.
- Users may require additional information regarding their accounts that may lie beyond system capabilities to answer online.
- Simplicity, members prefer to use the traditional way and call the centers.

- Members prefer to speak with a real person when they can not find the answers quickly enough.

In order to overcome these factors, an interaction system can assist companies redirect members from its centers and refer them to the company web site where they able to check all their queries.

For many members, using the web site is more desirable, since they don't have to wait in the queue for their answers. Also, members prefer to visualize the information, like their bills, rather than just listening to the representatives providing the explanation. The Wisconsin Public Service Corporation website is shown in the figure 3.9. A great complement for the company software can be an intelligent system, which is able to provide many interesting question and answering techniques, with a unique human approach.

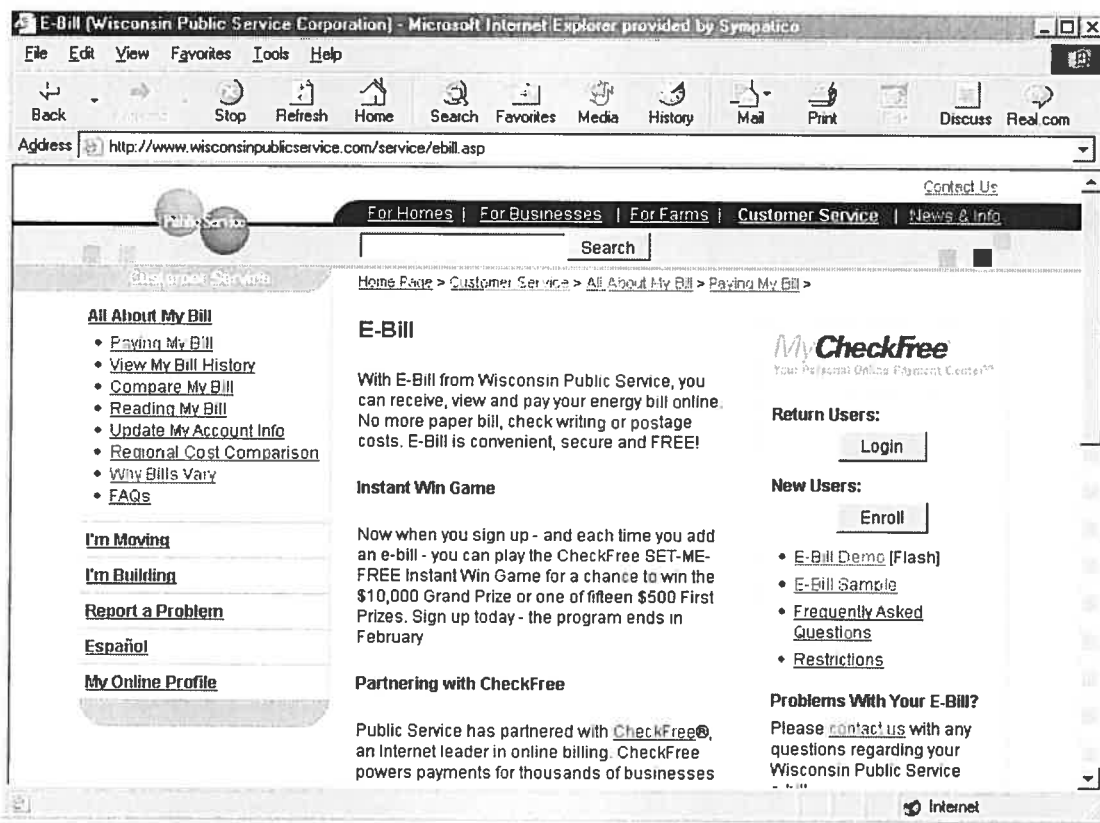


Figure 3.9 - Screen shot of Wisconsin Public Service Corporation

- *Comparison*

As we can see from the above examples, both companies are able to provide online billing; however, both lack the option of correcting bills online in case of errors. The technology used in both applications is to retrieve the information from members database, allowing the members to update their profiles in the database; like updating their addresses, printing information and many other basic operations that members can perform. The websites are very easy to access and are user friendly. Many tutorials and demos are available on the sites, to assist the members to understand their bills. Unfortunately, the intelligent element, like problem solving, of the billing errors, is missing. Both companies rely on their call centers to correct such billing errors and the response time depends on the agents available in queue. On the other hand, our system can perform similar basic operations in addition to correcting billing mistakes if applicable. The IIS also gives the member the choice of viewing the bill explanation in a more creative way rather than looking at the bill in general. Another advantage is the interaction environment and the simple explanation animation, which the other sites ignore.

3.4 CBR Overview

Over the last years many computer-reasoning techniques have grown in the internet world to help companies serve their members through their web sites. One of the pioneer techniques is the use of CBR [1,9] that applies knowledge of previous experiences to solve similar or new problems. The CBR technique is increasingly been adapted in commercial products and in many web applications currently in regular use.

Many definitions of CBR have emerged in books and research papers. And, all assert that case-based reasoning is a problem solving approach by machine learning and adapting to new problem solving [12, 17]. In other words, CBR imply that a new problem is often similar to old ones stored in the data base, thus past solutions may be reused for the current problem.

The history of CBR is not a long one; it started in 1977 at Yale University, with the research of Roger Schank. Schank's research was based on defining a structure for conceptual memory. In 1982, Schank was able to develop the Dynamic Memory Theory and Memory Organization Pack Theory (MOP) [17]. This development helped many researchers, like Janet Kolodner, to continue Schank work. In 1983, Janet Kolodner, developed what is known as the first CBR system called CYRUS [10]. Kolodner's CBR system was based on Schank's Dynamic Memory and MOP theory. Many other CBR systems appeared later, between 1985 and 1992, like MEDIATOR [19], PERSUADER [20] and CASEY [11].

In the 1990s, researchers helped the transition of CBR from academic research in cognitive science and artificial intelligence to the commercial field. For example, the US Defense Advanced Research Projects agency supported the development of many CBR systems [U20] to encourage the use of CBR techniques in different fields like on line shopping, medical diagnosis, financial analysis, quality control, etc. This increased the use of CBR worldwide due to its intuitive nature and simplicity.

3.5 CBR Cycle

The CBR concept is illustrated in the CBR Cycle as shown in figure 3.10 on the next page, to give a global view on how the process functions [U15]. The cycle consists mainly of four major processes:

- The retrieval process
- The reuse process
- The revise process
- The retain process

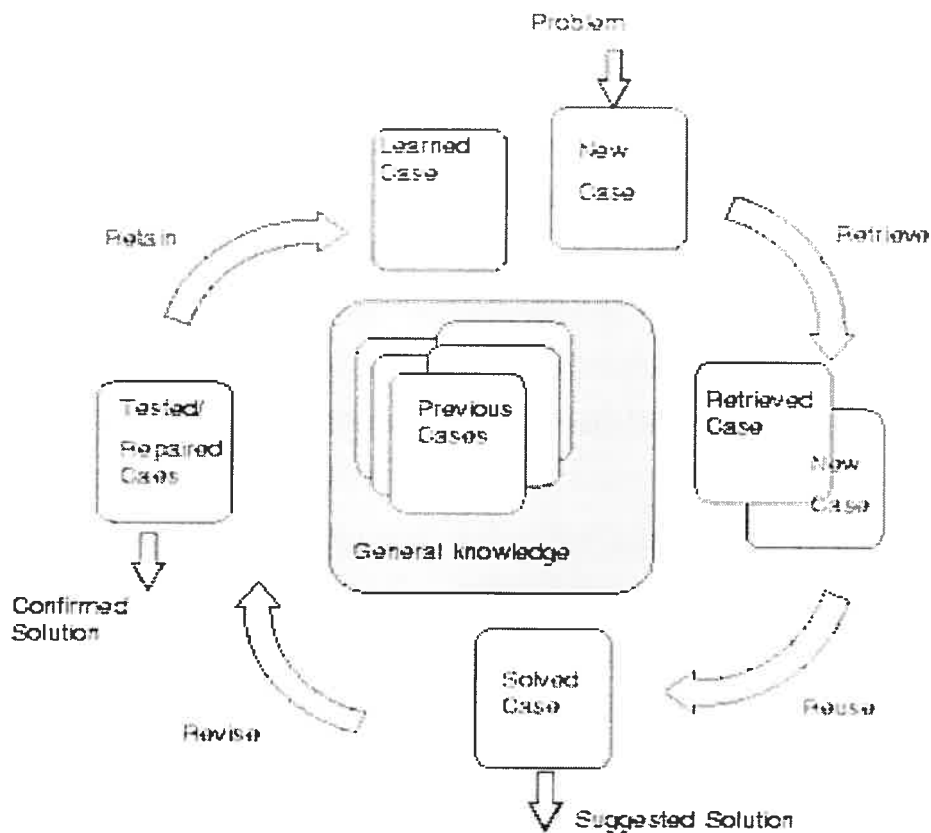


Figure 3.10 - CBR cycle

All case-based reasoning methods have the following process in common [U18]:

- Retrieve the most similar case (or cases), and comparing the case to the library of past cases using CBR similarity measure;
- Reuse the retrieved case and try to solve the current problem by applying the solution steps in the case;
- Revise and adapt the proposed solution according to the current situation if necessary;
- Retain the final solution in the database of cases as part of a new learned case.

As we notice from the cycle described above that the process of CBR starts when a new problem is processed; the system retrieves the most similar case to the new problem from the case base. In this process similarity measures will be applied to each retrieved case in order to find the most similar case. Many times, the retrieved

case may not be identical to the new problem. So, we can adapt the retrieved case by adjusting its past solution to current problem, before using again it in the reuse process. In the revise process, the suggested solution is evaluated in order to check its reliability. After verifying the result, if the solution works, we retain the new problem with its solution as a new case during the retain process. Otherwise, a new case is formed with a repaired solution. It is important also to note that not all CBR applications use all of the above described steps.

3.6 Principle Techniques of CBR

The principle techniques that make up the CBR are the sub-fields described in the CBR cycle: case representation, case indexing, case retrieval, and adaptation. The case representation is needed to define the case structure and its components: problem description, solutions and outcomes. The case indexing is needed in order to retrieve the case efficiently depending on the similarities measure. Finally, adaptation is needed once we adapt a suggested solution to the current situation.

3.6.1 Case Representation

The case representation in CBR is one of the most significant and difficult in the process. So, it is important to find the appropriate structure to define the case and describe its contents for effective indexing and retrieval methods. The case is the place where previous situations are stored. Usually, a case includes: problem descriptions, solutions and the outcomes.

- **Problem descriptions:** describe the problem to be solved in a certain situation when it occurred.
- **Solutions:** the steps to follow in order to solve the problem.
- **Outcomes:** the result occurred after the case occurred.

3.6.2 Case Indexing

The indexes of a case act like indexes to keywords in a text. Choosing the right case's indexes is very important to the process since it distinguishes it from other cases, and it helps in the retrieval procedure in general. Many indexing techniques have been developed to reduce the retrieval times of CBR applications like *K-d tree*, *case retrieval nets* [23], and many others. The basic idea behind indexing in CBR is to help the retrieval algorithm access and find relative cases in a faster and more accurate way. Many problems can rise if the indexing technique used was inaccurate and inefficient, since this can cause delay in response of the retrieval algorithm and the application will not get the right cases at the right time. Good indexes for case-based reasoning should be abstract enough to retrieve relevant case in a variety of future situation and should be concrete enough to be easily recognizable in future situations [12].

3.6.3 Case Retrieval

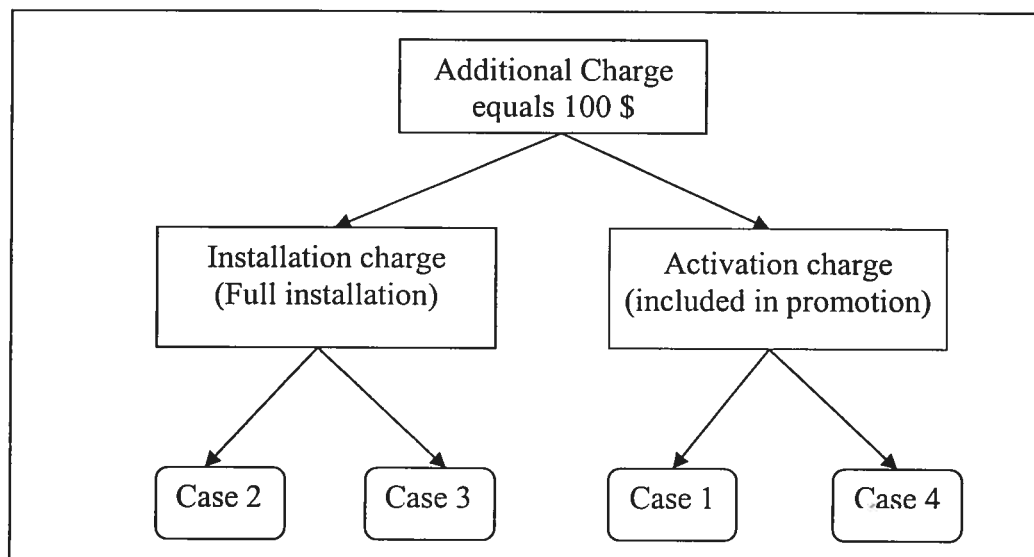
The process of case retrieval is to select the most similar cases to the new problem based on predefined similarity measures. In general there are two methods to case retrieval: the nearest neighbour retrieval and the inductive retrieval

- **Nearest neighbour retrieval** is often the most used method to measure similarity between a new problem and the stored cases in the case base. The algorithms of the nearest neighbour retrieval will verify the similarity between the problem and the stored cases in terms of the values of its case's attributes. Each case consists of many attributes with values that will be needed to verify similarity. To define the nearest neighbour algorithm we start with local similarity measures for all attributes. The local similarity is the computation of similarity upon the same attributes between the new problem and the past cases. Similarity can be derived from attributes with numeric values or non-numeric values.

Once the local similarity functions are defined, the global similarity of the two cases must be derived from local similarities. The usual way to do this is to apply a weighted sum to all local similarities. This is repeated for every case in the case base with respect to the new problem.

The similarities attributes are ordinal values that usually are normalized to the interval $[0,1]$. A value of 0 means that the query attribute is not similar at all when comparing it to the other cases in the case base and a value of 1 means that the query attribute is exactly what we are searching for in previous cases.

- **Inductive retrieval:** searches for patterns among sample cases, which are usually organized into a decision tree structure, to solve new problems. The induction algorithms verify attributes between the query case and the cases in the case base. Then, it identifies patterns amongst samples case and classifies the new problem into sub classes in the case base. Each sub class contains the sample cases that have at least one its attributes similar to the query case. The search continues into the tree structure type till solution is found. Usually attributes are dependent upon others in this method. Here is a complete decision tree example, in figure 3.11, to help understand the case base structure using the inductive retrieval method.



3.11 – Decision Tree

As we can notice from figure 3.11, the query case indicates that the member signalled an error in the activation charge of 100 \$. The system will verify if it is a installation charge or activation charge. For example, if it was an activation charge and included in the promotion the system will choose case 1 otherwise case 4.

Most of the applications based on CBR usually use the induction retrieval and the nearest neighbour retrieval. The choice between the two methods depends on the type of the application that we are planning to develop. Induction retrieval is ideal if retrieval time is an important issue in your application. However, if attributes in the cases are not clear or unknown the ideal choice will be the nearest neighbour retrieval.

3.6.4 Adaptation

A final challenge on of the basic steps of CBR is case adaptation. Adaptation is the process of adjusting the solution of the retrieved case to fit the current problem. There are several adaptation methods used in CBR applications in general [9]:

- **Substitution methods:** adaptation techniques that substitutes appropriate values between the old and the new situation.
- **Transformation methods:** are used to transform an old solution into one that still work in a new situation.
- **Special-purpose adaptation and repair:** heuristics are used to carry out domain-specific and structure-modifying adaptations not covered by the other methods.
- **Derivational replay:** derives a solution for the new situation by reusing the method for deriving an old situation.

3.5 Conclusion

This chapter summarizes the state of art of the e-service and CBR. It describes e-service approaches applied by different companies depending on their services and products. The different approaches are described in details with examples, to

illustrated current market trends and how it differs from our approach. We also gave examples on companies that offer e-service solutions and how human intervention needed in such software. The IIS prototype was also compared to two companies, Bell-Sympatico and Wisconsin Public Service Corporation, which offer online billing for their members. The applications resemble the basic operations, like updating member address or viewing the bill. However, the major differences are: the interaction environment and the intelligent feature of correcting billing errors online, in case they are valid. The comparison consists of highlighting the importance of the intelligent approach to complement current application. The intelligent interaction feature can help reduce the amount of calls handled by call centers, since member billing error is directly corrected via the web using the CBR. This improves company revenue by lowering the costs associated to manage call centers. Also, the IIS application adds the human aspect to its interaction with the member. The interaction personalizes the contact with the member and offers an approach more convenient to the user. The chapter also reviewed CBR and its sub-fields, case representation, case indexing, case retrieval, and adaptation.

Chapter 4

CHAPTER 4: IIS MANAGEMENT APPROACH

The IIS that we are proposing can be a perfect complement to the previously described online services. The application has a totally different approach since it personalizes the responses and options according to the member needs and intentions. Our intelligent interaction software assists customers to understand and correct their bills instantly in case the error was valid. Customers' information varies with every member due to many billing aspects. For example, members can have different types of internet access services (super-speed edition or high speed); or they could be tied to different promotion (10% discount when signing a contract or no discount without a contract). Furthermore, billing proration can be confusing to many members, and needs explanation. In other words, billing differs depending on the service type members are subscribed too. So, redirecting the members to an existing web page is inadequate to answer all queries. The IIS is able to explain, correct billing and provide detailed information for the members, which is a service usually handled by a customer service representative in a faster, more accurate and excellent customer service approach. For example, the IIS verifies if members are satisfied from the information provided to ensure his understanding and of the excellent customer service given.

