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CONTENTS

Conceptual design and architecture of an informatics solution for smart trading on wholesale energy market in Romania

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This paper presents conceptual design and architecture of an informatics solution that aims to implement analytical models for optimization and forecasting the electricity demand and generation, simulation and what if analysis for efficient trading activities on wholesale energy markets in Romania. The informatics solution will be developed as a prototype on a cloud computing platform in order to allow easy access to energy providers and network operators.

Keywords: *energy forecasting, balancing, optimization, cloud computing, energy market*

1 Introduction

This paper presents some preliminary studies regarding the research project "Intelligent system for trading on wholesale electricity market" (SMARTRADE) which is supported by National Authority for Scientific Research and Innovation through European Regional Development Fund (ERDF). Objective of the project is to design and develop an informatics prototype for forecasting, analysis and decision models for energy providers, in order to estimate energy demand and generation in a suitable way for an efficient trading on the wholesale energy market.

A prototype will be developed on a private cloud computing architecture and will be addressed to electricity providers and network operators alike, especially to the Transmission System Operator (TSO) and the Distribution System Operators (DSO), for estimation of the electricity demand and generation at the national/regional level. An important component of the informatics prototype consists in a forecast module that accurately predict the electricity generation/demand on short and medium term for all interested market participants (providers/producers) constituted as balance responsible parties (BRP). Main scope is to establish efficient trading offers on the energy market, based on business rules and decision models. This scope will be reached by going through the following specific objectives:

- Building a data model for processing information collected from smart metering systems, but also from trading markets;
- Establishing a consumption prediction component within BRP, taking into account the behavior of producers-consumers (prosumers);
- Establishing a component for the prediction of energy generation from renewable sources at BRP level which can improve predictions for hourly intervals and daily averages so that the costs related to imbalances can be reduced;
- Establishing an optimization component for electricity generation and consumption of BRP;
- Establishing business rules and decision models related to trades on energy markets;
- Developing interfaces for access to prediction, optimization, analysis and simulation services for energy providers and TSOs/DSOs alike.

Components will be developed and implemented into an informatics prototype

for simulation and decision support at the level of providers/producers constituted as BRP. Also, the informatics prototype will offer decisional support at the level of network operators by integrating data coming from providers and analyzing it in order to efficiently plan national/regional resources. The project's objectives are important in the context of not only the current need to integrate a higher volume of energy produced from renewable energy sources (RES), but also the need to implement smart metering systems to consumers until 2020, according to [1] and [2].

2 Conceptual design

First stage of the project is the conceptual design including; resources, methodologies and technologies that can be defined and used in the project. Conceptual design of the prototype is made based on following main objective; to develop a software platform which will be utilized to ensure supply and demand balance along a planning period in an electricity market. Supply and demand balance should satisfy transmission network constraints in an optimum manner. Optimality is due to fact that supply and demand balance could be satisfied by several solutions in a constrained network. Redispatching the generators based on merit order, cutting of generation from renewables when they are generating quite high amount of energy, and load shedding are among those solutions to ensure supply demand balance while satisfying network constraints [3]-[5]. Whether the solution is optimum or not in terms of cost effectiveness is the main question, which is intended to be answered by means of the proposed optimization techniques in the software platform.

Balancing problem has two main aspects: demand forecast and corresponding supply solution taking into account network constraints. Demand forecast is among the main inputs to the balancing problem. The software proposed in this study focuses on short-term supply demand balance problem. Short term corresponds to day ahead. Demand forecast should be performed for 24 hours along a day under the assumption that the settling interval of the electricity market is one hour, as in the case of Romania and most EU countries [6].

Electricity demand forecast is a probabilistic problem in nature [7]. Given this probabilistic aspect, the longer forecasting period, the larger error gap as illustrated in Fig. 1.

