TROUBLE CALL MANAGEMENT (TCM) WITHIN SCADA/DMS OF EDB

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INTRODUCTION

One of the main goals EDB has recognized is raising the quality of service towards its customers through realization of the contemporary solution: Call Centre. All functions of the Customer Support should be supported within this solution. Customer Support functions are defined through Interface Reference Model (IRM) according to IEC 61968 Series of standards. Existing practice of customer support through interaction only within specific business processes needed to be replaced by uniting all of these interfaces into one unique interface on the company level.

Since it was necessary to unite business and technical processes, which are, in it self, great challenge to integrate, scenarios integration realization began in several phases. After initial installation of the CC system and unique integration with telecommunication system within EDB IT system, Trouble Call Management (TCM) realization began. TCM was supposed to significantly promote service of customers affected by the loss of power due to a failure detected in the electric distribution network. Implemented TCM system enables: processing far more customer trouble calls than before, unique processing of incoming calls, as well as informing the customer of probable power failure cause and duration within short period of time since the trouble call was made.

CALL CENTRE OF EDB

EDB Call Centre officially started working at the beginning of June 2003 with the following job description:

- Accepting incoming calls and providing information to electric energy buyers concerning energy supply on the whole EDB supply area (account status, electric energy costs, accounting methods, interruption in energy supply (loss of power), registration, turn on/off, etc.).
- Accepting incoming trouble calls and other complaints from customers in the city area, and forwarding it to authorized departments for further processing.

There are ten agent and one leading agent positions in the Call Centre room. Each work place has its own digital phone with headphones and microphone attached (head-set) and also a PC with the LCD monitor. Work places are mutually isolated (separated) with the aluminium and glass compartments. According to needs of Call Centre, one telephone number (ACD group) with 20 input channels was defined. At first, customer is directed to a voice machine (IVR) and after that to an operator or a waiting queue which can hold up to 10 calls. Number of incoming calls and queue length can be automatically altered in accordance with calls dynamics. All incoming calls are recorded.

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Call Centre agents working hours are 07:00 to 20:00 h, five days a week. Voice machine is available to all customers 24 hours a day.

After the new digital central was installed at the end of 1997, and after the network connections between major parts of the company were provided, necessary technical conditions for project realization of EDB Call Centre were fulfilled.

Appropriate software was supplied for that purpose. Its main functions are:

- Telephony and computers integration.
- Database access - Screen pops.
- Voice machine – Interactive Voice Response.
- Automatic Call Distribution.
- Establishing, supervising and breaking connection.
- Statistic processing of calls.

For the purpose of accomplishing complete functional connection and accuracy in work, following servers were provided:

- Call Centre Server;
- IVR Server.

In the second phase of realization, starting October 2005, EDB Call Centre started receiving trouble calls. In the ongoing testing phase, Call Centre accepts trouble calls from 07:00 to 15:00, five days a week. This phase included expansion of Call Centre functions for the purpose of accepting trouble calls concerning other types of outage (ripple control devices, electric meters).

Figure 1 - Call Centre of EDB (CC EDB)

CUSTOMER SUPPORT

The IEC 61968 standard, taken as a whole, defines interfaces for the major elements of interface architecture for Distribution Management Systems (DMS). This set of standards is limited to the definition of interfaces and is implementation independent. They provide for interoperability among different computer systems, platforms and languages. The part 8 of the IEC 61968 standard and specifies the information content of a set of message types that can be used to support many of the business functions related to Customer Support. Typical uses of the message types defined in Part 8 Customer Service and Trouble Call Management (TCM). The integration scenarios or use cases are informative examples showing typical ways of using the message types defined in this document as well as message types to be defined in other parts of the standard. During the IEC 61968 standard implementation the attempt was made to completely fulfil Use Case 47 „Fault Isolation, Repair and Restoration of Supply“ [1, 2]. The abstract components realized in this phase of TCM implementation within SCADA/DMS of EDB are shown in Table 1 in bold text.

Business Functions	**Business Sub-Functions**	**Abstract Components**
Customer Support (CS)	Customer service (CSRV)	Service requests
		Construction billing inquiry
		Work status
		Self service inquiry (Web, **VRU**…)
		Customer connection
		Turn on, turn off
		Service level agreements
	Trouble call management (TCM)	**Outage calls**
		Power quality
		Planned outage notifications
		Media communication
		Performance indices
		Restoration projection/confirmation
		Outage history

Table 1 - Business Functions for Customer Support (IEC 61968 - 8)

The Customer Support message types describe information for the following types of document:

- Trouble Ticket

  The Trouble Ticket contains the information of a customer call.