The IIS follows a customer service call process according to the company guidelines that could be tailored to each company or department. Call process are call guidelines usually generated according to companies' needs and techniques of serving clients. When members try to access their accounts online or when they are trying to find general answers, they will have the option to log in to the system that launches the application, connects them to their accounts, and offers intelligent billing correction. The prototype can be modified to ask member to contact a live representative once information is not satisfactory to the member or once it is not able to meet member

demands, since customers service require years of experience and member can always demand to be contacted by a live agent.

Here are some general differences between the IIS approach and the traditional online ones that we summarize in table 4.1.

Table 4.1 - Differences between the IIS and the traditional online services

	IIS	Traditional online Service
Personalized service	Yes	No
Dynamic	Yes	No
Intelligent System	Yes	No
Update Personal Information	Yes	Yes
Human Aspect	Yes	No
Accuracy	Yes	Yes
Follow Call Process	Yes	No
Intelligent Interactive Environment	Yes	No
Billing Display	Yes	Yes
Billing Explanation	Yes	No
Billing Correction	Yes	No

4.1 Before E-service

Companies that offer online billing receive daily thousands of phone calls throughout their call centers requesting assistance from customer service representatives. Members request help to understand their bills and to signal service errors when they occur. However, only a small percentage of the members are diverted to the web site self-service or email/chat, as illustrated in Figure 4.1. This is mainly due to several factors as already mentioned in the previous chapters that divert members to speak with a customer service representative rather than finding the answers themselves. This requires the hiring of more and more agents to support customers as company members' database increases.

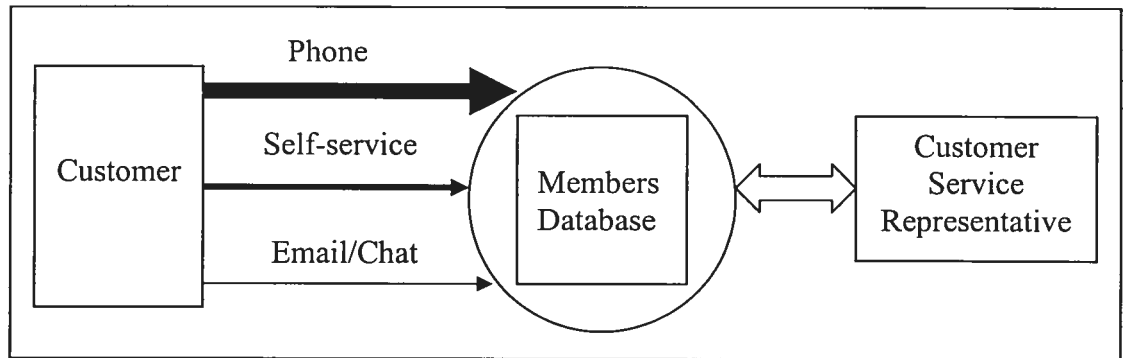


Figure 4.1 - Projection of contacting company before e-service

4.2 After E-service

After using the IIS, the call center mainly decreases phone calls requesting customer service representatives and increase the web self-service, as illustrated in Figure 4.2. The IIS is able to handle many members' requests and therefore eliminates the need of calling a live agent. This improves management operations and help the company meets its objectives and reduces costs associates with call centers. The unique experience of using the IIS encourages members to use this approach all the time for its accuracy, efficiency and fast response. Applying this technique helps the company free more human resources to handle complicated customer inquiries that require human attention.

Members can still contact the customer service representatives using email, chat and phone. However, they now have the option of using an intelligent application.

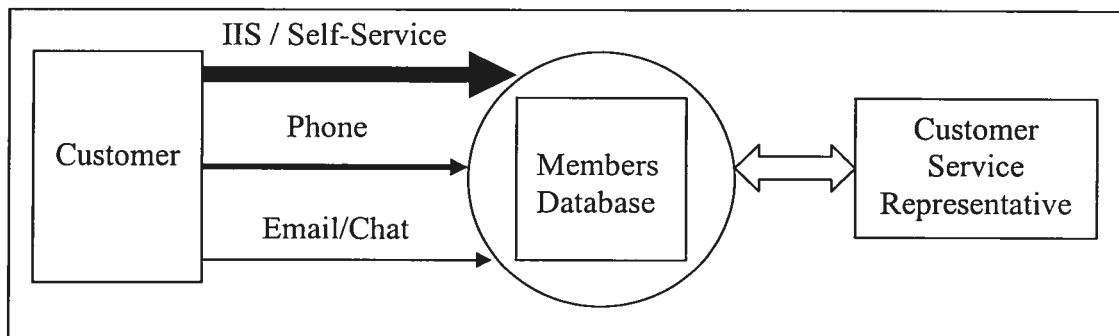


Figure 4.2 - Projection of contacting company after e-service

4.3 General Call Process

Almost all companies set call guidelines for their employees when processing inbound or outbound calls. These guidelines are set not only to help employees answer calls in an effective way, but also to provide better customer service; thus enhancing member satisfaction and loyalty for the company. Banks, insurance corporations, internet companies, computer software organizations and many others have constructed their own call process to assist their customers. So the call process varies with different companies, products or support line. For example, the call guidelines for representatives working in billing office, is different from the technical support, customer care, sale department, warehousing or management level. Furthermore, the process of the calls is always structured according to standard steps that can be divided as follows: the opening of the call mentioning the company and agent name, identifying and resolving member queries, offering further assistance and closing the call thanking the member for his business. The IIS applies its own call process and provides the member with exceptional customer service. The guidelines of the call process will be presented later in the chapter.

4.4 Call Process Examples

In this section, we present examples of call processes adopted by many companies in general. The guidelines can vary as we mentioned earlier. For example, in case of an internet company, members can call for technical support, billing explanation, general queries, to order a service or for more than one inquiry at the same time. The agent adapts his call process to support the member with any of these different demands when applicable. For instance, when it is a sales call the employee has to provide benefits of the product, overcome objections and close the sale, on the other hand, when it is a technical support call, the employee will have to fix the member's issue, offer further assistance and make sure that the member is really happy and satisfied with his service. The next section provides detailed examples of both approaches in order to emphasize the call process of our system.

Sales approach

Opening: the opening is the greeting an agent uses to welcome a client. The agent presents himself, brands the company name and offers the client his help.

Identify needs: the agent verifies the needs of the client by asking general questions about client activity over the internet and his usage type.

Recommend solutions: after verifying client needs and requirements, the agent recommends to the member additional services that suits his profile.

Provide benefits and uses: the agent provides the clients with the benefits and uses of what he previously recommended and educates the client by explaining the service and its importance.

Ask for the sale: the agent at this stage asks the client permission so he can place the order for him.

Overcome objections: the agent tries here to assure the client about the importance of the service and overcome objections if the client is hesitant.

Close the sale: the agent places the order for the client and informs him of the steps to follow.

Closing: the agent terminates the call thanking the client for his business and branding the company name.

Technical support approach

Opening: the opening is the greeting that agent uses to welcome the client. The agent presents himself, brands the company name and offers the client his help.

Identify needs: the agent verifies the needs of the client by asking questions concerning member problems in order to identify it.

Resolve needs: the agent troubleshoots with the member to help him fix the problem

Offer further assistance: the agent asks if the member needs anything else than the problem that has already been fixed.

Make sure member is satisfied: the agent asks whether the member is satisfied with the service he provided in order to ensure member satisfaction.

Closing: the agent terminates the call thanking the client for his business and branding the company name.

As we have already mentioned, these approaches vary with products and services offered. The call process might use a mixture of both approaches. For example, after the technician solves the member's issue, he or she could cross sell the member a compatible service or offer him or her the complementary services like an antivirus to protect his or her computer.

4.5 IIS Call Approach

The IIS approach also follows a call process guideline. In other words, the application follows exactly the same call process as agents follow during actual real calls. The call process created for our system is similar to the one applied by many call centers to answer members' questions regarding billing in general. This approach guarantees to answer all member queries in a satisfactory way. The IIS has a unique human approach to help satisfy members and company needs. The call process will include six major steps. The opening, identify needs and resolve it, ensure member satisfaction, offer further assistance for the member, try to cross sell members additional services and the closing. We have adopted this process for its simplicity and human aspect. Each of the major six steps described below provide general examples that the prototype uses to provide exceptional customer service.

1 – Open with a Warm and Friendly Greeting

The IIS announces his name and brands the company name in order for it to personalize the contact with the member. This will help the member understand the role of the application and continue with the flow of the process. The system offers help and asks the member to choose from the main menu to determine member inquiry or the member can simply type his questions using keywords. This helps the

IIS to redirect the member to the appropriate section of the self-service. For example, it uses the following greeting: thank you for contacting company name, my name is Samir, and how may I help you today?

2 – Identify and Resolve Need

The IIS assures the member that it can help him with his query and take ownership of the problem. The system clarifies the member's need by fact finding validating member profiles in order to give clear, accurate and consistent explanations of the member billing. In case the member signals a billing error, the system will validate the error and uses the CBR algorithm to solve it. For example, Mr. Smith, I understand you would like to know why the amount due last month was higher than previous bills. The reason Mr. Smith is you added the antivirus service to your account.

3 – Ensure member is satisfied

After processing the member inquiry, the IIS partners with him to ensure his understanding of the results and make sure he is satisfied. The system tries to create a unique customer service experience for the member. For example, it asks the member if he is satisfied with what he has done so far; or if he would like him to repeat explaining the bill.

4- Offer Further Assistance

In this part the IIS asks a member if there are any more questions or concerns that he would like to address. The system makes sure that all member questions are answered. In case a member has an additional question, the system returns to the main menu and gives members the option to restart again. For example, it asks: "Mr. Smith is there anything else that I can do for you or help you with? Or Mr. Smith, do you have any other questions for me today?"

5 – Identify Opportunity to Up-sell or Cross-sell

Before closing, the IIS tries to promote additional products/services according to member profile. The system recommends complementary solutions to current member service. The application will explain uses and benefits of such a service and its importance for the member before asking if member would like to add it to his account. For example, Mr. Smith I can see that you are current on the dial up 75 hours plan, are you aware that for 3 \$ more you can have unlimited access?

6 – Close using a Human Statement

At the end of the contact the IIS appreciates the member's loyalty by thanking him for his business. The system ends the contact using a human statement in order to add the final human touch to the contact. For example, "Mr. Smith, thank you for choosing our company and have a great day! Or, Good day to you Mr. Smith and thank you for choosing our company."

The IIS call process shows the interaction that the application follows while assisting member with their billing queries. We notice that the process starts with the log in section as shown in figure 4.3. The system displays the main menu and assures the member that he can help with any option the member chooses. The member also has the option to type in his questions using keywords and it will open to him directly the appropriate section. The following step would be to offer an explanation to ensure understanding and will be repeated until the member is satisfied. The IIS offers added assistance in case member s missed additional questions and usually repeats the main menu. Once this is done, the system will try to satisfy business needs by promoting additional services, especially if the member is interested in related internet service before the contact is finally closed. The IIS follows the chart in order to ensure the call process is respected. Additional features can be added in the future and this chart can be modified according to business needs. The flowchart helps understand the flow the application used to serve members in a consistent manner in order to increase customer satisfaction that is an important key value to the companies.

The IIS call process diagram is illustrated hereunder in figure 4.3 to show the steps that the IIS follows when answering a member queries.

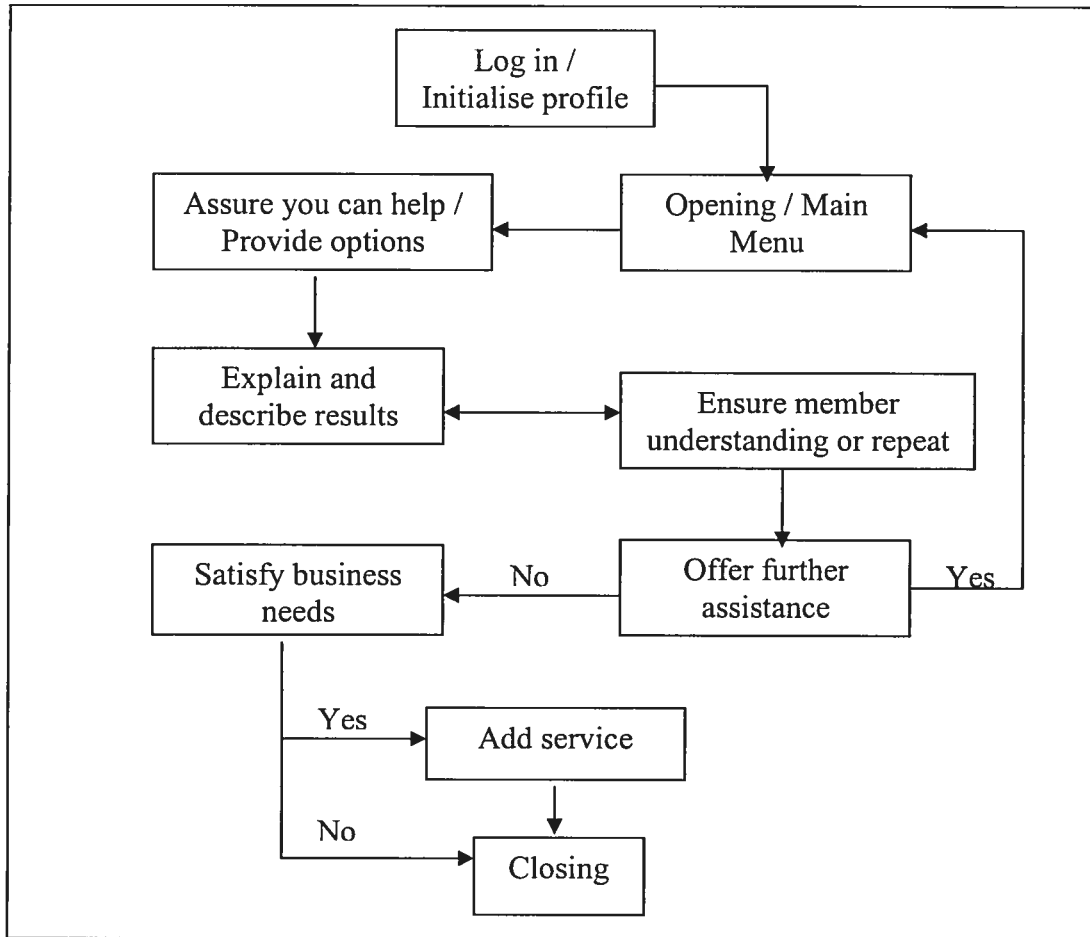


Figure 4.3 - IIS Call Process

4.6 Bill Structure

The bill form that IIS explains can be adapted to any other bill in general. The bill includes two sections: previous charges and current charges as illustrated in the figure 4.5. The previous charge section includes last month invoice amount and the payment we received. The current charges are this month's charges to member account; it includes monthly service charges, additional charges and adjustments if available. IIS is also able to explain *proration* in details. Proration is generated when the member changes promotions or price plan within the billing period. Once there is a change in the price during the billing period, the system has to calculate the

difference in price accordingly. The change in price creates an adjustment or adds a charge on member next bill. For example, if the member is paying 30 \$ per month, and in the middle of his billing cycle he changes his promotion to a faster service that cost 50 \$. The system will charge him an additional charge of 10 \$ on his next bill as illustrated in Figure 4.4.

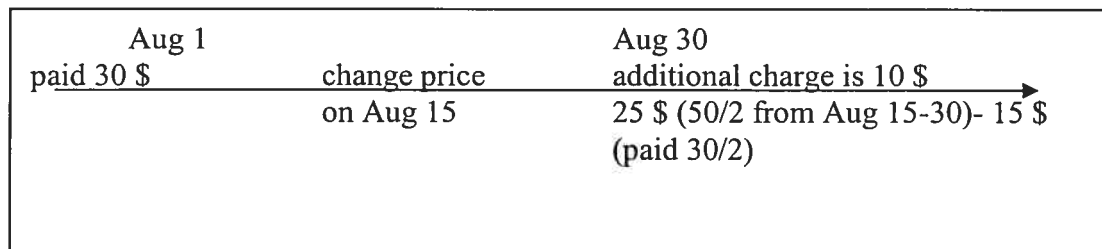


Figure 4.4 - Proration Example

Figure 4.5 illustrates a sample of the bill that the member is able to access online. A description of the bill sections follows to illustrate the items that could be listed in the bill which the system is able to explain and correct in case of valid errors.