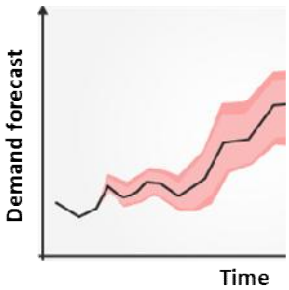

Fig. 1. Probabilistic load forecast

Literature includes both deterministic and probabilistic short-term electricity demand projection approaches. Deterministic approaches which define normal, high and low demand scenarios are also commonly utilized in supply demand balancing problems [8]. In this study, a probabilistic demand forecast module is designed. Upper and lower levels of the probabilistic demand forecast are assumed to be high and low demand forecast scenarios, respectively. Average is assumed to be normal scenario. These normal/low/high demand forecast scenarios are utilized deterministically in the simulations.

Short-term demand forecast analysis are proposed to be performed under a dedicated forecasting module of the software platform. Renewable generation forecasting module is the other forecasting module of the platform as depicted in Fig. 2. Renewable generation sources are classified as; wind, PV and run-of-river hydros. Renewable generation forecasting problem is also probabilistic in nature.

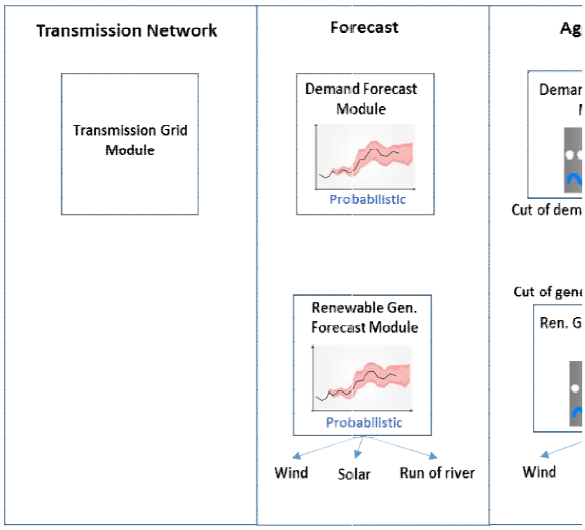

Fig. 2. Modules of the prototype

Renewable generations will be considered as negative loads in the software platform, like in many studies relevant in the literature [9]. It is assumed that generation from renewables are injected to the network directly. It is essential that demand forecast minus renewable generation forecast will give net demand of the system. This net demand should be supplied by conventional generators which mainly includes; nuclear, gas, coal, fuel, and dam-type hydro. In addition to that, these conventional generators should provide spinning reserves for balancing the supply and demand minute by minute. The software platform proposed in this study determines optimum commitment and dispatch of the conventional generators in order to balance supply and net demand while ensuring network constraints and reserve requirements. Commitment of cascaded hydro power plants is a challenging problem which should consider dependencies of the power generation of the power plants located on the same river [10]. Therefore, a dedicated module is designed for hydro catchment problem as shown in Fig. 3.

Cut of generation from renewable sources and load shedding will be considered as flexibility options to ensure supply and demand in the short-term, as illustrated in Fig. 3. Since it is a short-term supply demand balancing problem, such flexibility options might be indispensable particularly in case of supply deficiency and/or transmission constraints. Such issues can essentially be resolved by proper generator and/or transmission investments in the long-term. Nevertheless, the proposed platform, which focuses on short term supply demand balancing problem, can be utilized for identifying necessary investments in the long-term as well.

Aggregator modules will be considered in modeling either demand or renewable generation shedding. Demand and renewable generation aggregator modules are representing demand shedding capability and renewable generation shedding capability for the balancing problem, respectively.

Supply and demand balance problem is proposed to be solved by ignoring network constraints first. This step is called as "market simulation" which gives supply and demand balance result assuming that all the generation and loads are connected to the same bus. Then, "network simulation", which takes the results of the market simulation as input, is run. Network constraints are relaxed by the following options depending their cost effectiveness: i) changing commitments and/or redispatching of the conventional

generators, ii) load and/or renewable generation shedding. Input/output interrelation of the modules and sequential market and network simulation approach are illustrated in Fig. 3.