- Outage Record

  A document describing details of an outage in part of the distribution network. An OutageRecord is produced as part of a planned activity (e.g. work order for maintenance) or following a breaker trip detected by SCADA or within a Trouble Call System by grouping customer calls.

- Outage Step

  For an Outage, It lists each supply point (distribution transformers MV/MV and MV/LV, MV feeder (bays) and LV feeders (bays)), that is affected by the outage.

- Outage Remarks

  It is chronological list of textual remarks describing the events/actions during the restoration phase.

- Planned Outage Notification

  When an outage is planned due to a equipment maintenance, the customer affected needs to be informed. The Trouble Call Management (TCM) system has to publish messages for another system to generate telephone calls to the affected customers.

- Interruption Notification

  For a PlannedOutageNotification it lists the Supply Interruption times.

- Environmental Damage

  This describes any environmental damage associated with an outage record.

- Outage History

  Outage History allows to examine the number of outages suffered by a customer. This also provides data to calculate the total supply interruption to any customer over a given period.

- Outage History Detail

  It lists the outages suffered by customers and the RestorationPhase and the FollowUpEvent document associated with the outage.

Also, TCM supports following types of messages in order to facilitate some of the Outage Management conditions:

- Restoration Phases

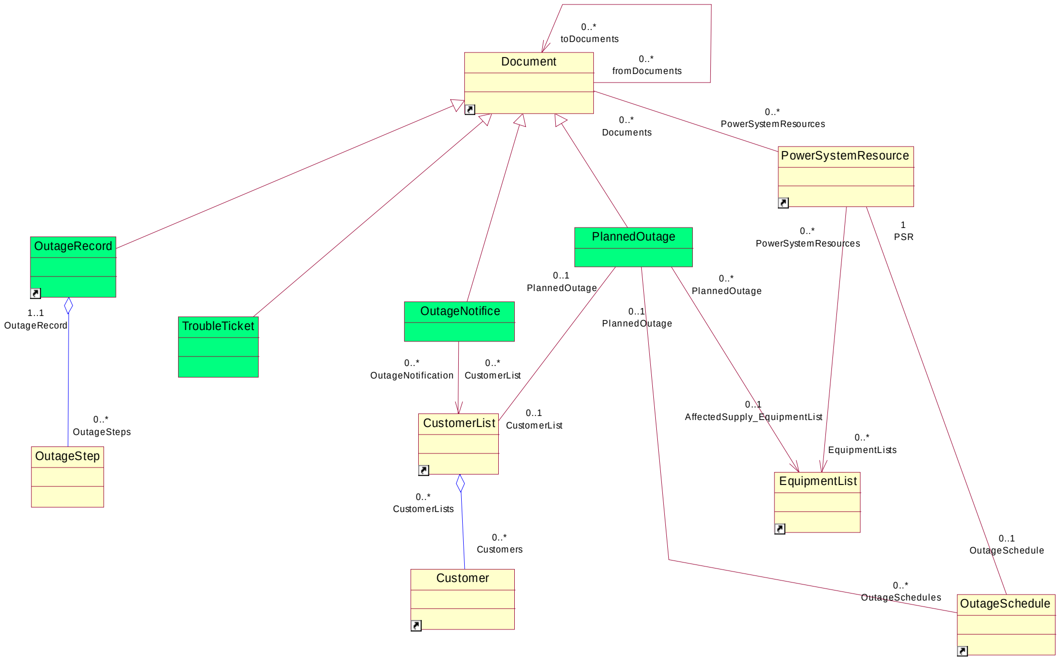
During an Outage, switching operations are carried out to restore supplies to the customers.

- Restoration Phase Steps

  During each restoration phase the steps identify the sections of the network affected, affected load and date/time of interruption and restoration of the affected customers.

- Outage Follow-Up Event

  Call centre agents need to answer any status enquiry from a customer regarding an outage. To help monitor the progress of an outage, TCM produces OutageFollowUpEvent for each action/event associated with the outage.