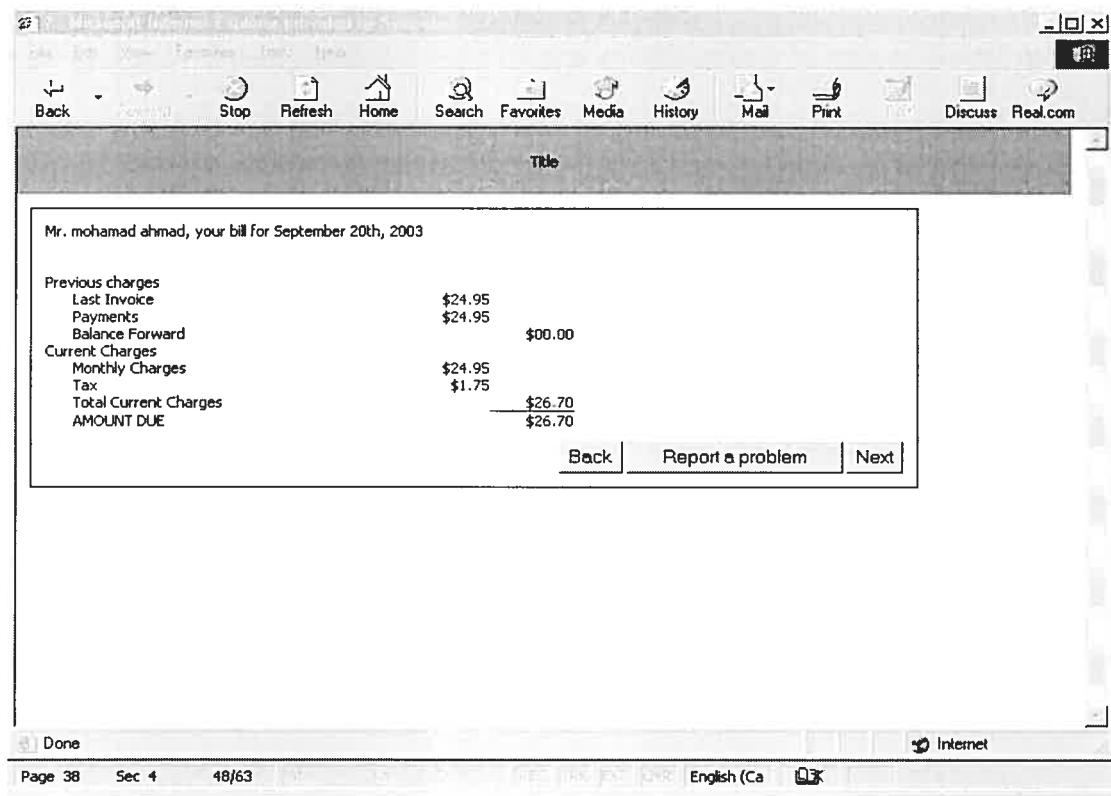


Figure 4.5 - Bill Sample

Monthly Charges include

Service Fee: the service fee is the regular monthly charge for the service. The fee differs with different services in case it is dial up access, super-speed access, or in case the member rented additional accessories.

Modem Fee: in case the member is subscribed to super-speed and requires that we rent him a modem, a modem fee will be applied to his account accordingly under the modem fee.

Router Fee: member has also the option to install his own network at home where the company provides him a router for a monthly fee.

Proration: as previously described when member change price plan during the month an additional charge or adjustment will be generated on his next bill. In this case the proration will be charge for the priced difference.

Additional Charges include

Bandwidth Charges: are charges associated with the amount of downloads and uploads that occur on member super-speed or high-speed accounts if the limit was exceeded.

Usage charge: the usage charge is for the dial up account once the member has a plan with a limited number of hours and he exceeds his limit.

Additional Service Charges: those charges are for the additional services a member can add to his current dial up or high-speed account. The services can be a complementary service to the internet access like an anti-virus or a firewall. Or, it can be a completely different type of service like a monthly computer magazine subscription.

One-time charges: are charges applied once on member's account in general, like the charges associated with activation, installation, hardware charges, or technical support assistance.

Moving Charges: the member receives moving charges when moving his account to a different location.

Miscellaneous Charges: are simply for miscellaneous things like back billing charges when member bills are not generated for a period of time, once rectified a back billing is created.

Adjustment Charges include

Error in promotion - Incorrect promotion: the IIS is able to correct the promotion associated with member account and adjust it accordingly in case of errors. Member history file always includes the last correct promotion a member is attached to

System billing error: an error that is generated due to system error, like wrong calculations applied on member account, the application can adjust the amount charged incorrectly.

Public relation: it is an adjustment accorded to retain the member, for example to match a competitor's offer or for an inconvenience on member account or service.

Goodwill: the adjustment is given as goodwill and kindness from the company to the member.

Service Proration: this adjustment presents a change in price to a lower one. The proration could also represent the removal of an additional service that has already been prepaid in full.

Error in Service Charges: this adjustment represents an error in the additional service charges that occurred on member account.

The IIS explains in details all the structure of the bill. The system displays the member adjustments, charges, and additional charges with break down of the amounts, if necessary, in order for the member to understand it in details. The reason and description of the amounts will also be displayed for the member to ensure his understanding as part of the bill explanation performed by the system. Once the member opens the bill to view it, the description of the bill will appear slowly one by one describing the charges in details.

4.7 Conclusion

This chapter enumerates various aspects of the IIS. It discusses its impact on a company before and after using the prototype. It also provides a comparison between our system and the traditional online services, in order to show the benefits of using an intelligent interaction like the IIS. The chapter also illustrates the call process in general and gives examples on live representatives' call process. The unique call process of the system is discussed in details with all its steps to ensure understanding of the IIS functionality. A sample of the bill is presented including a description of the bill sections and its associated items with a specific definition and description of the proration.

The IIS prototype gives an exceptional human aspect on how the application behaves with the member and answers his questions. The application is able to process member queries while verifying his profile in order to up-sell or cross-sell him at the end of his query. This initiative differs from other e-service billing application. Since, after the application satisfies member needs and answers his questions, the IIS offers additional services for the member to increase company's revenues. The billing sections are separated to facilitate the explanation, and ensure each amount can be clarified to the member.

The process of placing all these steps together is shown in the next chapter. In addition, a presentation of the system architecture for intelligent and no-intelligent query is illustrated, with a description of the case-based reasoning process that the prototype follows.

Chapter 5

CHAPTER 5: METHODOLOGIES & SYSTEM ARCHITECTURE

A major factor for a successful application is the way we can follow up on the steps of its system life cycle during a reasonable time limit [U12]. The IIS prototype was managed and designed according to two main phases that we developed during the project progress. The first phase replies to members' general queries like updating personal information or verifying when member promotion will be over. This is a simple search, retrieve and display process since the system access the information from member profile. This includes no intelligent assistance or request. However, the second phase requires a more complex approach since the system corrects billing error in real time after interacting with the member. CBR was applied in order to assist the prototype complete billing error correction based on the intelligent interaction. An overview of the system architecture and algorithm is presented in this chapter, in addition to a presentation of all CBR steps used in the prototype, along with examples on each step to illustrate the process.

5.1 Case-Based Reasoning in IIS

As previously mentioned, the idea of CBR is to solve new problem by comparing them to old ones, which have already been solved in the past [24]. The existing old problems and their solutions are stored in the database of cases. Each case typically contains the problem and the solution steps that are needed to repair it. The IIS uses CBR technique and intelligent interaction to correct online billing. The reasoning process in our prototype is based on the CBR cycle previously described in chapter 3. When a new problem is signaled by the member, a new case problem is presented, the system verifies the validity of the error and the CBR system matches it against the cases in the case base and similar cases are retrieved. The concept of case similarity measure plays an important role in performing this process. The retrieved case or cases are then used to provide a solution to the detected problem. The solution can be

revised when necessary according to the current new problem. Finally, the current problem and the final solution are retained in the database case as part of a new case. The IIS uses CBR approach to adapt solutions to similar billing error previously corrected. Errors, as previously discussed, can be related to simple calculation errors, wrong promotions given to members, wrong charge applied to his monthly charge or other problems that the system can detect and correct using previous cases. So, errors are related to the attributes of the bill.

5.1.1 Case Representation and Case Base

As we have already mentioned, CBR uses cases' comparison to solve new problems from old ones. A case is a set of information representing a problem and the correction steps needed in order to correct this problem. Cases come in many shapes and sizes and differ according to the nature of the application [12]. However, all cases represent a problem and its solution. Since our application deals with billing correction, the outcome of the case varies according to the accounting aspect of the bills. The outcome can apply an adjustment, a charge, reverse charge or adjustment, change promotion, simply educate and explain the account for the member or a combination of two or more of the mentioned outcomes. In general, the cases of the system use parameters and attributes associated to problem - solution sections as illustrated in table 5.1.

Table 5.1 - IIS Case Representation

Problem	Solution
<ul style="list-style-type: none"> • Additional charge error • Adjustment error • Service fee error • Promotion error • Proration error • Calculation error • Additional service error 	<ul style="list-style-type: none"> • Apply charge • Reverse charge • Apply adjustment • Reverse adjustment • Change promotion • Clarify information • Educate member

For example, a new member was charged 40 \$ on his first bill as an activation charge. This error was generated due to a billing defect that triggers this activation charge once members are registered on the promotion 'S00155'. Once the member reports the problem, the IIS checks if the error already been fixed. If not, the application searches for best similar cases or case, having problem as additional charge error. The attributes in this case are the activation charge and the member promotion. After verifying and analyzing all the cases parameters and constraints, the IIS is able to find the case where a member was previously overcharged for activation with similar promotion, and the solution was to adjust his account by the amount overcharged as shown in table 5.2.

Table 5.2 – Case example

Problem	Solution
<ul style="list-style-type: none"> - Additional charge error = "activation charge" - Promotion = "S00155" 	<ul style="list-style-type: none"> - Apply Adjustment - Amount = "40 \$" - Inform member

The parameter values of the case can be a real number like a charged amount, string parameter like the promotion name attached to the member account. Each case is important since it presents a solution to a certain problem. The content, of the IIS case, suggests that there are two main sections as show in table 5.1. The first section describes the problem or situation that the member signals through our interactive approach. For example, the member signals an error in additional charges by clicking on activation fee charge in the bill. The second section shows the remedy to the occurring problem, like reversing a charge or simply informing the member that the information is correct and recaps the bill's explanation. The outcome of the case is presented to the member in order to ensure his understanding. For example, once the member signals that there is an error in a charge applied to his account. The IIS validates the charge and reverses it in the member profile. The outcome of the

correction is presented to the member, and he is informed that the charge was reversed and will get a credit on his next bill.

Our case base is not very large; the initial cases were chosen according to the problem types defined in this section. Any billing error that occurs in the system is due to one or more problem types already viewed in the case representation. However, most of the problems are generated because the promotion associated with member account was not applied correctly. As well, some errors can be associated to the additional charges or adjustments, and additional services errors. So, almost all the cases in the case base have the promotion as part of its index. And, the initial cases were chosen having the promotion and other problem type as an index for the cases. The only problem types that are not directly related to the promotion, since it can be ordered separately and can generate billing errors, are the additional service and the additional charge errors. For example, the moving charge is one error that is not directly related to the promotion. All these special cases have similar cases to represent them in the case base. For example, if member didn't get his discount due to billing problem, the system looks for the similar case having index as the discount error with the member promotion. In other words, the center of the cases in the cases base is the promotion of the member.

The case base is updated mainly when there is a need to create or update the case with new index attributes among the cases. In other words, the case base is updated when a new problem type is introduced through the case. The system uses the indexes to insert the case appropriately into the case base. For example, if the management decides to add an additional service charge for a new product related to the internet industry, the system updates the case base with the new case according to its new indexes once member signals an error in that charge.

5.1.2 Indexing Technique

The principle of having an efficient indexing technique is very essential for case representation, storage of cases in the case base and retrieval of the cases. Case indexing is crucial in order to facilitate cases retrieval from the case base.

Members are able to report billing errors according to the elements in the bill structure. So, members' errors are limited to the bill items mentioned in chapter 4, like an error in the promotion charge or an invalid additional service. Thus, a representative set of cases should reflect the billing error that the member can signal or report on the bill. These problems in the billing can be a fault in the charge, adjustment, promotion, amount charged, or error in miscellaneous charge.

The IIS indexes the cases according to the problem type and its related attributes that the member reports during the interaction on the bill. The attributes add additional constraints to problem type in order to differentiate it from other cases at the same category. In addition, the IIS links the problem type to the member profiles, promotion profiles, history profiles, and other information to facilitate the indexing process. An example of the indexing technique used by the system is shown in figure 5.1. The IIS organizes its cases hierarchically [3] where the cases are related through the problem type and subset attributes accordingly. So, cases in the case base are organized into a decision tree structure that works perfectly with the inductive retrieval method for our prototype.

For example, as illustrated in figure 5.1, when member signals an error in the bill charges due to additional charge error. The IIS verifies if the charge is generated due to installation charge, activation charge, promotion or others depending on what the member has signaled. Once found and confirmed it was due to installation charge error, the IIS continue its verification till the appropriate attribute is found. So in this case, the IIS associates the index to the case base on the additional charge error, promotion and discount error.

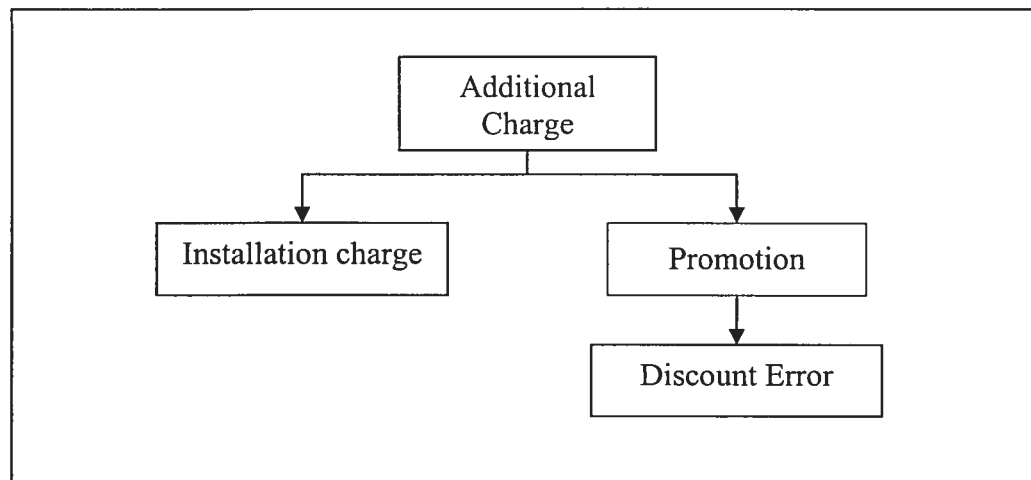


Figure 5.1 - Indexing Technique Structure

The above figure explains the IIS technique of indexing the cases. The cases are sorted by problem type and each problem is divided into subcategory or subset as already mentioned.

The indexes for the cases vary with the number of attributes needed to label each case. For example, an account having an error in the service fee caused the bill to be generated without the discount and the member was charged the full price. So, the bill total was 50 \$ instead of 30 \$ since the discount of 20 \$ was not applied. The case problem in this example is the service fee error due to discount error on the promotion itself, and not because of the wrong promotion associated to member account. The system will index the case using service fee error as the problem type at the first level of the tree, followed by promotion name and discount error at the second and third level accordingly. The solution to the case is to create an adjustment for member of 20 \$ on his next bill. And, the system informs the member that he will get an adjustment of 20 \$ on his next bill if the bill is already paid by the member, and apologizes for the inconvenience.

5.1.3 Similarity Measure and Case Retrieval

CBR uses similarity measure to help find and retrieve the most similar cases in the case base for problem solving. Similarity measure is a function that assesses the similarity of a given problem/situation to the cases in the case base. In other words, it will try to find the best previous case that is similar to the new one. Many similarity functions can be used and practiced depending on the type of the application [14, 25]. In our prototype, the similarity measure used is based on inductive retrieval. The system will find the closest case that matches the query searching the case base and matching the sub-attributes of the cases.

The member triggers a query $Q(X)$ for a billing error, where X represents the attribute. A new problem is initiated after the system checks whether the problem is valid and was never been corrected before. The IIS checks the validity and the correction history in the account profile to avoid fraudulent attempts by correcting the error more than once. For example, a query for charge Q (additionalcharge) is triggered on one of the member's bills, as indicated previously in figure 5.1. So the CBR algorithm matches the query $Q(X)$ to the available cases in the case base and identifying useful cases. The IIS searches in tree structure type for all cases looking for similar attributes, for example the problem type as error in the charge and hence X is equal to additional charge. After locating all the cases with similar attribute $Q(\text{additionalcharge})$, the IIS extends his search into a sub-attribute query and extracts the cases with similar attribute to the sub query search; for example, the activation charge attribute as illustrated in the example, and hence the sub-attribute query is $Q(\text{additionalcharge}Q(\text{promotion}))$. The IIS repeats his sub-attribute query recursively till it locates the cases that match most of the attributes and the constraints of the initiated problem. The highest similarity measure, between the query and the cases retrieved from the case base, is the most satisfactory case and is the one chosen from the case base [13]. For example, the search ends up by finding the case that has the attributes corresponding to member profile, the sub-attribute search is $Q(\text{additionalcharge}Q(\text{promotion}(\text{discount error})))$ where promotion equals to the one on member profile same for the amount of the activation charge.

5.1.4 Adaptation

The CBR approach used by the IIS does not only retrieve existing cases from the case base, but also adapts case solutions to new problem signaled by the member. So, adaptation is to change retrieved case solution so it would fit the new problem. The adaptation occurs after the system has fixed member problem, entered it on his profile and updated his history profile. The adaptation method used in our prototype is the case-based substitution. Substitution is the process of replacing some parts of the case solution by new ones that correspond to current situation. The IIS manages the substitution depending on the similar case found and the accounting parameters needed to fix member account. This can be simply changing different attributes, like an adjustment to a charge, a substitution of amounts to adjust a certain parameter, or a combination of two or more methods at the same times.

The adaptation methods lead to the modification of old solution to a new problem, which is very efficient for our application. This is due to the changing environment of internet services and promotions in current competitive markets. Furthermore, the CBR process used in the system is very structured, in which problems are divided into sub-problems with their related sub-solutions, which render the adaptation more convenient and easy to use by the application. For example, if the member was overcharged since he was given the wrong promotion. Member was registered on regular promotion 40 \$ however he requested to have a yearly contract to have a discount every month and pay only 30 \$. Member noticed the error one month after and signaled the promotion error using the IIS. After searching the case base for the most similar using CBR similarity measure. The system analyses the solution of the retrieved case, in order to verify if changes needed on the case's solution so it reflects the correct steps. The original solution of the case retrieved was to change member's promotion and to inform him of the modifications. However, in the revised case, the solution is also to apply an adjustment for the proration period till the error was signaled, change the wrong promotion to the correct one, and inform the member of the modifications. This example is illustrated in table 5.3 where the IIS adapts the

previous solution and substitutes it with the new solution. The new case is added to the case base according to its index for future use as part of a new learned case.

