

멀티채널 환경에서의 콜 에이전트 설계 및 구현

A Design of Call Routing Agent for Multi-Channel

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요 약

CRM(Customer Relationship Management)은 비즈니스 환경에서 기업의 이익과 경쟁적 우위를 차지할 수 있도록 하는 비즈니스 전략이다. 기업의 고객 응대 기법으로는 인터넷, E-mail, SMS(Short Message Service), 텔레포니 서비스, DM(Direct Mail)이 이용되고 있다. 최근 수익성 모델 향상을 위한 노력으로 기존 고객의 이탈 방지 및 유지, 신규 고객의 가입 및 유지를 통한 비즈니스 모델을 다각화하고 있다. 또한 고객의 최초 접점이 될 수 있는 CRM 센터의 업무 프로세스 재설계(Business Process Re-engineering), 업무 프로세스 관리(Business Process Management)가 빈번하게 발생하고 있다. 본 논문에서는 고객 응대 CRM 모델 구축시의 고려 사항을 제시하고 콜 객체 라우팅(Call Object Routing)을 위한 에이전트(Agent)를 제안하고 구현 및 성능평가를 하였다. 제안한 모델은 대 고객 응대 CRM 모델로 효율적으로 이용될 수 있다.

Abstract

CRM(Customer Relationship Management) improves the competitiveness of small companies to large enterprises. E-mail, SMS (Short Message Service), telephony service, DM (Direct Mail) are used for customer response in many companies. In order to improve company's profit, business diversification is in progress with protecting the succession of existing customers, and the entry of new customers. Furthermore, BPR (Business Process Re-engineering) and BPM (Business Process Management) of the CRM can be easily found in many companies, because it is the first contact point to the company at the customer's view. This paper discusses the development of CRM, and proposes a call object routing agent that is the main engine of the CRM. Results of performance evaluation of proposed method show that the system is effective and powerful enough to use at the multi-channel environment.

키워드 : routing, call agent, CRM

1. Introduction

Company's customer response service has to accept various customer requirements with temporal and spatial limitations[1,3]. Response methods are based on the CRM model. The customer response service should be made on 24 hours in 365days. The general methods of customer response service are in-bound-channel and out-bound-channel of CRM contact center, Web service response, SMS, telephony service, and DM[1,2]. The first issue of

recent CRM is how to make efficient and consistent service to various customers. The second issue is how to make profit model. This paper proposes a consistent agent for the call object routing that is raising in the financial and banking agencies. Also, the proposed model has been implemented and evaluated its performance.

2. Related Researches

2.1 Concept of CRM

CRM is the open structured model that breaks from the conventional inside-oriented business

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model, and it is consistently developing process. It is typical way approaching and connecting between company and customers, and it requires manpower, technology, and the continuous investment to improving the business process[5].

1) Definition of CRM

CRM is the wide approaching method for the entry of new customers, management of existing customers, and understanding/influencing to the customer movement pattern by using continuous communication[4]. Consequently, CRM means actions for finding, acquiring, and managing customers who are valuable for continuous growth of the company.

2) Customer

Most companies give higher priority to the customer requirement at the beginning. However, they focuses internal issues after some achievement of growth because of the complexity of internal operations. The object of CRM is the conversion of large size of internal/external customers and future oriented customers into the business target by using company's cost[4].

3) Relationship

The essential relationship of CRM interacts with customers and company, instead of one way transmission of information. There should be clear merits establishing relationship between company and customers rather than feeding the biased intentions[5].

4) Management

Management is the part to earn the profit for

both customers and company. CRM management has to consider prediction, favor, and the number of accesses based on the customer relationship.

3. Call Object Routing Agent for Customer Response

3.1 Considerations

Recently, customer's inquiries via CRM and the other media are expanding. Therefore, the insufficient responses caused by increment of various media channels, evolution from single CRM contact center to multi-sites, and the load of multiple channels become major issues in this area. The company also considers the performance and the maintenance plan based on the cost of development. Table 1 shows considerations for the development of customer response CRM center. The center can be developed single center or multi-center. The single center supports small size of customers, while the multi-center supports the credit card and/or financial industries with large number of customers. The multi-center consists of a main center and a backup center that distributes approaching customers and offers tolerance while system fault occurs. Switch has a role to branch off and connect the voice/data signals. Organization of switch is decided by the structure of center and its environment. CTI server represents the middleware that transmits and manages customer calls. Whether using the CTI server is decided by the number of accessing customers.