0..*
toDocuments
Document
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fromDocuments
0..*
PowerSystemResources
0..*
Documents
PowerSystemResource
OutageRecord
PlannedOutage
0..*
PowerSystemResources
1
PSR
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PlannedOutage
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OutageRecord
TroubleTicket
OutageNotifice
0..1
PlannedOutage
0..*
OutageNotification
0..*
CustomerList
0..1
AffectedSupply_EquipmentList
0..*
OutageSteps
CustomerList
0..1
CustomerList
0..*
EquipmentLists
OutageStep
EquipmentList
0..*
CustomerLists
0..*
Customers
0..1
OutageSchedule
0..*
OutageSchedules
Customer
OutageSchedule

Figure 2 – Part of IEC 61968 UML diagram (Trouble Call Management)

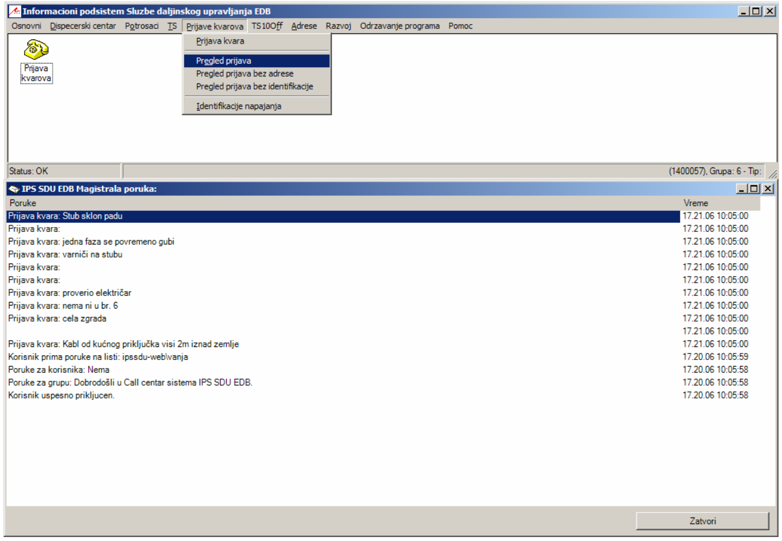
TROUBLE CALL MANAGEMENT (TCM)

“Trouble Call” is the application for creating and processing consumer trouble calls and field crew (work force) management. There are two versions of the Trouble Call application:

- Accepting and processing incoming trouble calls within CC where the initial selection of the data is performed. This modules main task is input of the data in the fastest and most accurate way, as well as grouping of that data according to current topology in order to determine potential outage source.
- The dispatcher application, which implements trouble call processing functions such as outage summary on the graphic view of topology, or topology presentation from the place of trouble call generation towards the supply points.

Main functions of this module are: accepting incoming trouble calls, work orders creation, intervention planning and organizing, force crew managing, creating work orders for maintenance purposes and keeping the dispatcher journals. As well as the other modules (applications) of EDB SCADA/DMS system, Trouble Call has appropriate appearance depending on connected user group. Trouble Call Management interface for Call Centre group has following appearance (shown in Figure 3).

Second part of the screen is occupied by the Message Bus. It displays list of messages for the logged-user-subscription-group with optional sound signalization. For example: dispatcher will receive messages concerning registered outage (faults) of high priority (police, fire …) accompanied by the sound signalling, in order for intervention to be as fast and efficient as possible.


Informacioni podsistem Sluzbe daljinskog upravljanja EDB
Osnovni
Dispecerski centar
Potrosaci
TS
Prijave kvarova
TS10Off
Adrese
Razvoj
Odrzavanje programa
Pomoc
Prijava kvara
Pregled prijava
Pregled prijava bez adrese
Pregled prijava bez identifikacije
Identifikacije napajanja
Prijava kvarova
IPS SDU EDB Magistrala poruka:
Zatvori

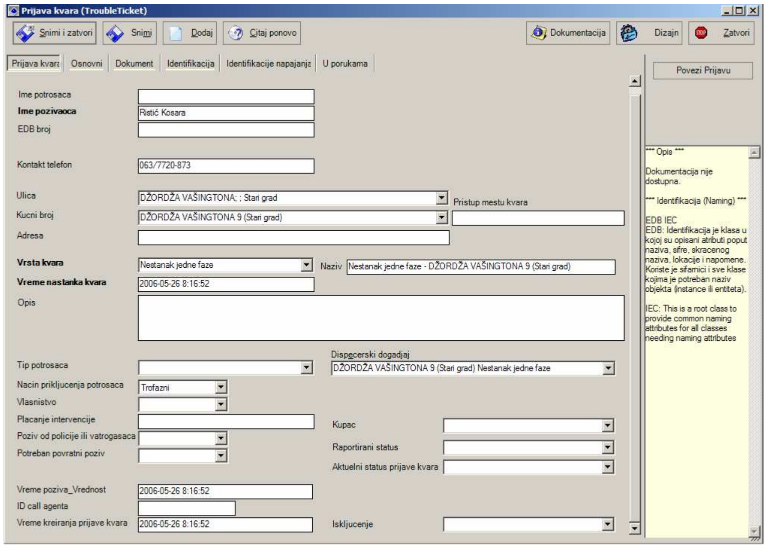
Status: OK

(1400057), Grupa: 6 - Tip:

Poruke	Vreme
Prijava kvara: Stub sklon padu	17.21.06 10:05:00
Prijava kvara:	17.21.06 10:05:00
Prijava kvara: jedna faza se povremeno gubi	17.21.06 10:05:00
Prijava kvara: varniči na stubu	17.21.06 10:05:00
Prijava kvara:	17.21.06 10:05:00
Prijava kvara:	17.21.06 10:05:00
Prijava kvara: proverio električar	17.21.06 10:05:00
Prijava kvara: nema ni u br. 6	17.21.06 10:05:00
Prijava kvara: cela zgrada	17.21.06 10:05:00
	17.21.06 10:05:00
Prijava kvara: Kabl od kućnog priključka visi 2m iznad zemlje	17.21.06 10:05:00
Korisnik prima poruke na listi: ipssdu-web\vanja	17.20.06 10:05:59
Poruke za korisnika: Nema	17.20.06 10:05:58
Poruke za grupu: Dobrodošli u Call centar sistema IPS SDU EDB.	17.20.06 10:05:58
Korisnik uspesno prikljucen.	17.20.06 10:05:58

Figure 3 – Overview of TCM interface

By calling the unique Call Centre of EDB telephone number, citizens report loss of power or any other event to agents on duty. Agent fills out the main Trouble Ticket form, inputting in the system important data necessary for processing outage by the authorized dispatching centre.


Prijava kvara (TroubleTicket)
Snimi i zatvori
Snimi
Dodaj
Citaj ponovo
Dokumentacija
Dizajn
Zatvori
Prijava kvara
Osnovni
Dokument
Identifikacija
Identifikacije napajanja
U porukama
Povezi Prijavu

Ime potrosaca	
Ime pozivaoca	Ristić Kosara
EDB broj	
Kontakt telefon	063/7720-873
Ulica	DŽORDŽA VAŠINGTONA; ; Stari grad
Kucni broj	DŽORDŽA VAŠINGTONA 9 (Stari grad)
Pristup mestu kvara	
Adresa	
Vrsta kvara	Nestanak jedne faze
Naziv	Nestanak jedne faze - DŽORDŽA VAŠINGTONA 9 (Stari grad)
Vreme nastanka kvara	2006-05-26 8:16:52
Opis	
Tip potrosaca	
Dispecerski dogadjaj	DŽORDŽA VAŠINGTONA 9 (Stari grad) Nestanak jedne faze
Nacin prikljucenja potrosaca	Trofazni
Vlasnistvo	
Placanje intervencije	
Kupac	
Poziv od policije ili vatrogasaca	
Raportirani status	
Potreban povratni poziv	
Aktuelni status prijave kvara	
Vreme poziva_Vrednost	2006-05-26 8:16:52
ID call agenta	
Vreme kreiranja prijave kvara	2006-05-26 8:16:52
Iskljucenje	

*** Opis ***

Dokumentacija nije dostupna.