Table 5.3 - IIS Adaptation Example

Previous Solution	New Case Solution
<ul style="list-style-type: none"> • Change promotion to the contract (30 \$) • Inform member of modifications 	<ul style="list-style-type: none"> • Change promotion to the contract one (30 \$) • Apply adjustment of 10 \$ • Inform member of modifications

5.2 IIS Architecture

The IIS architecture reflects the development of the two main phases that we developed during the project progress. As already mentioned, the first phase replies to members' general queries, like updating personal information. There is no intelligent assistance or request in this phase. It is composed of three levels, the *internet level* allows the system to interact with the users, and the *server level* contains the IIS prototype that is in charge of processing the information from data sources and the *database level* that contains the system database.

However, the second phase requires an additional process since the IIS corrects billing errors using CBR after interacting with the member. This phase is different from the first phase due to CBR that is added at the server level to help correct billing queries. It uses the traditional CBR steps that were previously mentioned. To realize our approach, the IIS architecture is presented in the following two figures below 5.3 and 5.4, which describe the two phases, the non-intelligent phase and the intelligent phase. The system architecture is presented in two phases in order to simplify the process.

5.2.1 Non-Intelligent Phase

As we conclude from figure 5.2, the IIS performs non-intelligent activities, since it only performs regular actions to access or update information from member and bill profiles. For example, if the member requests to update his credit card, the IIS retrieves the current information from the database and displays it to the member. The member updates the number and continues the call process. Many additional general questions can be added to the application depending on the questions' trend that the management notice in members' calls. Information or queries, on many subjects, can be added in the future; such as, upcoming service enhancement, available different promotions, price analysis of other internet companies, types of services, Internet tutorials, and other features depending on clients' requests.

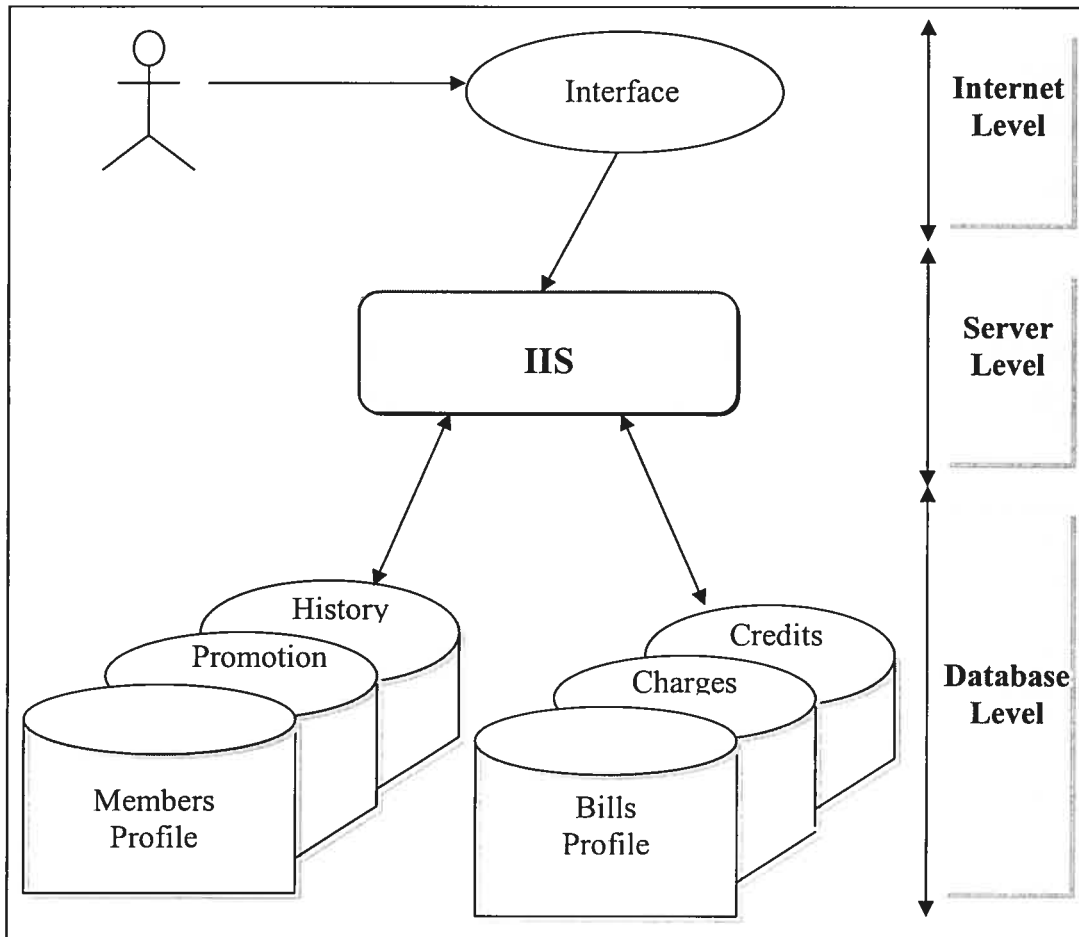


Figure 5.2 - General query diagram

5.2.2 Intelligent Phase

The second phase of the IIS is developed based on CBR and intelligent interaction so the member can signal errors in case of occurrence. The IIS validates the member profile and compares it to the bill coordinates. Once the member reports a problem, it triggers the CBR algorithm; and helps correct the bill when needed. As we notice from the figure 5.3 below, the CBR has been added to the architecture to distinguish it from regular queries. The CBR algorithm, developed and used in the application, is launched when the system confirms the error is valid and is not already been corrected. This verification is confirmed through the *Events* file where the billing corrections are stored.

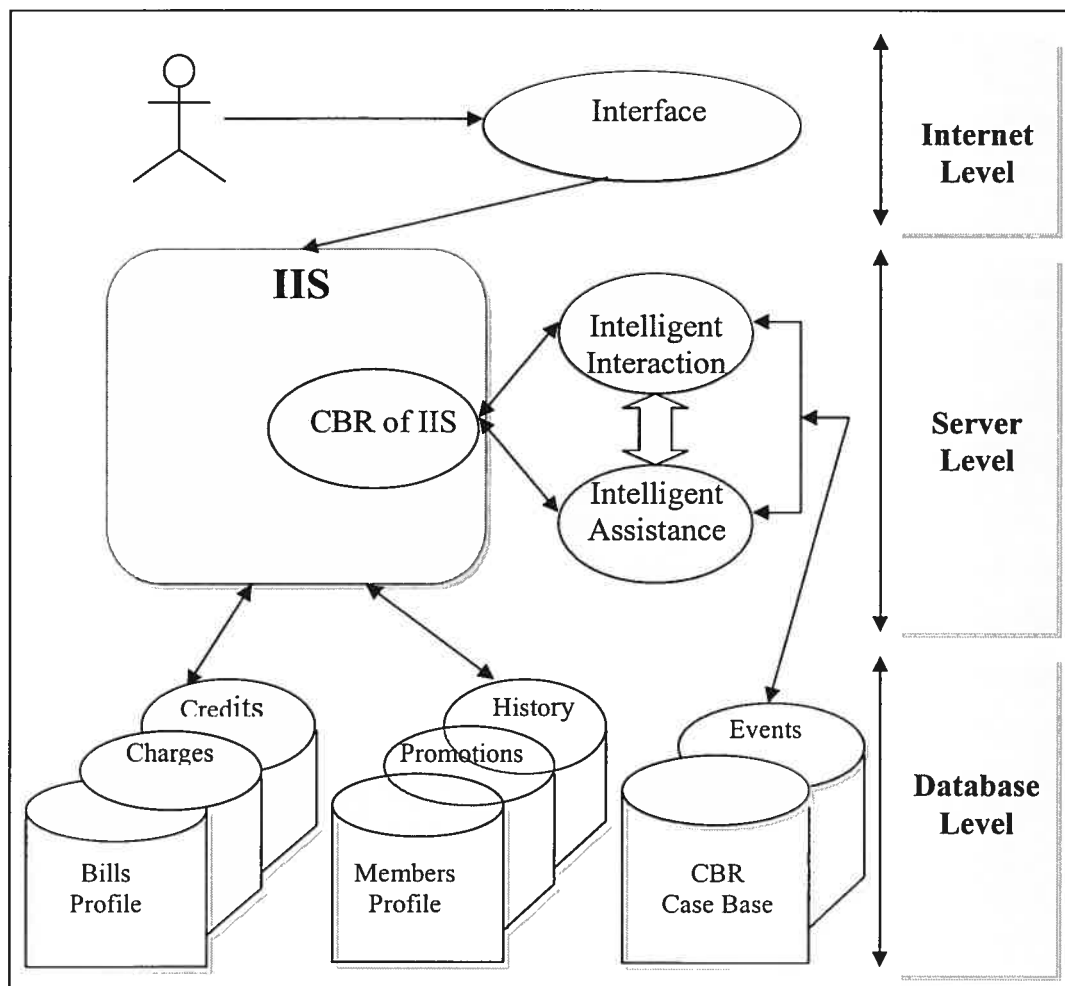


Figure 5.3 - Query based on CBR diagram

The proposed solution uses intelligent interaction to assist the member signal the billing error. So, in other word the IIS applies intelligent assistant to pinpoint billing error signaled by the member. The intelligent interaction allows the member to signal the billing attributes that are associated with his bill. For example, the member will not be able to signal an error in additional service charges if he is not registered to any additional service. The IIS assists the member by highlighting the area where the bill errors can occur; an example illustrates the interaction in chapter 6.

So, the IIS proposes new intelligent approach to help member correct online billing errors:

- Intelligent assistant that highlight only the areas that match member profile on specific sections of the current bill this is triggered once the member report a billing errors after the IIS finish explaining the bill. The sections on the bill vary according to member billing and the service he is subscribed too. This approach presents all opportunities where billing errors can occurs.
- Intelligent interaction that understands member reporting once he clicked on the bill section. The system is able to differentiate the different billing sections. The system validates the error, analyze it to verify if already been corrected, and then launch the traditional CBR that follows the CBR cycle as illustrated in chapter 3.

5.3 Architecture's Levels

There are three levels in total, as we can notice from the IIS architecture for both the intelligent and non-intelligent phase: *Internet Level or Interface Level, Server Level, and Database Level*. The different levels of the system architecture interact with each other in order to respond to member requests and provide excellent customer service response.

Internet Level: this level shows the interface between the users and the IIS application. The member can signal his queries and interact with the system in order to understand, view or correct his bills from any computer that has access the internet with a web browser. The IIS is able to interact, understand member requests and submits it to be processed at the server level in a very effective and efficient way. Also at this level, the IIS communicates the results to member's queries whether it is general, simple queries or intelligent ones that need the use of interaction and the CBR algorithm.

Server Level: this level contains the IIS prototype and the CBR algorithm. At this level the application retrieves the information from the database application and answers member requests when it is non-intelligent requests. For example, member wants to verify when his promotion will be over. The IIS gets the data from the database and displays it in a personalized way according to the member profile. In this case, the application uses most of the database except the case base since no correction is needed. When member signals a billing error and requests correction, the system communicates with the CBR that uses its traditional algorithm and technique to verify billing error validity and correct the error when feasible. The CBR of the IIS has access to the case base and the events.

Database Level: at this level, we have the database of the IIS prototype. The database is implemented with MySQL for its simplicity and efficiency. All information related to the members, bills, cases and many others are presented. The information is divided mainly into three categories, as shown in the figure 5.3 the bills' profile, the members' profile, and the case base. The bills profile consists of generated monthly bills associated with member accounts, credits and adjustments applied to bills. The members' profile contains member information, promotions and history files that document member profile modifications. And finally, the case base contains the cases of the CBR and the events refer to the corrections implemented on members' bills.

5.4 CBR Diagram and Algorithm

The IIS relies on CBR to correct billing error once signalled by the member. The main functions of the CBR algorithm applied in the IIS follows the CBR steps presented in the CBR cycle.

The algorithm does the following:

- 1- Call a function to check if the problem is valid and whether the error corresponds to the company billing aspects. If the problem is not valid, the IIS will inform the member and no modification will be applied.
- 2- Call a function to check if the problem was already fixed, the system checks in the event file if an entry was entered to reflect the correction. If the problem is already fixed he will inform the member and no modification will be applied.
- 3- Generate New Problem attributes and parameters that could be used by the IIS to check similarity with the case base.
- 4- Check for a previous similar cases, if found retrieve solution, else revise and adapt the proposed solution to the current situation.
- 5- Apply a solution to the current problem
- 6- Add the new case in the cases profile if necessary.

The CBR cases are stored in the case base. The profile also contains the events profile that system uses to verify if the member has already signaled the error before and if it was corrected. So, before signaling a new problem for the CBR process, the IIS verifies the error validity and proceeds to the next steps of the system check. Those two steps are very essential for the CBR algorithm.

The CBR diagram is illustrated in figure 5.4 hereunder:

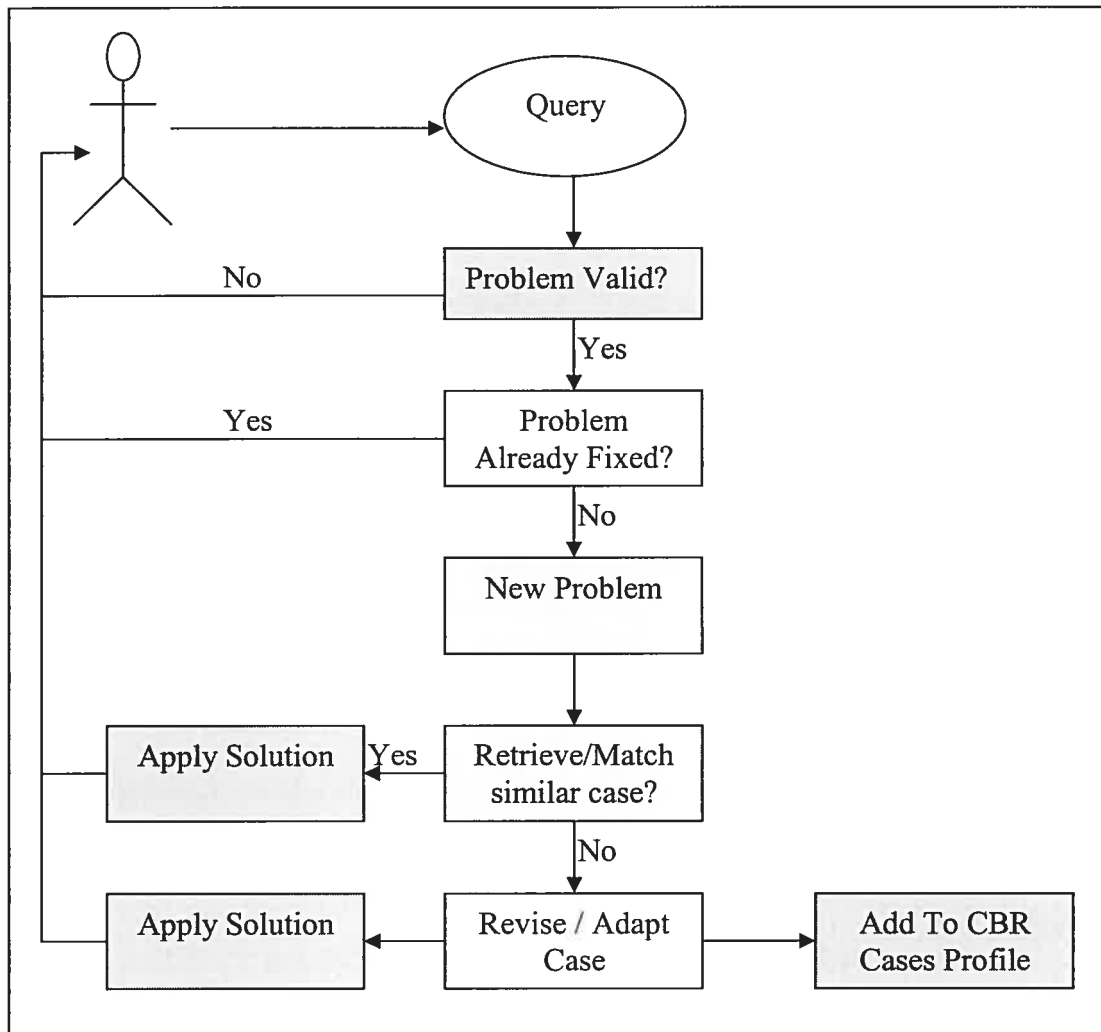


Figure 5.4 - CBR algorithm diagram

The CBR algorithm of the IIS application is illustrated here:

Function IISCBR (*Problem, bill*) return results

Results = no change

If not problemvalid? (problem) then return results

if problemfixed? (problem) then return results

NewProblem(Problem, bill) return case

loop do

if found?(case) in the casesprofiles successfully with all indexes

```

        apply casesolution(case) and return results
    else
        apply casesolution(case), addtopofile(case) and return results
end

```

*Function NewProblem(Problem, bill) returns attributes
generate the attributes indexes for case matching*

*Function casesolution(case) returns results
pick a solution from the casesprofiles where indexes match the case ones*

*Function addtopofile(case)
add the case to the casesprofile for future similar cases*

5.5 Conclusion

This chapter explains the IIS architecture and algorithm by presenting, in details, the CBR algorithm used and its steps, in addition to the different parts of the levels of system architecture. The two phases of the IIS are described to give an overview of the application and how it handles non-intelligent and intelligent queries. Non-intelligent queries based on simple operations to help member retrieve, view and update his information. Intelligent queries based on the CBR problem-solving technique and intelligent interaction. An overview of case representation is elaborated to help view possible problems and solutions that the IIS can manage. The Indexing technique follows a hierarchical approach to facilitate retrieval algorithm. The similarity measure and case retrieval procedures and adaptation represent a simple approach used by the application due to limited options of current billing aspect. The CBR algorithm is also mentioned along with the implementation of the validation function to test problem validity. The IIS architecture in both phases are illustrated and described with their different structure levels to help understand the system role. The information presented in the chapter review the intelligent factor related the prototype. The interaction approach distinguishes the IIS from available online billing, which are static software, and help define new approach to online billing explanation and correction.