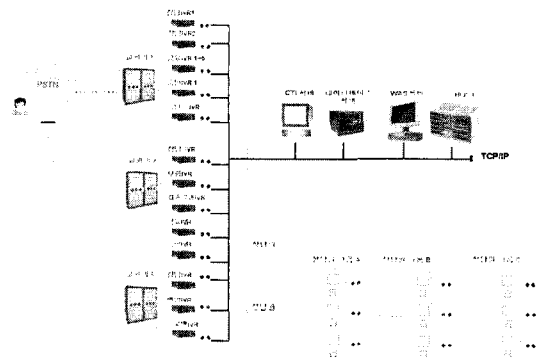
<Table 1> Considerations in CRM center

Classifications	Considerations	
	Centers	single center
Network	dual network	location of switch

PBX(Private Branch eXchange)	IP switch	TDM(Time Division Multiplexing) switch
PBX environment	TDM-base, IP-base, hybrid-base	
use of PBX	without PBX	with PBX
use of CTI(Computer Telephony Integration) server	without CTI	with CTI
Channels	single channel, keyphone level	IVR(Interactive Voice Response) server/SMS/Fax management/recording
Range of preparation of failures	switch, IVR/CTI/recording	
Security of system	simple level, use of encryption	
Statistics and Log	simple package	unified package
use of WAS(Web Application Server) server	organization of WAS	
Operators	single/multiple skill operators	
In-bound and out-bound	in-bound and out-bound business processes	
Expandability	expandability of site	
Size of customers	Data management system, use of CTI	
Customer maintenance	Analysis of CRM, marketing automation	
Market share improvement strategy	sales automation, cross sales tool	
Classification of customers	sales/marketing automation, analysis CRM	
Spatial issues of multiple sites	single platform, open structured structure	

3.2 Block Diagram of Call Object Routing Agent

Figure 1 shows the block diagram of call object routing agent. In order to develop the multi-center, three-way switch and T-server middleware from Genesys as the CTI server are used in the system. Switch 1 and 2 locate in the main center, and the switch 3 constitutes the backup center. The IVR server operates as the call object routing agent. Because the agent manages incoming call objects, supports various inquiries of customers, transmits call objects and customer information to the CTI server when customer wants to talk to operator. The IVR server operating as the call object routing agent has to be fault tolerant while the CTI server fails.



〈Figure 1〉 Block diagram of routing agent

The agent distributes calls to the backup center while the main center is overloaded. The opposite direction of distribution is also supported. The constructed system not only distributes the overloaded calls, but also switches the calls while main or backup center fails. Table 2 presents the algorithm that the agent connects to the operator by using CTI server. If the CTI server is in normal operation, the call object is routed to the CTI server by using the proposed CSMuteTransfer function. If the CTI server is not in normal

operation, the call object routing agent in the table 3 routes the call by using Intel E1 voice board.

<Table 2> Connecting operator by routing agent

```
int CSAgentTransfer(int code, CString strLocalLineNum)
//Code means operational service code.
//strLocalLineNum is the channel number of call object
routing agent
{
//Beginning of critical section
EnterCriticalSection (&cs);
//Receives CTI server status from T-server as an
event
//Routes call object with CTI server if it is normal.
if ((g_CtiServerConnectCheck == 1))
{
if ( Server->cvMuteTransfer
(channel->m_ChannelIndex,ivrno,
channel->m_tConnectionID,
s_VDN,BRANCH_NO,ANI_NO,CUST_NO) > 0)
{
LeaveCriticalSection (&cs); //End of critical
section
return 1;
}
}
}
//Tolerates the fault while the CTI is in failure.
//Reads the VDN number for call routing while
CTI is in failure.
//Sets the environment and call corresponding
VDN when customer wants operator. The operator
group is decided by the VDN.
i_dead_ret_code = Agt_Check_DEAD(code,
channel->m_LocalPhoneNo);
//Returns VDN value
//IVR server routes the call object for fault tolerance
for the case of CTI server failure.
channel->DS1FD_Dial(s_DEAD_VDN);
LeaveCriticalSection (&cs); {...}
}
```

Table 3 shows the algorithm that the agent handles the fault when the CTI server fails. DS1FD_Dial function has been proposed. The IVR server transmits AOFF/BON and AON/BON signal to the switch in order to send the call object

routing signal, and routes the call object to the VDN that is prepared for the failure of CTI server by calling dx_dial function.

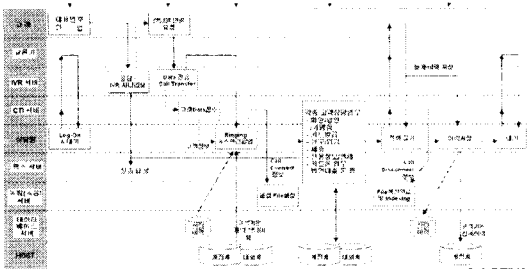
<Table 3> Fault handling while the CTI fails

```
//char *dialno is the fault allowance VDN for the case
of CTI failure.
//dialno is the fault allowance VDN for failure
int DS1FD_Dial(char *dialno)
{
//IVR server sends call routing signal to the switch by
using AOFF, BON and AON, BON.
if(dt_settsigsim(m_NetworkH,DTB_AOFF |
DTB_BON)== -1){..}
if(dt_settsigsim(m_NetworkH,DTB_AON |
DTB_BON)== -1){..}
if(dx_dial(m_VoiceH,dialno,NUll,EV_SYNC) == -1){..}
//Routes the call object at the IVR server.
//m_VoiceH is customer's voice channel
return 1; //Terminates corresponding channel after
routing.
}
```