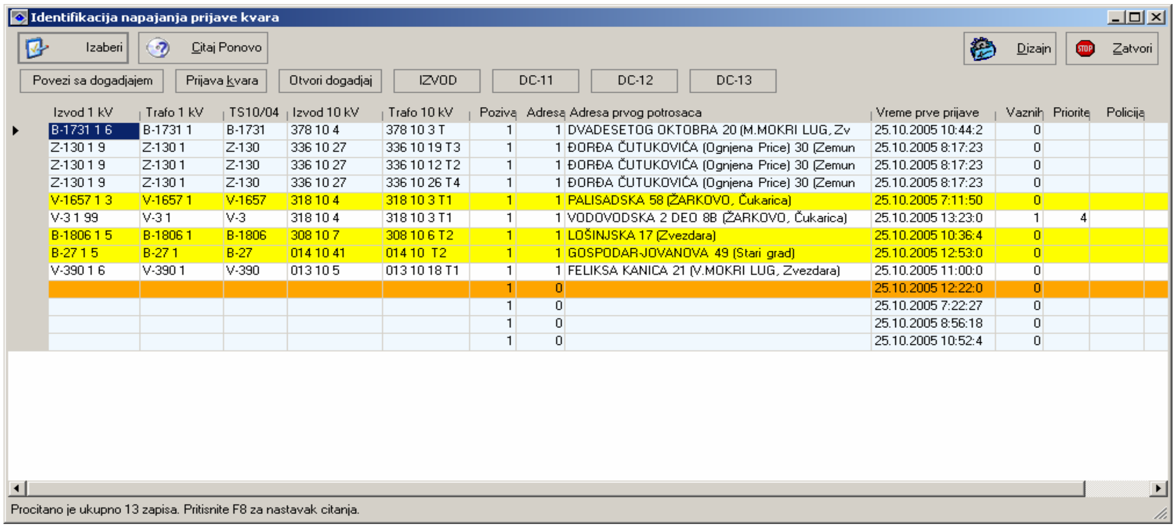
*** Identifikacija (Naming) ***

EDB IEC
EDB: Identifikacija je klasa u kojoj su opisani atributi poput naziva, sifre, skracenog naziva, lokacije i napomene. Koriste je sifarnici i sve klase kojima je potreban naziv objekta (instance ili entiteta).

IEC: This is a root class to provide common naming attributes for all classes needing naming attributes

Figure 4 - Overview of Trouble Ticket form

According to address entered by the CC agent, system discovers supply line and automatically generates consumers supply line identification. If the same supply line identification trouble tickets already exist, system binds them minding the number of calls and number of different trouble-call-addresses from the same supply line. On the basis of that data, message is generated with information about outage current status (if the fault is already known), as well as estimated time of repair. In that way, agent is capable of giving the feedback to customer promptly. In order for trouble call to be processed, it needs to be bonded to dispatcher's event. Dispatcher's events are created manually or automatically in cases when SCADA system recognises power network element failure. Creating dispatcher's events according to network events (including outage detected through trouble calls), as well as carrying out dispatcher actions are functions enabled through interface adapted to needs of "Dispatchers" user group. Trouble calls are attached to certain supply identification group. Supply identification groups are formed according to supply nodes (feeders, power transformers, substations) and according to additional statuses (firemen call, police call etc.).

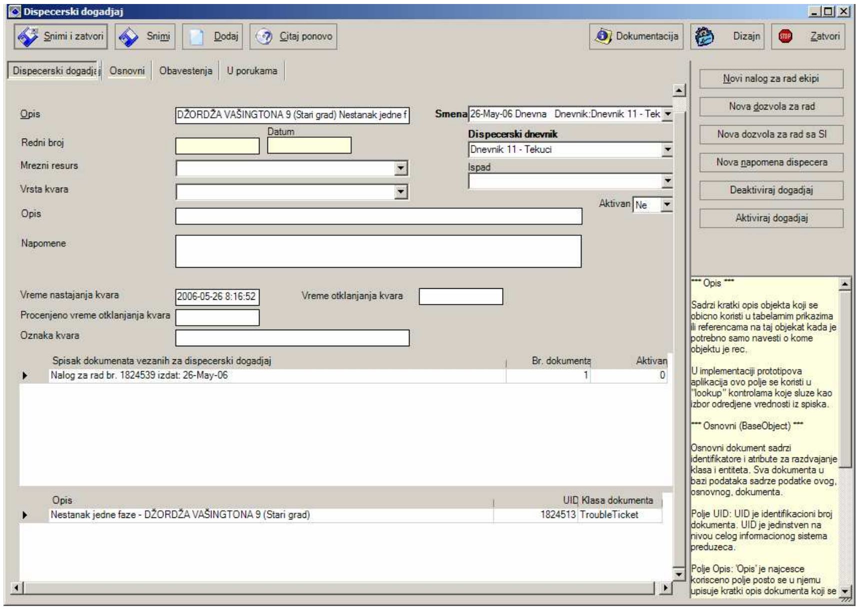

Identifikacija napajanja prijave kvara
Izaberi
Citaj Ponovo
Dizajn
Zatvori
Povezi sa dogadjajem
Prijava kvara
Otvori dogadjaj
IZVOD
DC-11
DC-12
DC-13