An illustration of the IIS application implementation, menus, options, screenshots and examples is discussed in the next chapter. Furthermore, it reviews key components of the IIS in order to clarify its design and functionality.

Chapter 6

CHAPTER 6: IIS SOFTWARE

This chapter discusses and presents the IIS software. The application is implemented using PHP. PHP stands for *PHP: Hypertext Preprocessor*, which is a widely used general-purpose scripting language that is especially suited for Web development and can be embedded into HTML [U18]. The chapter also presents the steps that the IIS follows in order to assist and serve the members. The menus are described in details to help understand how the interaction between the members and the application occurs. The interaction is necessary to understand member requests and queries in order for the IIS software to respond with the appropriate answers. Many important key components are presented in order to clarify the design and the functionality of the application. The IIS manages the interface and information retrieval for the member and respond to his queries. The CBR is launched once the member signals a billing error and requests to report the error. A complete scenario is also presented in the chapter to illustrate the interaction and the CBR functionality.

6.1 Log in Section

This section illustrates how members can access to the application through the company web site. Members can access the link on the company site that launches the Prototype. The launch opens the log in window as illustrated in Figure 6.1, asking member for their user id and password to log in. On the other hand, if the member fails to enter the correct user id and password, a message appears asking the member to re-enter the information again. With the assistance of a help screen, members can view a sample a user id in order to help them locate their personal information. In the future, a similar application can be developed for non-members to assist in their general question. A lot of non-members are interested in verifying current new promotions and services offered by the internet service providers. An additional part

to the IIS can be implemented to answer non-members about general questions regarding: promotions, billing methods, billing dates in general, or simply compare prices with competitors... This information is usually in the FAQ section. Unfortunately, the information is not personalized. The IIS could also verify member budget and propose the service that best suites member needs.

After the member enters his user id and password in the log in section, the IIS authenticates the user id and password with the IIS database. This helps the application to retrieve member information like name, salutation and others in order to facilitate the interaction with the client. In addition, the IIS analyses member profile to provide personalized service according to the member's needs [4]. For example, if the member has an antivirus service, the IIS can offer the firewall application as a complementary service to his protection software. Or, the IIS offers member a contract to help him get a discount and save money. In other words, the IIS acts like a consultant that satisfies member and company needs. The user id and password are given to the member once the account is created, and are the only parameters needed to log in.

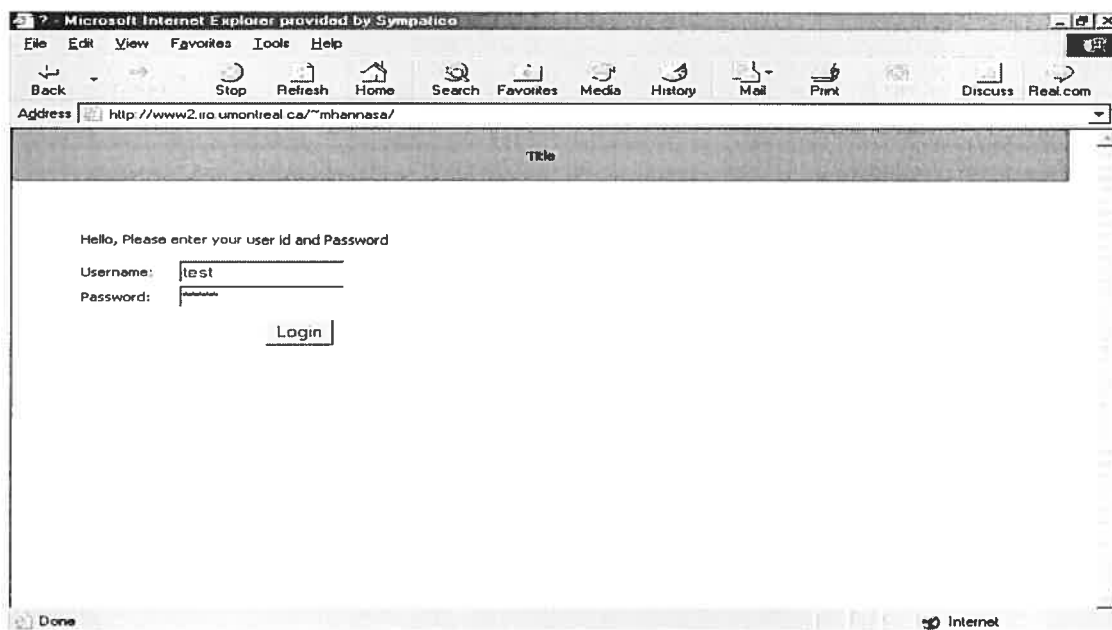


Figure 6.1 – Screen shot of log in window

6.2 Menus & Windows

After retrieving member information, the system posts the first menu giving the member the chance to choose his questions from a main menu or to type it. Options are already displayed in the main menu and the member can choose the question that corresponds to his query. The questions' selection is based on most requested questions in internet call centers. The menus are automatically modified depending on the number of occurrences of a certain option from the menu. The menu manipulation and the number of occurrences can be changed according to company objectives. For example, when the members choose the option of updating their credit cards by clicking on it, the application is able to count the number of occurrences of credit card update. Once the count reaches a certain number predefined by the management, as already specified, the system automatically remove the option of updating the credit card information from its current menu and place it in the main menu to appear directly to the members once they log in. This allows the IIS to present and keep track of the most chosen options in the main menu to facilitate members' search.

As illustrated in Figure 6.2, clicking on the '*menu*' button opens a new window with additional options to clarify member needs, or a member can simply click on '*typing*' button and types his questions using keywords. The IIS application parameters can be modified accordingly to reflect the company and the application names. For example, by setting the parameter of the application name to Sam, the IIS will introduce himself as Sam. As we can notice from the figure, the Members can choose one of the three available buttons. The first button opens the main menu window, the second opens the typing window that allows the member to type his questions. For example, after clicking on the '*typing*' button, if the member wants to update his credit card, he can simply type CC or credit card in the search field and the IIS takes him directly to the window where the credit card information can be updated. The IIS application adopted this technique of keywords for the members who like to go directly to the related window. This helps the application to avoid member frustration of not being able to find the right menu directly. Figure 6.2 also shows the log out button that

signs the member out from the application. Members can sign out using this button when they finish handling their accounts. The system also signs member out automatically when the application is idle for more than five minutes for security measure. This method minimizes the risk of allowing someone else to access member's account and information, in case member quits his station without logging out from the IIS application.

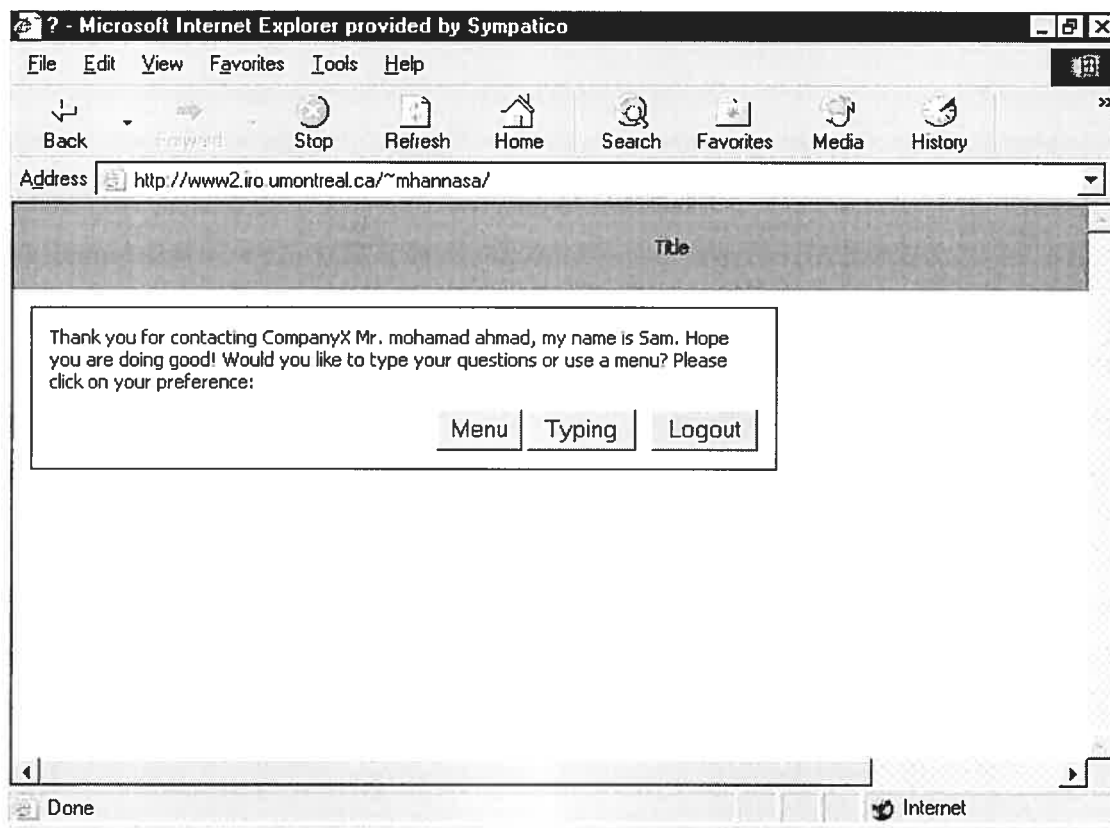


Figure 6.2 – Screen shot of typing/main menu window

As we notice from the above window, the IIS used a friendly and warm greeting by using member name to customize the interaction. Members can choose their category of interest, which will lead to additional and subcategorized menus. Each option opens a new window with related questions/options to that section and is available on the page. The new windows include related options and generate the second step of the IIS call process, which is to assure it can help the member with his queries. Here

are some examples of the IIS call process paths, described in chapter 4, that follow when member choose his question from the menu.

- Main Menu>Verify your billing questions> Billing explanation>Ensure satisfaction of the billing> Offer Further Assistance> Offer Additional Services>Closing.
- Main Menu> Verify your promotion questions>Promotion Menu> Promotion question> Ensure satisfaction of the billing> Offer Further Assistance> Offer Additional Services>Closing.
- Main Menu> General questions> Questions menu> Question answer> Ensure satisfaction of the billing> Offer Further Assistance> Offer Additional Services>Closing.
- Main Menu> View History> check history parameter> Question answer> Ensure satisfaction of the billing> Offer Further Assistance> Offer Additional Services>Closing.

Once the member starts the main menu window, many menus appear to diversify member options and let him choose his questions. The following section gives examples of the IIS Menus and Windows and helps understand how the IIS personalizes his contact with the members. The main menu gives the member many options, such as directing him to the billing in order to assist him understand it. Clicking on any choice within the menu opens a new window with multiple options depending on member's choice, as illustrated in Figure 6.3. The figure shows the main menu that appears to the member. For example, the main menu gives members different options that they usually expect from internet service companies. Members can update their personal information like address, view their monthly bills, view their history, change internet service and clarify promotion information. The IIS allows members to access their history files, where the IIS records all the

modifications made on member account, like change of service, adjustment or charge applied on the account. The menus' structure used in the IIS application is similar to the traditional web application that is based on mouse click and allows the user to navigate among web pages that contain different window applications.

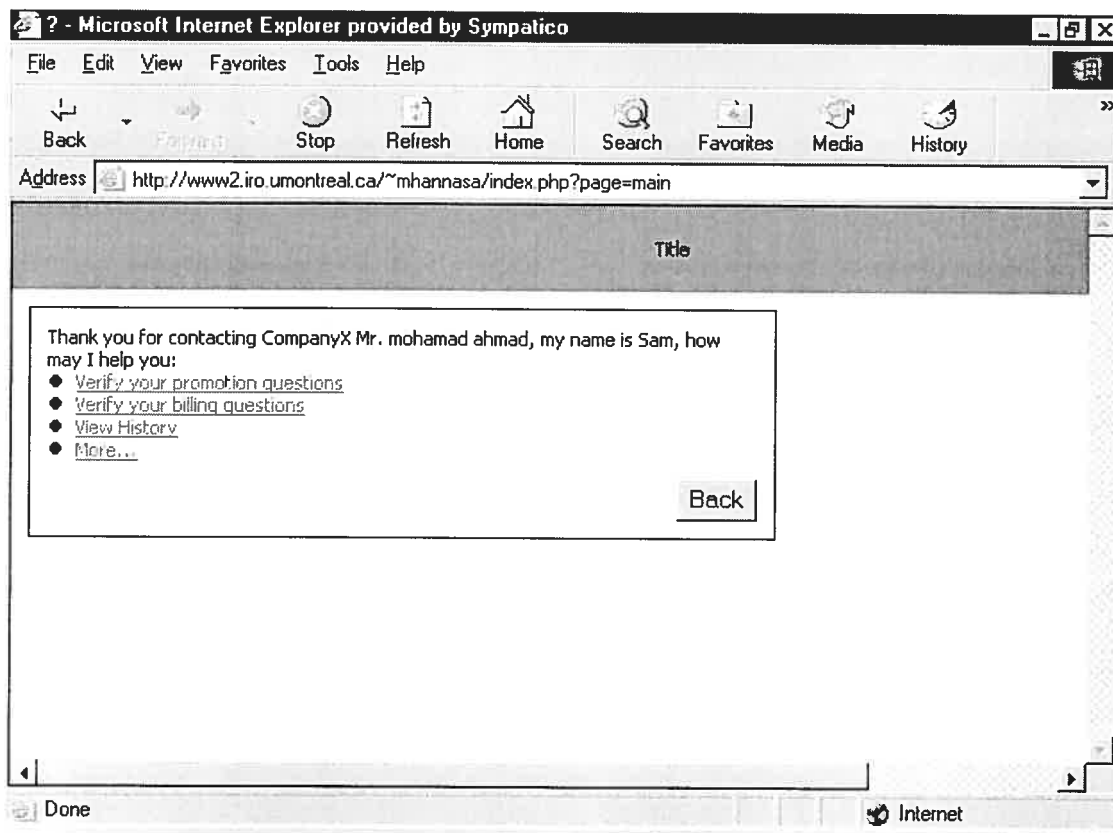


Figure 6.3 – Screen shot of Main Menu

A member can navigate through the menus and choose the options that meet his request. The IIS, as previously described in chapter 5, manages this interface through menus and interactions. The system is able to lead the member to the appropriate menu once he chooses the section or question. The member can simply click on one of the available options and the application can redirect him directly to the appropriate web page. For example, figure 6.4 shows the questions related to promotions in general; such as, whether the member can have a new promotion. When a member clicks on the promotion menu, a new window opens and gives him the option to choose any of the promotion questions. For example, members can

verify when their promotion will be over in order for them to know when they will start paying the full price. These types of questions can be adapted according to the type of services or products the company offers.

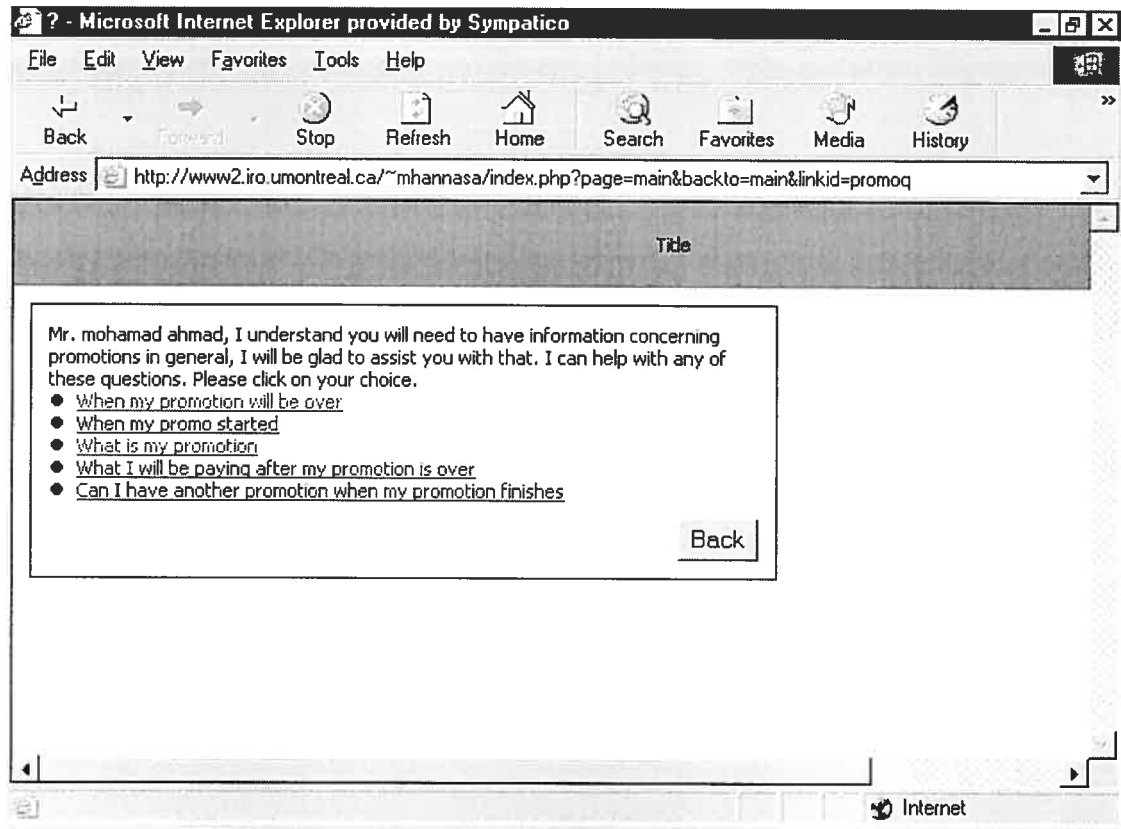


Figure 6.4 - Screen shot of promotions window

The IIS application is so flexible that the parameters of the menu can be manipulated and changed in order to suite any companies' products and services. As we also notice from the example in figure 6.5 of the update menu, the IIS application is able to clarify member question and elaborate on the options that a member can have. This interaction personalizes the application so the member feels like contacting a live customer service representative. Each of the menus on the second level of the main menu points directly to the information. Thus, the member can access any information in his account by two or three mouse clicks at the most. This facilitates the findings of members' queries and encourages them to use the system for its simplicity and efficiency.