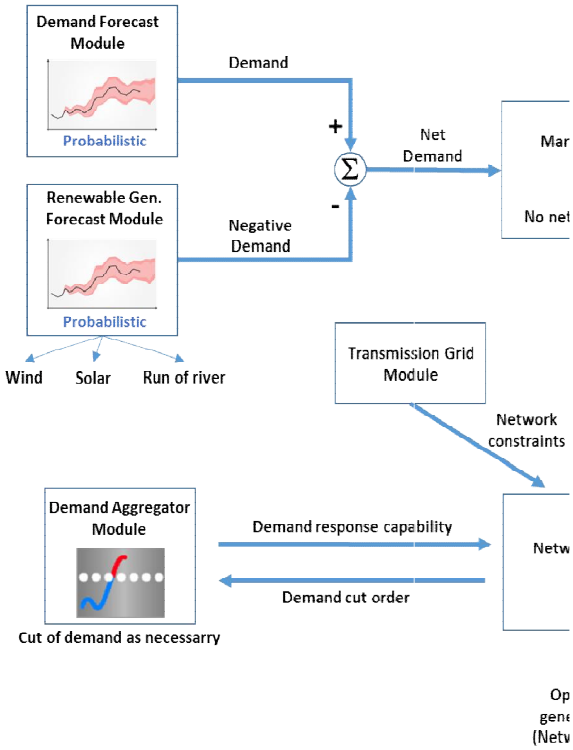

Fig. 3. Conceptual design of the proposed solution

3 Proposed architecture

The prototype will be created in an online environment on a cloud computing infrastructure which will offer providers the required infrastructure to process and analyze data, without being required to invest in their own hardware and software equipment. A simulation and analysis component service will be instanced and configured in the cloud computing environment for each energy provider. For the development of the components, we will use Java with Application Development Framework (ADF) with Business Intelligence (BI) elements, in order to build interactive interfaces, easily configurable and accessible through mobile devices.

Created in online technology, on a cloud computing platform, the solution will be easily scalable and reproducible for customers, based on a standard platform that will be cloned and customized to answer the individual needs for trading sessions and reporting of each BRP. The prototype architecture (Fig.4.) consists in several models and components described below:

- ***Data model***. The system's entities will be modeled in a relational schema to enable fast and real time access to real data and information about the viability of renewable energy generation and performance of smart meters. An advanced Extract, Transform and Load (ETL) process will be used to gather data from heterogeneous sources (smart meters, intelligent devices, energy trading platforms) after a quick data profiling process like in [11]. The solution for data management is Oracle Database 12c in

order to provide cloud computing facilities. Regarding the smart metering systems' data, the Oracle NoSQL Database in cloud computing will offer access for BRPs to consumers' data without investing in expensive IT&C infrastructure for Big Data solutions. At the present time in Romania there is no solution that can offer real time data and analysis on renewable energy or smart meters' data and we hope that the current project will provide a single access point to a platform that will contain the information needed to support inspired economic decisions.

- ***The forecasting, optimization and analysis models*** described in section 2 will be developed and implemented in Java on a cloud computing platform. The forecasting model will be developed based on artificial neural networks algorithms with good performance as demonstrated already in [12] and [13]. For optimization of supply/demand balance under network constraints, decomposition techniques will be utilized given complex nature of the problem.
- ***Presentation and reporting model*** will be developed in Java with Application Development Framework with Business intelligence elements in order to allow a flexible and interactive interface for real – time data analysis. The components will include dashboards, customized reports, pivot tables, charts, interactive maps that can be easily accessed through different devices like mobiles, laptops, PC tablets. The prototype will facilitate the access of the managers to relevant information to justify their strategic decisions regarding the trading activities, will minimize the time of decision making process through immediate access to information and aggregate reports, and will increase the relevance of information, as demonstrated in [14].