Izvod 1 kV	Trafo 1 kV	TS10/04	Izvod 10 kV	Trafo 10 kV	Poziva	Adresa	Adresa prvog potrosaca	Vreme prve prijave	Vaznih	Priorite	Policija
B-1731 1 6	B-1731 1	B-1731	378 10 4	378 10 3 T	1	1	DVADESETOG OKTOBRA 20 (M.MOKRI LUG, Zv	25.10.2005 10:44:2	0		
Z-130 1 9	Z-130 1	Z-130	336 10 27	336 10 19 T3	1	1	ĐORĐA ČUTUKOVIĆA (Ognjena Price) 30 (Zemun	25.10.2005 8:17:23	0		
Z-130 1 9	Z-130 1	Z-130	336 10 27	336 10 12 T2	1	1	ĐORĐA ČUTUKOVIĆA (Ognjena Price) 30 (Zemun	25.10.2005 8:17:23	0		
Z-130 1 9	Z-130 1	Z-130	336 10 27	336 10 26 T4	1	1	ĐORĐA ČUTUKOVIĆA (Ognjena Price) 30 (Zemun	25.10.2005 8:17:23	0		
V-1657 1 3	V-1657 1	V-1657	318 10 4	318 10 3 T1	1	1	PALISADSKA 58 (ŽARKOVO, Čukarica)	25.10.2005 7:11:50	0		
V-3 1 99	V-3 1	V-3	318 10 4	318 10 3 T1	1	1	VODOVODSKA 2 DEO 8B (ŽARKOVO, Čukarica)	25.10.2005 13:23:0	1	4	
B-1806 1 5	B-1806 1	B-1806	308 10 7	308 10 6 T2	1	1	LOŠINJSKA 17 (Zvezdara)	25.10.2005 10:36:4	0		
B-27 1 5	B-27 1	B-27	014 10 41	014 10 T2	1	1	GOSPODAR-JOVANOVA 49 (Stari grad)	25.10.2005 12:53:0	0		
V-390 1 6	V-390 1	V-390	013 10 5	013 10 18 T1	1	1	FELIKSA KANICA 21 (V.MOKRI LUG, Zvezdara)	25.10.2005 11:00:0	0		
					1	0		25.10.2005 12:22:0	0		
					1	0		25.10.2005 7:22:27	0		
					1	0		25.10.2005 8:56:18	0		
					1	0		25.10.2005 10:52:4	0		

Procitano je ukupno 13 zapisa. Pritisnite F8 za nastavak citanja.

Figure 5 – Supply line identification list form

According to trouble call type, trouble call binding group is determined. If the group doesn't exist, system will automatically create one and show it in the trouble call supply line identification list. According to level grouping implemented in this way, decision making process for dispatchers, concerning further electric distribution network manipulations, was facilitated. At the same time, the overall time necessary for locating the damaged network element was reduced. When dispatcher creates an event for certain supply line identification group, all trouble call tickets in the group will be attached to that particular event.


Dispecerski dogadjaj
Snimi i zatvori
Snimi
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Citaj ponovo
Dokumentacija
Dizajn
Zatvori
Dispecerski dogadjaj
Osnovni
Obavestenja
U porukama
Novi nalog za rad ekipi
Nova dozvola za rad
Nova dozvola za rad sa SI
Nova napomena dispecera
Deaktiviraj dogadjaj
Aktiviraj dogadjaj

Opis: DŽORDŽA VAŠINGTONA 9 (Stari grad) Nestanak jedne f
Redni broj:
Datum:
Mrezni resurs:
Vrsta kvara:
Opis:
Napomene:
Smena: 26-May-06 Dnevna   Dnevnik:Dnevnik 11 - Tek
Dispecerski dnevnik: Dnevnik 11 - Tekuci
Ispad:
Aktivan: Ne
Vreme nastajanja kvara: 2006-05-26 8:16:52
Vreme otklanjanja kvara:
Procenjeno vreme otklanjanja kvara:
Oznaka kvara:

Spisak dokumenata vezanih za dispecerski dogadjaj	Br. dokumenta	Aktivan
Nalog za rad br. 1824539 izdat: 26-May-06	1	0

Opis	UID	Klasa dokumenta
Nestanak jedne faze - DŽORDŽA VAŠINGTONA 9 (Stari grad)	1824513	TroubleTicket

*** Opis ***

Sadrzi kratki opis objekta koji se obicno koristi u tabelamim prikazima ili referencama na taj objekat kada je potrebno samo navesti o kome objektu je rec.

U implementaciji prototipova aplikacija ovo polje se koristi u "lookup" kontrolama koje sluze kao izbor odredjene vrednosti iz spiska.