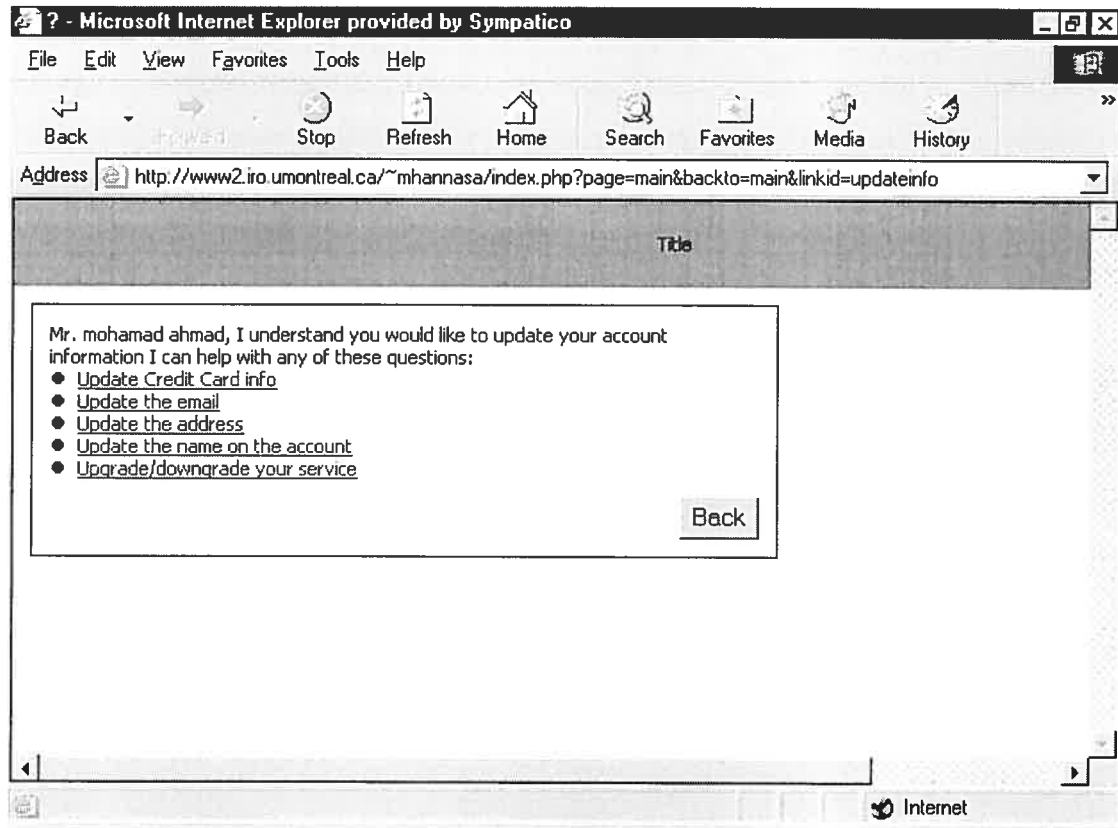


Figure 6.5 - Screen shot of update menu

6.3 Billing Explanation Example

Another example of member's bill is shown in figure 6.6. The window shows a detailed summary of the bill, billing date and coverage period. The bill also includes all the additional charges like the installation charge, monthly charges, additional service charges like the antivirus, tax and the total amount charged. The screen shot of the bill also shows the 'report of a problem' button that members can use to signal an error in the bill. The bill explanation starts after a small delay and the IIS opens small windows to the right of the bill respectively, describing the charges one after the other in order to make it easier for the member to understand all the charges. The IIS explains to the member the bill in details, as illustrated in Figure 6.7. The IIS uses information provided in the member account from the company database, and provides the explanation; this information changes with different members accordingly.

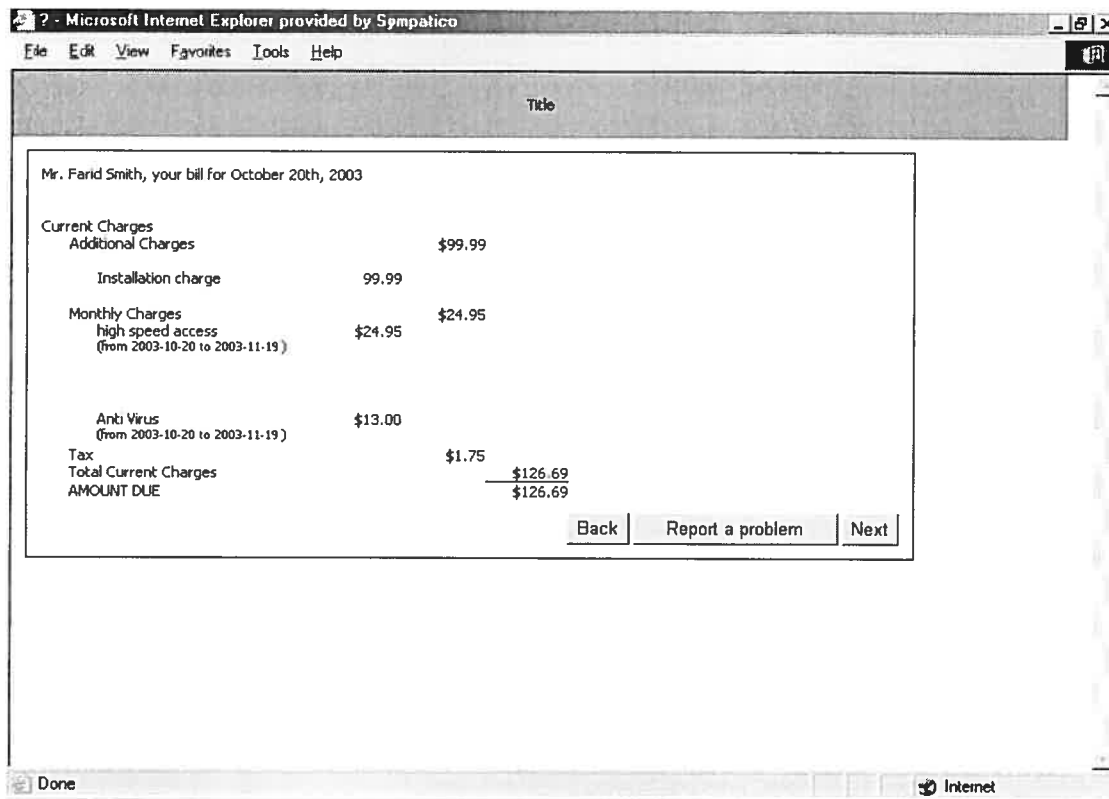


Figure 6.6 - Screen shot for the bill in general

During the process of bill explanation, each section corresponding to the explanation is highlighted. The details of the description stay on the bill to give members the time to review the information for clarification. The bill items, like the monthly charges, at this point are not highlighted. The member has the option of continuing the process if he is satisfied with the system explanation and click the next button. Or, in case the member finds an error and wants to signal it, he can simply click on the 'report a problem' button.

Once the member clicks on 'report a problem' button, the IIS will use its intelligent interaction and assistance to direct the member to appropriate bill section where the error can occur. Otherwise, the IIS will explain the bill section by section as illustrated in figure 6.7.

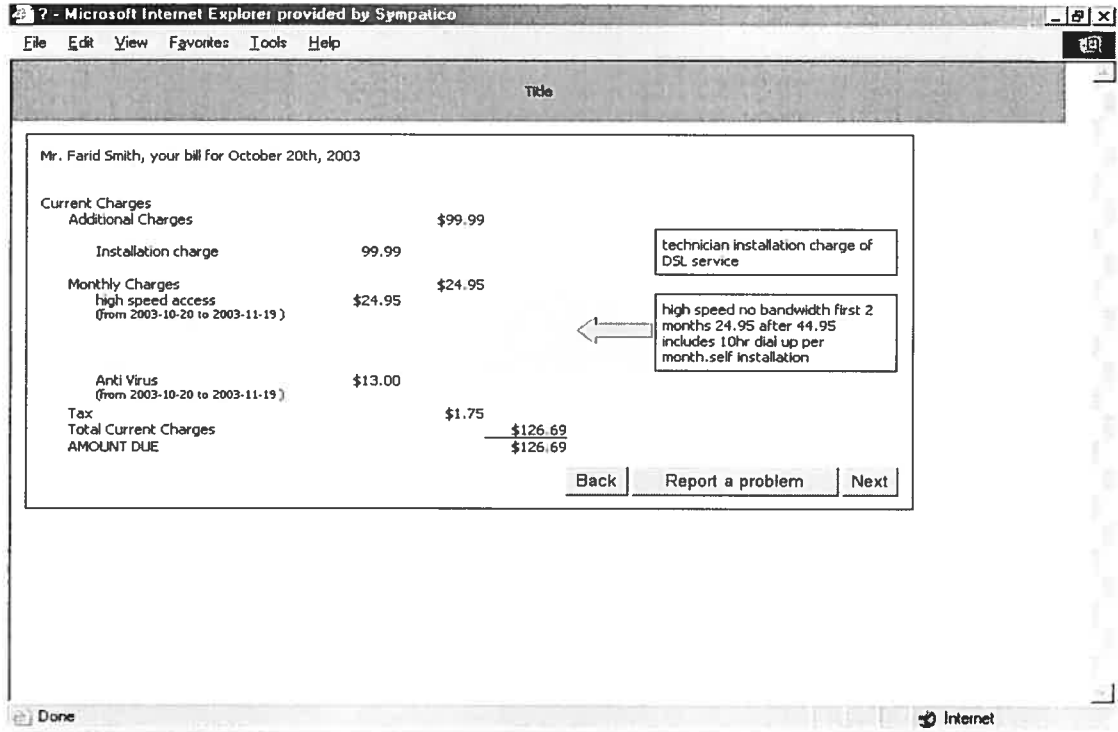


Figure 6.7 - Screen shot for the bill explanation

6.4 Reporting Errors Example

Retrieving information from the IIS database is fast and accurate as described and illustrated in the system architecture. The IIS takes command of retrieving member bills, or general information depending on member request, and explain it to him when necessary. The member is able to view the information and get a clear description and explanation of the bill. The explanation provided by the IIS is dynamic and changes according to member service. The member also has the option to report a problem if the information presented is inaccurate or incorrect. This triggers the intelligent assistance that waits for the member to signal the billing error. Now, in case of billing error, the member can simply click on the highlighted area to report the error. The highlighted area covers the bill sections, like the monthly charges, additional charges and many others. The error can be anywhere in the charges, promotion, price or services sections. The application analyses member request with the help of the IIS's CBR, using validation rules and CBR algorithm, as described in the previous chapter to

validate if the request is accurate and correct in case of billing errors. All this is done automatically by a mouse click and the member does not have to enter any parameter or attributes at all. Figure 6.8 shows the member bill, after he clicks on 'report a problem' button, so that the section is highlighted and ready to launch the CBR algorithm once the member choose the section that contains the error.

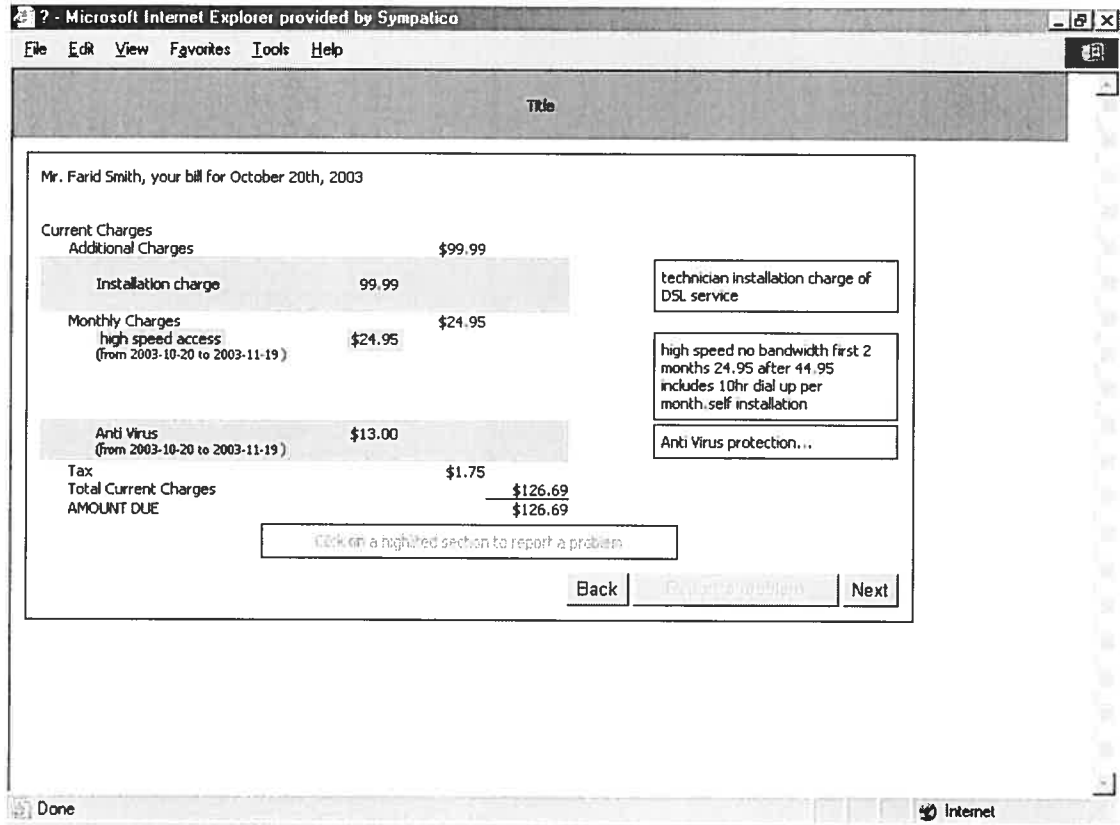


Figure 6.8 - Screen shot of member reporting a billing error

For example, if the member does not get his discount for the last month. When the member signals that there is an overcharge under the service monthly charges, the IIS launches the CBR algorithm after verifying if problem not fixed before, and if it is valid. If valid, the CBR searches the case base for similar cases, as the problem is an overcharge in the service price. Once the cases are collected, a second search is launched for wrong promotion within the collected cases until the same promotion number is matched. Once found the system applies the solution of the case, if necessary, the IIS modifies the overcharged amount and adapt the new solution. The

IIS checks whether the error has already been corrected before, to avoid for example adjusting the account more than one time. Thus, in case the member tries to signal the error more than once, the system is able to track it from the events file and inform the member of the date the error was corrected as illustrated in figure 6.9; Otherwise, the IIS apologizes to the member for the billing mistake and informs him that a correction is applied and that he will get the modification on his next bill. The IIS records all modifications on the service in history file so members can view it in details.

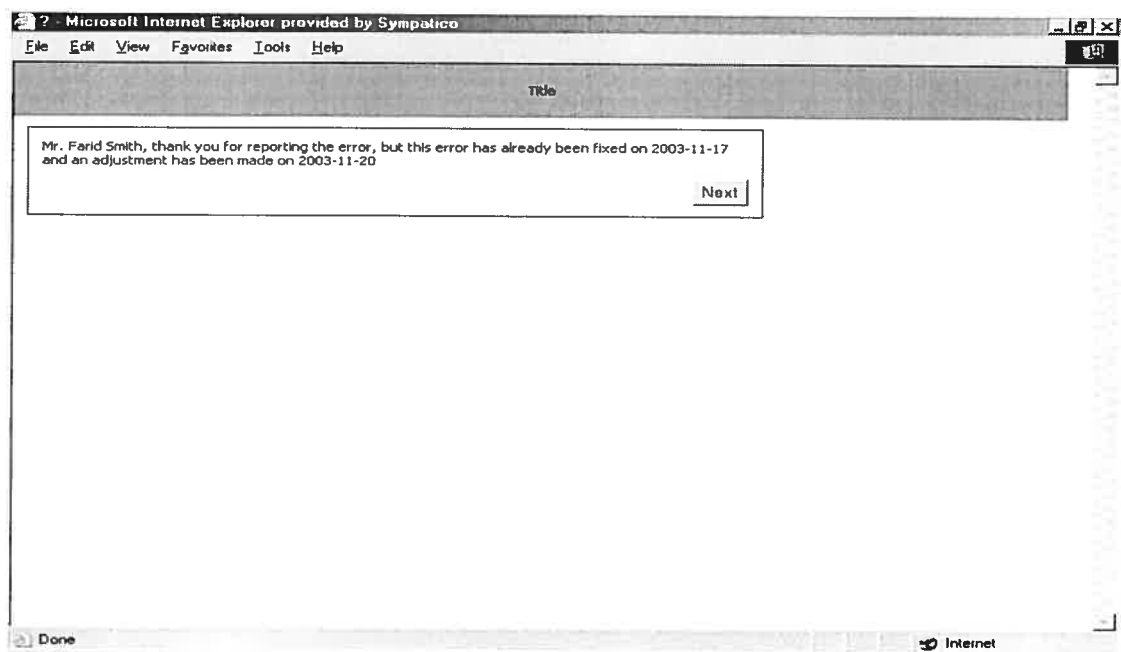


Figure 6.9 - Screen shot of the IIS replying that problem was fixed

6.5 Scenario

In this section, we present a complete scenario that shows the use of the CBR in the IIS application. In this example, Mr. Smith registered for the super-speed service for 24.95 \$, and the promotion 'SSAV02' included an antivirus service for 13 \$. Unfortunately, due to system accounting error, all members registered to this promotion were charged installation charge. Mr. Smith received the package and installed it himself. One month later, he wanted to verify his bill online and he

noticed that he was charged 99.99 \$ for installation charge as shown in figure 6.6. Mr. Smith was surprised and directly clicked on 'Report a Problem' button as shown in figure 6.8. The bill sections became highlighted and Mr. Smith clicked on the installation charge to signal the error. The system receives a request that the member reported a billing error and started verifying and analyzing the information. It will verify the validity of the error since according to member profile he didn't request any technician to install the service. Also, the error was not corrected before. The IIS launches the CBR algorithm that searched the case base for case (or cases) similar to the Smith case. Mr. Smith case attributes are: additional charge as the installation charge and the promotion as 'SSAV02' describing the case problem. Since, there is an exact similarity with another case in the case base, the IIS reuses the retrieved case and solve the current problem by applying the solution steps in the case. The solution is to apply an adjustment on Mr. Smith account for 99.99 \$, and to apologized for this billing error. The IIS confirmed the modification to the member and continued with the call process. Mr. Smith enjoyed using the system because of the fast and accurate response. The following month Mr. Smith verified his bill to ensure that the adjustment was done and all the information was correct.