4. Design and Implementation

4.1 Business Process

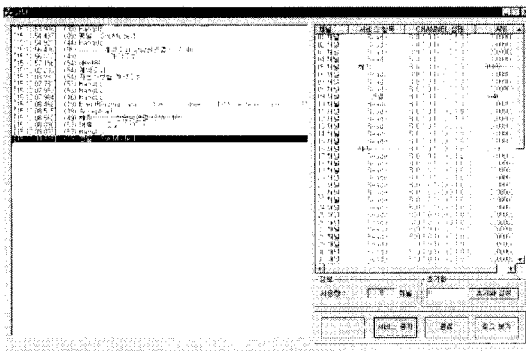
Figure 2 shows the process block diagram of the IVR server as the call object routing agent that is the first contact point of customer. The agent supports the self-service for in-bound channel, operator connection service for additional inquiries, and interconnects with the host server for supporting customer's business. The operator can be connected via the CTI server. The agent supports fault tolerant system as shown in table 2 and table 3. The agent supports link between switches and the CTI server, fault tolerance, packet transmission to fax server, and the host communication.



〈Figure 2〉 Block diagram of IVR process

4.2 Implementation

Implementation of the call object routing agent is shown in figure 3. The implemented system consists of Intel 5300 server with Xeon3.0 processor, 1GB memory, 72GB Ultra320 SCSI hard disk, Intel E1 board for voice. The middleware that manages customer's call is T-server from Genesys. The agent manages the call while the CTI server is in failure. Microsoft Visual C++ 6.0 is used as the programming language, and the environment of switches is based on Avaya switch.

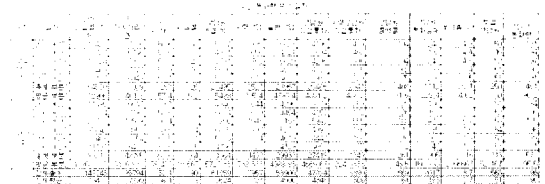


〈Figure 3〉 Call Object Routing Agent

As shown in figure 3, the voice service is available for incoming customer call, and the log of customer call can be verified.

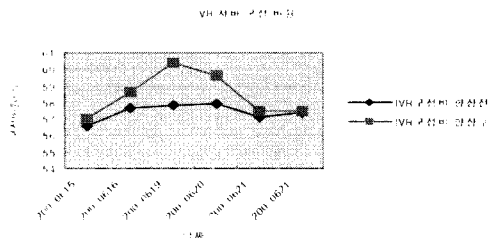
4.3 Performance Evaluation

Figure 4 shows the performance evaluation based on the total number of calls, the number of auto settlements, IVR ratio, number of missing calls, number of connections to operator based on his/her skill, total number of connections to operator, number of callbacks, number of failed calls, give up ratio, transition for the number of operators, and number of calls handled by each operator. As shown in figure 4, after applied proposed call object routing agent with fault tolerance of CTI, the system has higher performance compare to the performance before applied the prosed method.

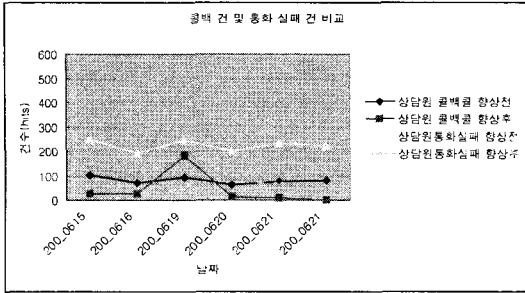


〈Figure 4〉 Analysis of Performance Evaluation

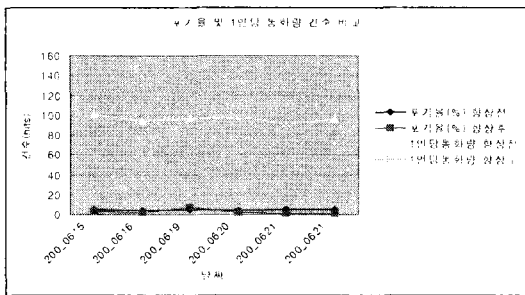
The number of auto handling calls of IVR server is increased 7,401 to 8,130 as shown in figure 5. In figure 6, the ratio of IVR server is increased 57.4% to 58.4%. The average number of callbacks, as shown in figure 7, is decreased 81.6 to 43.5. The decrement of callbacks makes possible to reduce the operator's load. The call give-up ratio is also decreased 4.6% to 2.6% as shown in figure 8.



〈Figure 6〉 IVR server ratio



<Figure 7> Number of callbacks and failed calls



<Figure 8> Give-up ratio and calls for each operator

5. Conclusion

Company tries to build the CRM contact center that gives higher effects with lower cost. The paper proposes the call object routing agent for the CRM contact center, and the proposed method has been implemented and evaluated. The result shows that customers can have consistent and higher quality service from the company for banking, approvals, and other inquiries. Also, the company can obtain the stronger business competitiveness by consistent response to current and new customers. The voice

recognition, the intelligent customer response system, the optimal out-bound solution, and the e-Voice technologies will be the major topics for the next step of research in this area.

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