*** Osnovni (BaseObject) ***

Osnovni dokument sadrzi identifikatore i atribute za razdvajanje klasa i entiteta. Sva dokumenta u bazi podataka sadrze podatke ovog, osnovnog, dokumenta.

Polje UID: UID je identifikacioni broj dokumenta. UID je jedinstven na nivou celog informacionog sistema preduzeca.

Polje Opis: 'Opis' je najcesce korisceno polje posto se u njemu upisuje kratki opis dokumenta koji se

Figure 6 – Dispatcher event edit form

Lists of consumers and especially important consumers are generated for every network resource. Essentially, lists of consumers affected by the loss of electric power due to a failure of the network resource are generated in this way. All changes concerning trouble call tickets and their grouping according to supply line identification will be sent to Message Bus. This will allow other user groups (which are depended on Dispatcher Centre actions) to receive information important to them. High-quality communication between users is essential in case of exact procedure defining on the basis of accepted business process models.

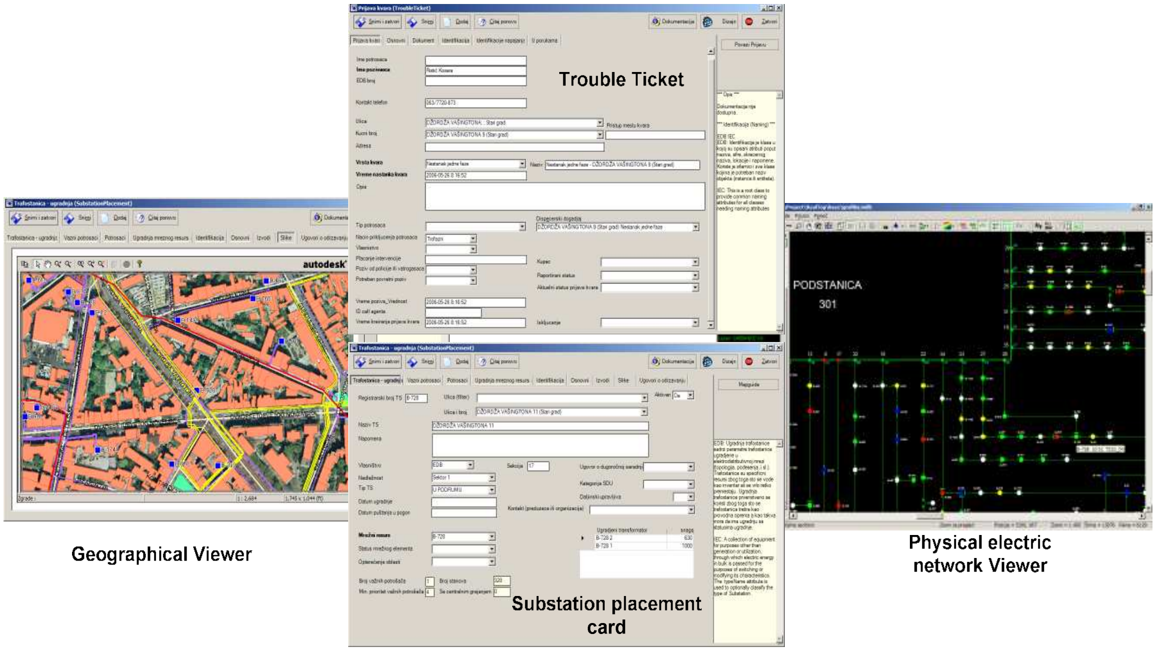

Figure 7 – Full TCM integration

Connecting to the system enables users from the “Dispatchers” group: planning and organizing network interventions, work force management, work orders creation, creation of work orders for maintenance purposes and keeping documentation. Dispatcher journal application (module) represents integral part of the EDB SCADA/DMS system which gives great opportunities for connecting with other modules and applications. Those are, in the first place, applications for physical and geographical electric distribution network viewing, as shown in Figure 7. Especially, integration with standard package for viewing vector and raster layers has been achieved. This enabled graphical presentation, via intranet, of located network resource that caused outage as well as tracing supply lines and also search and selection of network elements according to different criteria. All that was realized in order to facilitate: locating and eliminating damage on the network elements, preparing network manipulations as well as effective work force management.

TROUBLE CALL STATISTICS

Since the Trouble Call application started working, consumer calls statistics were kept within Call Centre of EDB. Trouble calls are still received only through agents (two agents at a time) but not through IVR (Interactive Voice Response) as was planned in this phase.