6.6 Conclusion

This chapter reviews the IIS application and how it works. The menus and windows are described in details to assist understanding how the interaction between the members and the application occurs. A member can open the bill and the explanation of the charges will follow; or he can simply report a problem and signal in which part of the bill the problem is found. The IIS validates the reported error and if valid, it corrects the error and informs the member of the outcome. The chapter also describes how the IIS personalizes his responses to member queries in order to add a human aspect to the system. The application answers members as if the member is talking to live agents.

Many examples and screen shots illustrate the unique approach of the IIS. The user can easily notice the shaded areas where the interaction can occur. The interaction environment is simple and easy as a mouse click. Members also have access to their history files, in order to help them view online when modification took place. The application uses the history file to validate member requests and as a proof of member modifications. In contrast to the available online billing application, members have no access at all to their history information.

Chapter 7

CHAPTER 7: EXPERIMENT & RESULTS

This chapter presents and analyzes the experiment performed on the IIS prototype and its results. The experiment is described in detail and consists of two parts to discuss all aspects of the prototype. The first part describes the application functionality and the second measures key values to validate its success. The two parts illustrate the results and its effects on users and the company. Furthermore, the chapter reviews and compares the results of the evaluation to the online available services. We are going to present and describe the experiment steps and then discuss and illustrate the results.

7.1 Experiment Description

The experiment performed on the IIS is based on users' feedback and is divided into two phases:

The first phase of the experiment is to test the IIS application and assure that all the components are functional and free of bugs. The experiment requires the help of variable users to test the prototype and get feedbacks in order to enhance the IIS application. The random users are selected according to three groups, to help test the software:

- The first group of users consists of computer science graduate students with experience in the domain.
- The second group includes members who contact call center for billing explanations.
- The third one consists of my colleagues who are supervisors and agents in an internet service provider call center.

The total number of all different users is 47 (n=47), the first group consists of 12 users, the second group contains 20 users, and finally the third group consists of 15 users. Testing the application with variable users permits us to ensure that the intelligent and non-intelligent phases are functional and free of bugs. The different users are also able to give their comments and findings in order to reveal the benefits the application reflects on the company and the members, as illustrated in figure 7.1.

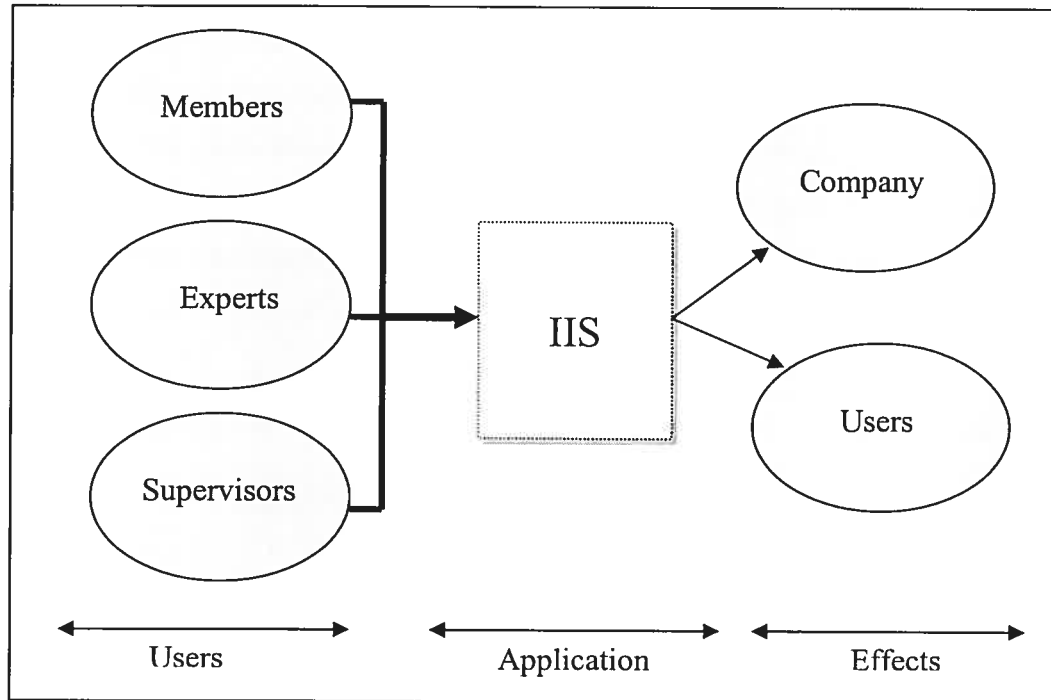


Figure 7.1 – Experiment groups and effects

The second phase of the experiment was to measure multiple key values to validate project success. The keys are selected to reflect the effects of the IIS on the company objectives and the users of the application. The key values measured, in the questionnaire, are divided into four categories:

- *The level of customer satisfaction:* contains questions related to member satisfaction from using the IIS prototype.
- *The application performance and response time:* contains questions related the prototype performance in order to encourage member to use it.

- *The intelligent interaction and billing correction*: contains questions related to the prototype ability to correct the billing error with minimum member intervention.
- *The system interface and if it is user friendly*: contains questions related the prototype interface. For example, if it was easy to use and if it is user friendly.

All questions, of the four categories, can be found in the questionnaire presented in the appendix. The users provide their queries and the system answers their questions respectively after they login. The validation of the application occurred on the web from different locations. Some of the users test the application in my work location, the internet service provider call center, others from home or work since they were sent an email including the questionnaire, tips, and access information.

The application is accessible from any computer with access to the internet at <http://www2.iro.umontreal.ca/~mhannasa>. Each one of the users was given a user id and password in order to log in and test the IIS application. The respondents were asked to fill the questionnaire when they run the IIS.

The users are asked to test the application twice, and to enter the duration each time accordingly in the questionnaire. During the test of the application, the users had no time restriction to view their account, manipulate with the billing or request general queries. However, the average of the duration reported in the questionnaires for each session varied significantly between first and second time. When users accessed and tried the application for the first time, they reported a duration of 10 minutes on average, the second time was about 5 minutes. This shows that users were able to adapt directly to the application and familiarize to the options it included. Figure 7.2 shows the impact of testing the IIS application more than one time on the duration to complete member queries. In other words, users require a reduced amount of time to complete their queries after accessing and using the application more than one time.

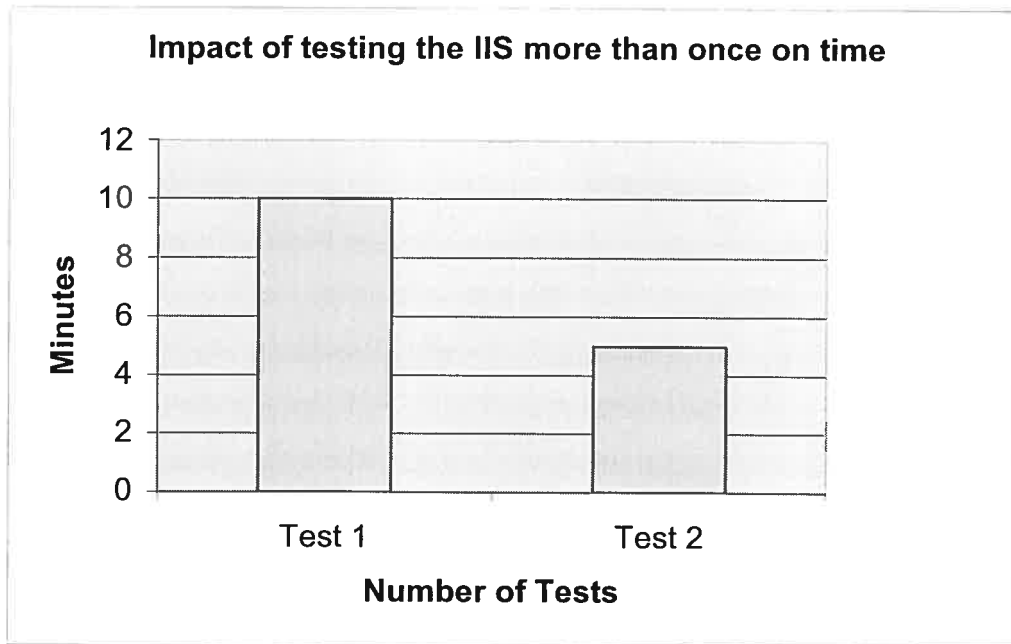


Figure 7.2 - Comparison of the duration time

Our case base is not very wide; it included 80 cases with billing defects that are described by problem types. The cases are generated during the test that we are performing while developing the application. In our experiment, we choose accounts that have billing problems in the following attributes: discount-error, wrong promotion, overcharge and wrong additional service. For example, an attribute of discount-error is when the member didn't receive his discount. Member supposed to get a 20 \$ discount for his first month according to his promotion. However, the system generates the member's bill without the discount and he is charged the full price. In this case, the member can report the billing error and expect that the IIS is able to fix it.

A paper including tips is distributed to each user in order to assist him run and use the application. A copy of the tips and the questionnaire are available in the appendix. The same information can be added on the company web site in the help section to assist the member in case he requests help and guidance. The hardware needed to run on the application does not need to be powerful and users tested the IIS on the available computers on locations.

7.2 Evaluation & Results

The users' evaluation of the IIS application is based on aspects that reflect the importance of such an application for members that contact the call center for billing issues, and for the companies that want to reduce cost and increase customer satisfaction. The users had to evaluate four different aspects of the IIS application as described above in the experiment section. Each aspect reflects the benefits that members and a company can get by developing such a system

7.2.1 Level of Customer Satisfaction

Customer satisfaction is one important aspect for many companies in order for them to stay competitive in today market. In general, members complain about agent impatience when explaining the bills due to the time limitation many companies impose on their customer service representatives. Another aspect is the wait in queue for the next available representative to take member's call and help him with his inquiries. According to the different groups invited in our experiment, the users are in general satisfied with the application service and its personalized responses. The percentage of satisfaction reported by the users is 70% compared to online available billing display. The users did not encounter any difficulty in using the system. The percentage of the level of satisfaction is produced by calculating the average of the amounts given by the members. The members had to answer four questions related to their satisfaction as illustrated in table 7.1 and 7.3, all the questions were related to customer service and the averages were calculated from these results.

After analyzing member answers in the level of customer satisfaction section, we noticed that even though the current application helps the member through the call process steps like real agents, some users (47%) are disturbed by the fact that it is simply a machine and they preferred to speak to a live agent. Figure 7.3 illustrate the collected answers to the first three questions in the first section of the questionnaire mentioned in table 7.1.

As we notice from the information gathered from the users for this section of the questionnaire, users are really satisfied with the IIS application. The prototype can personalize its contact with the members and answer all their questions. However, it is obvious that users are still having difficulty trusting the application since 47% of the users still like to contact a live agent to explain and fix their billing issues. Even though 47% seems a small number but many companies will be thrilled if they can redirect half of their members to the company's web site, and thus reduce the inbound calls. Specially, if the customer service representative of the company receive thousands of calls every day.

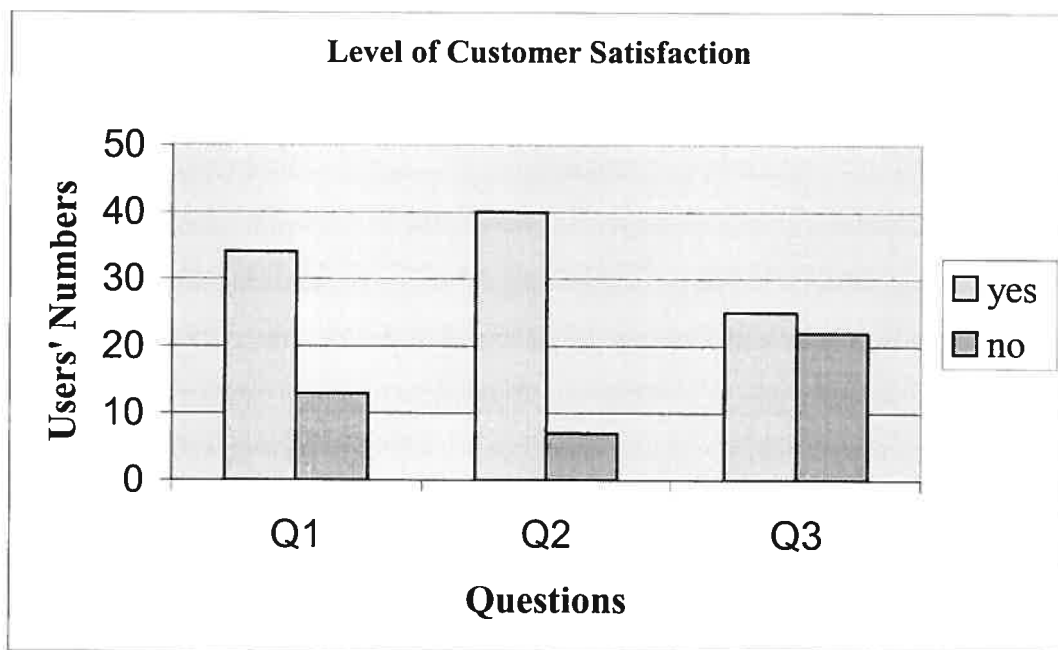


Figure 7.3 – First three questions of Level of customer satisfaction

The last question of this section represents the satisfaction of users from the application's customer service. This question is very essential for the application success, since this type of applications gradually replaces customer service representatives. Users have graded the application in a different ways depending on the customer service they expected from customer representative. However, the results

were good and the mean of the customer satisfaction ends up 70% with a standard deviation of 5.6 which makes the application to be acceptable by the majority of the users since the satisfaction is approximately above 65%. The information is shown in table 7.3.

Table 7.1 – Results of Yes/No questions

Customer Satisfaction	Yes	No
Did the application provide a personalized service?	72%	28%
Was the application able to answer all your questions?	85%	15%
Do you prefer to use the application than calling a live agent?	53%	47%
Application Performance and Response Time		
Was the application fast in her responses to your questions?	87%	13%
Do live agents perform faster than the application?	9%	91%
Intelligent Interaction and Billing Correction		
Did the billing explanation was clear?	64%	36%
Do the billing correction method applied reply to and satisfy your needs?	83%	17%
Did you understand the billing correction and the steps that the application will follow?	77%	23%
System Interface		
Was the application user friendly?	89%	11%
Did you like the interaction with the application?	85%	15%
Do you prefer this interaction on chatting with a real agent?	94%	6%
Do you recommend the modification of this method of interaction?	4%	96%

Table 7.2 – Results of performance question

Application Performance and Response Time	Less than 1 second	Less than 3 seconds
How many seconds the application needed to fix your billing problem? (Less than 1sec, less than 3sec, less than 5sec)	83%	17%

Table 7.3 – Results of percentage questions

Customer Satisfaction	Mean	Standard Deviation
Please state your total satisfaction of the application customer service in percentage	70	5.6
Intelligent Interaction and Billing Correction		
Please state your total level of satisfaction of the application correction of billing error in percentage	75	7.8

7.2.2 Application Performance and Response Time

The performance is crucial in such online applications in order to gain members attention and encourage them to use it. According to the results of this section, the users were very satisfied with the application performance and response time. Information retrieval is as easy as navigating any web site, even billing correction require fraction of a second, as users commented in the questionnaire. The response time reflects the efficiency of the indexing technique used in the CBR algorithm. Customer service representatives need in general between 8 to 12 minutes to understand, explain and correct member billing and close the call. In addition, members waste time waiting in the queue for their turn, and during busy hours it can be too long. The IIS application will minimize the waiting time in queue, is available all the time and one can access it from any computer with access to the internet in a few seconds.

The application performance and response time to general queries are negligible compared to live customer service representatives, as indicated by the users. Live agents need to access the information, understand, and present it to the member while building a rapport with the member for better customer service. This can take longer time when members are irate due to billing error. However, with the IIS, the information is presented in a customized way and the rapport is built from the beginning of the contact. This facilitates the interaction with the member, since members will try to solve his problem rather than complain to the live agent for this inconvenience. The users' reaction to the performance and response time is illustrated in the questions presented in table 7.1 and 7.2.