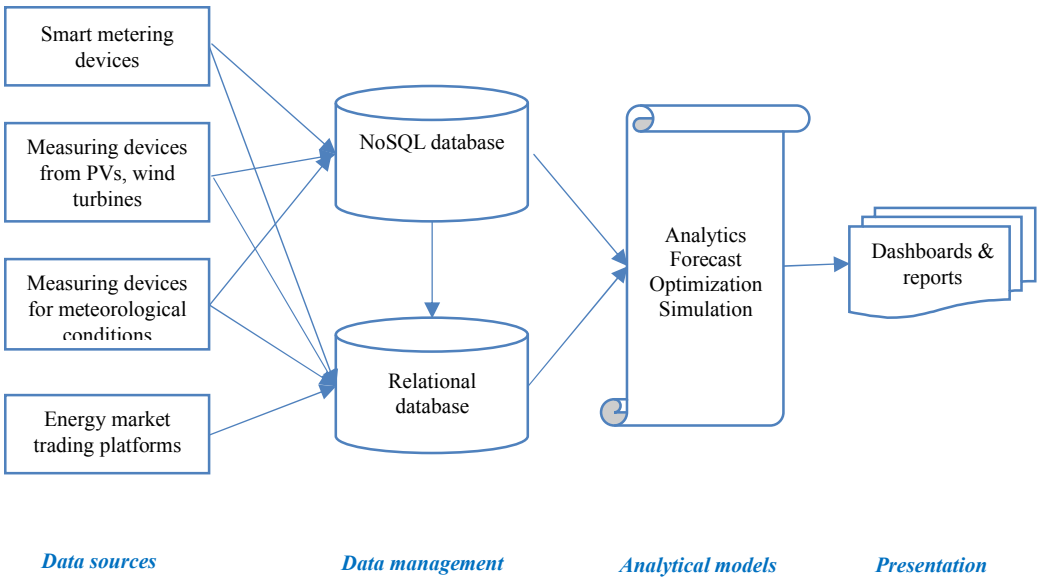

Fig.4. SMARTRADE prototype architecture

The prototype will be created on a flexible and scalable architecture, so that it can be further developed through the inclusion of components derived from technical improvements (as Internet of Things intelligent equipment, new measuring devices), in order to satisfy the beneficiaries' requirements on the long run. The implementation of the prototype will bring to the companies a competitive edge in the market share from existing competitors.

4 Technologies for informatics solution development

4.1 Databases & Cloud Computing

According to [15], NIST (National Institute of Standards and Technology) defines Cloud Computing as a model of computing architecture that enables on-demand network access to a multitude of resources shared between users. Resources refer to a wide range of items, like data stored in databases, functionalities and services offered by applications, storage capabilities and hardware support.

In a cloud computing architecture, all applications are controlled, managed, and served by a cloud server. Its data is replicated and preserved remotely as part of the cloud configuration. Table 1 presents some differences between standard and cloud computing architectures.

As detailed in [15] and [16], cloud computing has three service models that need to be virtualized as services:

- Infrastructure as a Service (IaaS) - is the main model in Cloud Computing and refers to sharing raw computing hardware over the network (e.g. Web-hosting);
- Software as a Service (SaaS) - users access applications provided by the cloud administrators (e.g. Web-based email, Google Docs);
- Platform as a Service (PaaS) - offers a range of software necessary to develop applications which will run on systems software and hardware provided by another company (e.g. Google Apps Engine).

Table 1 - Some differences between standard and cloud computing architecture

Standard computing architecture	**Cloud computing architecture**
Each entity maintain its own IT infrastructure	IT infrastructure is shared and used by multiple entities
Systems are heterogeneous and complex	The platform is homogeneous, simplified and unified controlled
Infrastructure is managed by specialists	Infrastructure is virtualized, optimized and well managed by specialists
Low-level support from the specialists	High-level support
Intensive usage of energetic resources for a high number of data centers	Optimized usage of energetic resources by aggregating data centers

As stated in [16], starting from these services a number of new ones have also emerged, such as: Database as a Service (DBaaS), Big Data as a Service (BDaaS), Storage as a Service (StaaS), and so on.