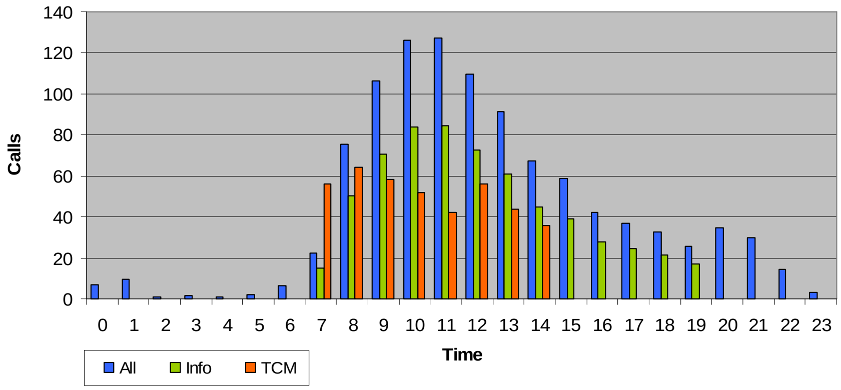

Figure 8 – Average number of calls per CC agents (January 2006)

In October 2005, 18.1% of total calls to CC EDB were trouble calls to agent, while in March 2006 that percent was 31.7%. As shown in Figure 8, large amount of trouble calls happened during first few hours of CC EDB working hours. This is due to the fact that during the night LV dispatching centres are not capable of efficiently processing trouble calls. Figure 9 shows parallel presentation of work before and after introducing the TCM system. It clearly shows growth in trouble call processing efficiency. On the other hand, Figure 10 presents structure of calls within TCM. This figure shows more interest of consumers during the winter period in information concerning outage, in comparison to spring period when that interest gets focused on planned work, since the number of outage is decreasing.

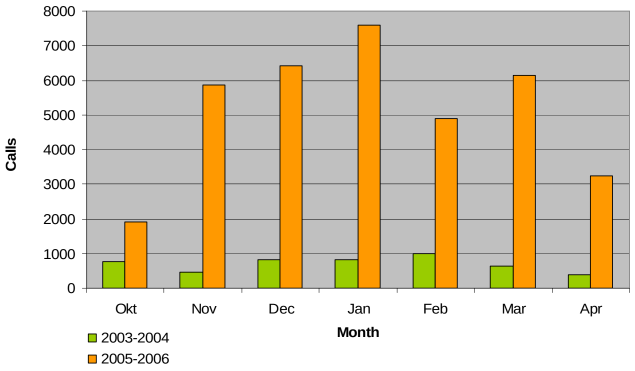

Figure 9 – Total number of calls without and within TCM

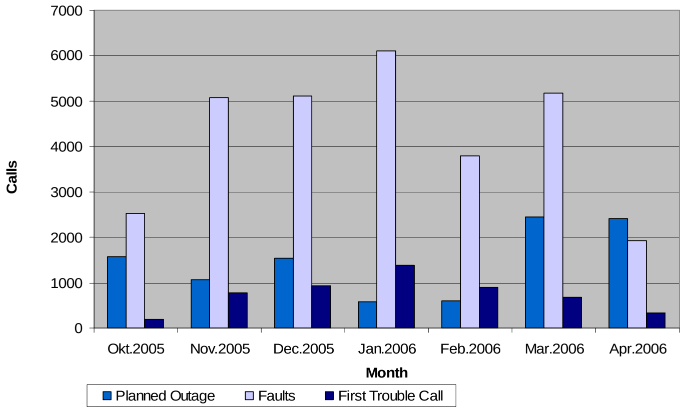

Figure 10 – Structure of calls within TCM

CONCLUSION

On the basis of previous TCM constructing and implementation experience, it has been shown that it is possible to significantly reduce outage-location-time which leads to a decrease in total amount of undelivered electric energy. Also, this solution enables more trouble calls to be processed and more consumers to be served, giving them right information concerning the type and duration of outage. Successful realization of this project was enabled and supported by latest technology tools and solutions that helped creating completely opened system. That system can further be incorporated into overall integral IT EDB system according to different scenarios. This solution is expected to gain importance in the upcoming business reorganizing process within EDB, since it is constructed to enable all consumers on the EDB supply area to get equal treatment. This will significantly raise the level of service that EDB provides for its consumers.

Keywords**: Trouble Call Management, Call Center, CIM, IRM, DMS**

LIST OF REFERENCES

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- 2. WEB site of IEC TC 57 WG 13/14/16, 2006, (www.cimuser.org).