As we can notice from the results, members signaled that the IIS application is much faster in its response from any live agents. Figure 7.4 illustrate the results for the first two questions with a big difference between the application performance and that of the agent.

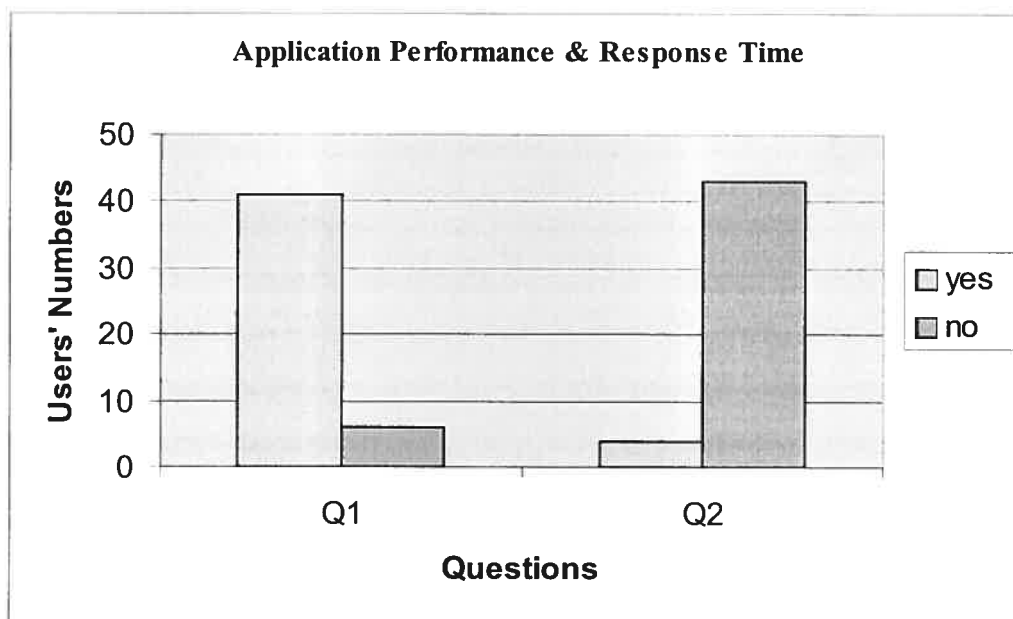


Figure 7.4 – First two questions of second section

The users estimated the executions time of their billing inquiries, and as we can notice around 83% of the users signaled a fast response for the IIS application. The response time was less than one second in most of the member queries. The fast response

reported by the users helps the application to distinguish itself from the regular traditional service. For example, now users will avoid sending email requesting billing investigation and clarification, and wait for the response that may take 12 to 24 hours.

7.2.3 Intelligent Interaction and Billing Correction

This part of the evaluation checks the users' responses to the billing explanation, correction and how the interaction of reporting a problem is implemented. The questions of this section, as used in the questionnaire, are shown in table 7.1 and 7.3. The users were able to correct their bills directly through the application and were eager to try it again to check if the system allows a second adjustment on their accounts. Most of the users understood directly the difference between the actual online service and this application after reaching this part of the evaluation. The actual online service is static with no interaction or the possibility of correcting or signaling billing errors. The users also proposed the development of a more showy animation that appear with the explanation and the billing correction.

The process of correcting the bill was very easy according to the users since it was reduced to a simple mouse click. All the questions, in this section, aim to involve members in the interaction and explanation process to ensure member satisfaction and understanding of the results.

Figure 7.5 represent the questions related to the billing aspect of the IIS application. We can notice from the results, that members were satisfied and happy with the IIS application. The software was able to satisfy around 64% of the users with the way he explained the bill, still animation improvements need to be introduced. Here, potential improvements are needed so we can satisfy at least 75%. Moreover, billing correction was very clear and satisfactory to members due to the clear steps the application follows. This is reflected in the results which reached around 77%. The IIS application informs the member of the investigation's results instantly whether there is an credit to be applied or if the adjustment is denied.

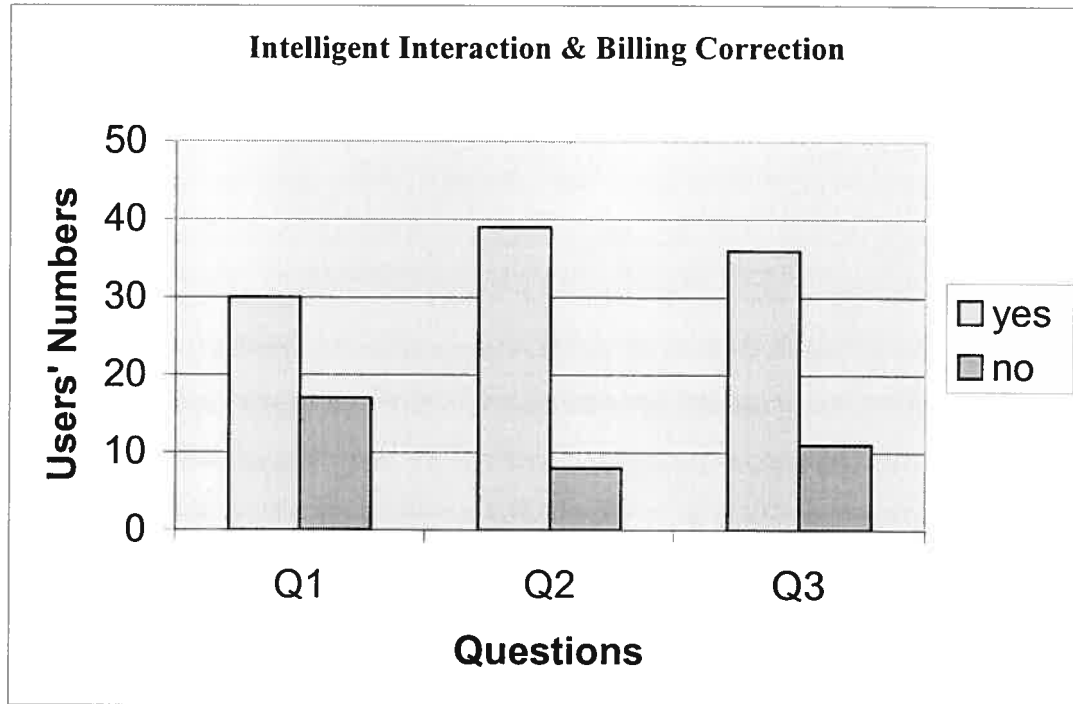


Figure 7.5 – First three questions of third section

Table 7.3 elaborates the total satisfaction level of the application billing correction. As we can notice from the mean which reflects the users' average satisfaction from the billing explanation and correction, users were able to examine the billing content and help the system in the billing correction. However, the standard deviation which reflects how widely values are dispersed from the average value is 7.8 and the mean is 75. This reflects the success of the application using this approach of billing correction compared to the traditional ways. Also, the standard deviation of 7.8 reflects that the unique approach of billing correction, that the IIS uses in real time, is well accepted and understood by most of the users who tested the application.

7.2.4 System Interface and User Friendly

Each application can be personalized according to its clientele. In order for the application to be accepted by the members, it is very important to be user friendly. The IIS application relies on member interaction and the interface that is provided to the

member. According to the users in our experiments, the application interface was clear and simple. The IIS application is very simple in its usage and aspects since it minimizes member request to a simple mouse click. According to the evaluation presented by the users, 96% of the users recommended to keep the same interface of the application for its simplicity. Members can view their options through the menus or simply type it and the IIS takes them to the appropriate menu section. The questions of the evaluation for this section are elaborated in table 7.1.

Figure 7.6 summarizes the results of the fourth and final section of the questionnaire. This section reflects the use of the interface and whether it is user friendly. The results show that users liked and preferred this interface to chatting with a real agent. The users preferred the IIS way of interaction, compared to chat online with live agents, with 94% of the users. The users also requested additional graphical interface as mentioned in the questionnaire. The suggestion was to use three-dimensional graphics so that accessing the information would be more interesting. The most astonishing part was that almost all the users agreed on this interaction method. The percentage of the users that agreed with the current interaction is 85%.

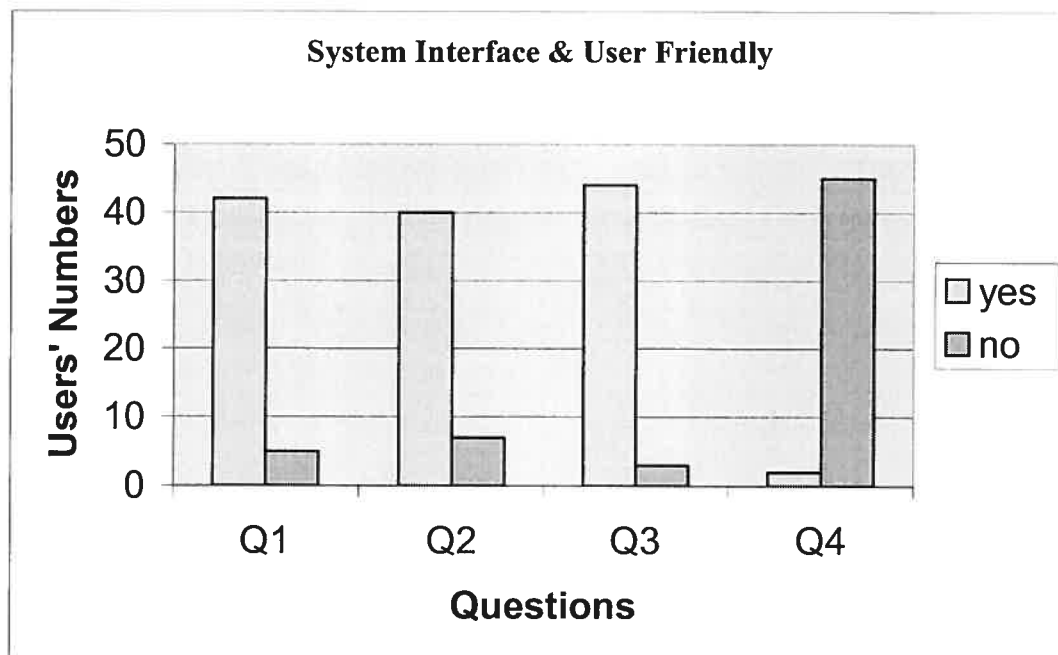


Figure 7.6 – Comparison of answers of the fourth section of the questionnaire

7.3 Conclusion

This chapter describes the evaluation experiment that we have applied to test the IIS application. All aspects of the experiment are exposed in detail. The groups that participated are divided into three groups to diversify the outcomes and profit from their constructive feedback. The results are divided into four parts which satisfy company objectives to develop such an application and members demands for a better customer service. The four aspects are: the level of customer satisfaction, application performance and response time, intelligent interaction and billing correction, and finally system interface and user friendly. Results and diagrams are drawn to illustrate their importance. The most two important aspects of the results are the billing correction and the interface, which reflected the high percentages of the users satisfaction. Almost 75% of the users enjoyed and agreed with the IIS technique of billing correction. In addition, 96% of the users recommended keeping the interaction methods since it replies to their needs.

Users agreed, in general, on these aspects of the testing reflecting the importance and success of this application. Users also signalled missing opportunities in the explanation animation to help better understanding the billing explanation. Even though, users agreed on the efficiency of the IIS, many still prefer to speak to live agents since they feel more comfortable with that.

Chapter 8

CHAPTER 8: CONCLUSION & FUTURE WORK

We presented several existing aspects of the e-service though out this thesis. The role of e-service has been evolving and adopted through most companies to overcome competition, increase market share and satisfy customer by creating a unique interaction with their technology. The e-service helped many companies reduce cost and meet/exceed their customer expectation. Managers rely on the e-service technology to run their operations to reach more potential customers all around the world and, to deliver an excellent service in a fast effective way. We have presented the methods and approaches used in our today e-service technology in the state of art. Each approach has its unique way depending on the company services or products. According to many companies, these approaches have increased their members' satisfaction and kept members asking for more products or services.

In our project the IIS helps operations overcome cost, competition and is pioneer in the market. The software uses interaction and CBR to assist members access and correct their bills online. The system uses many interesting questioning-answering techniques, and has a unique human aspect attached to it. IIS benefits the operations since it minimizes the phone calls redirected to customer service representatives working in call centers, since members get the information online in an accurate and interesting way.

The IIS application follows a simple contact structure to answer member needs. A call process is implemented in order for the system to provide an excellent service and increase member satisfaction. As illustrated in the guidelines throughout the report, the prototype uses similar guidelines to call centers that present a world-class service. Explaining and correcting the bills for the members, is as easy as a mouse click. The IIS also relies mainly on menus to interact and understand member

queries. The system architecture is designed to illustrate intelligent and non-intelligent phases of the system. Intelligent phase rely on the intelligent interaction and CBR to correct the billing error. The CBR steps used in the application are described in details. All menus are straightforward and activity icons are limited to two or three to ensure member understanding. Most of the database updates is done using separate applications such as; calculating proration, or generating bills at the billing cycle dates using dedicating software. According to the experiment and the results collected, users were very satisfied with IIS performance and response to problem solving. The four aspects of the experiment discussed customer satisfaction, performance, interaction and billing correction, and the interface. 96 % of the users that tried the IIS recommended the interface to other applications, since it was easy and simple to use.

So, here are the main contributions obtained through our work:

- Development of an intelligent interaction and assistance prototype based on CBR that helps the members correct their online bills.
- Increase member satisfaction since the billing correction occurs in real time and there is no more need to call customer service representative for billing issues.
- Emphasize on the human factor in the IIS prototype that follows similar call process as real customer service representatives.
- Importance of the IIS prototype in reducing companies' costs associated with members calling the company call center to correct their billing issues.
- Provide personalized customer service regarding account inquiries, billing explanation or correction.
- Ability to provide customized billing explanation and not just display the bill online.

Additional features could be designed in the future to enhance IIS performance and options. Additional questions and answers, like installation guides, could be

programmed to excel the system capabilities that could lead to the ideal application. This helps companies to educate and assist their members on the service's value they get with the product. It also creates a unique binding with their members and enhances their customer service. Certainly, new challenges posed by dynamic procedures modification will help identify and implement solutions on an ongoing basis [U13].

Here are the restrictions that face the IIS prototype:

- Billing defects need to be reported on each bill since the IIS will not review previous bills if the member doesn't report it.
- The system is not applied or used in any company, since companies prefer to have representatives to correct error when it comes to bills.
- Collaboration with other system, for example search engines to gather prices of different services and produce a comparison.
- Ability to deal with irate member and take charge of member problem without his interaction.
- Opportunities to deal with non-member and providing not only billing explanation but also technical support.

Finally, the process of continuous improvement, of the IIS, works whether you are trying to improve existing billing explanation and correction, add more options to the menus, or create a different line of service embedded within the system. Additional features like interaction through intelligent voice response can be a great complementary to the application, where the prototype replies to member queries. The application now deals with the billing part of member account; an extension to technical support would be enormous in the future. Technical support agents follow guidelines and charts to help them assist and troubleshoot members' connections. So, adapting those guidelines to trouble shoot member account can be a great complementary to the IIS application, where member can access the information

online through other computer or download the trouble shoot application online. Furthermore, additional section can be developed for non-members to assist them in their general questions regarding promotions, billing methods, speed, installation and many others. A lot of non-members are interested in verifying current offers and compare it to other competitors. Therefore, challenges posed by new competitors could help identify and implement solutions on an ongoing basis. This enhances ability to deliver excellent customer service and thus increase customer satisfaction.

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Appendix

Intelligent Interaction Software Questionnaire

Thank you for your help and assistance in testing and evaluating the IIS application. The IIS application allows you to access your account online, update your account information, view your bills online, get bill explanation and even correct them in case of billing errors. Please answer all available questions hereunder, and looking forward for your comments.

Your user id is _____

Your password _____ (password is case sensitive)

Please test the application twice and enter the duration accordingly in minutes

Duration 1: _____

Duration 2: _____

Customer Satisfaction

- Did the application provide a personalized service? Yes / No
- Was the application able to answer all your questions? Yes / No
- Do you prefer to use the application than calling a live agent? Yes / No
- Please state your total satisfaction of the application customer service in percentage between 0-100% (Not satisfied at all 0% - Too much 100%) _____%

Application Performance and Response Time

- Was the application fast in her responses to your questions? Yes / No
- Do live agents perform faster than the application? Yes / No
- How many seconds the application needed to fix your billing problem? (Less than 1sec, less than 3sec, less than 5sec) _____ seconds

Intelligent Interaction and Billing Correction

- Did the billing explanation was clear? Yes / No
- Do the billing correction method applied reply and

- satisfy your needs? Yes / No
- Did you understand the billing correction and the steps that the application will follow? Yes / No
- Please state your total level of satisfaction of the application correction of billing error in percentage between 0-100% (Not satisfied at all 0% - Too much 100%) _____%

System Interface

- Was the application user friendly? Yes / No
- Did you like the interaction with the application? Yes / No
- Do you prefer this interaction on chatting with a real agent? Yes / No
- Do you recommend the modification of this method of interaction? Yes / No

Comments for additional improvements on the application

General comments and feedback

Tips for using the application

- 1- Use the user id and password to access the application
- 2- The password is case sensitive
- 3- Clicking in the menu opens the related window according to the option chosen
- 4- Try to update your account information
- 5- Try to view the billing explanation
- 6- The system needs a couple of seconds to start the bill explanation
- 7- To report billing error use the report a problem button
- 8- Click on the highlighted section to report the billing problem
- 9- To log out click on log out
- 10- The system logs out the application if you keep it idle for more than 5 minutes
- 11- Fill the questionnaire at the same time you are testing the application
- 12- Add your comments and feedback once done