In the component architecture of database systems, the most important role it is held at the data layer by the databases. Cloud computing offers an efficient way of processing and managing large volumes of data, because big time philosophy involves storing and processing large data sets, inefficiently managed by conventional

database systems and related software tools.
Oracle Database 12c is specifically designed for the cloud architecture. It offers a cloud solution that brings new features such as: providing database as a service in the cloud, optimization, integration and Big Data analysis, security facilities etc. [17].

4.2 Java framework
An application framework makes it easier to develop an enterprise application by offering specific functionalities, like: design patterns, database accessibility, error handling, easy compilation, versioning, debugging tools, maintenance tools etc. A recent study showed a Java framework ranking [18] which reveals the most popular Java frameworks in 2016: Maven, Java 8, IntelliJ IDEA, J2EE and Spring.

An important application development framework for J2EE is Oracle ADF, which will be used for develop the informatics solution for efficient trading activities on wholesale energy markets in Romania.
Oracle ADF (Application Development Framework) is a service-oriented architecture (SOA) for creating J2EE applications, which uses JSF (Java Server Faces) and it is implemented in Oracle JDeveloper IDE (Integrated Development Environment) [19]. ADF works as a cross-platform solution that allows developers to use the same services and security solutions across desktop, mobile, and web applications.
Figure 5 reveals Oracle ADF architecture, showing the main technologies used by each of the levels of a standard MVC (Model-View-Controller) informatics solution architecture.

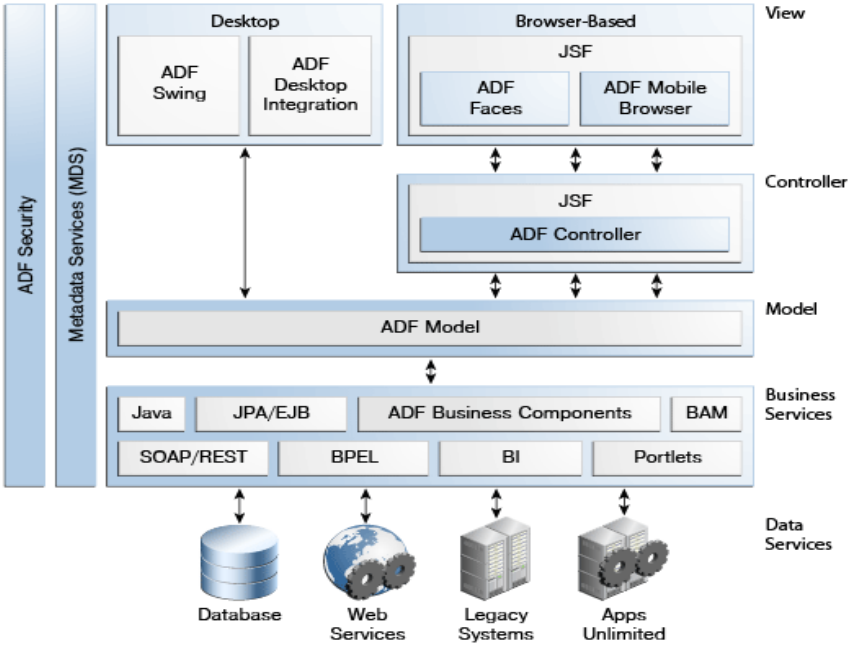

Fig.5. Oracle ADF architecture
Source: [19]

Analyzing the above figure, we discover the four layers of the ADF architecture and also the main ADF components which can be involved in a MVC solution:

- Business Services Layer: offers access to data from various sources and addresses business logic. Through ADF Business Components are provided basic functionalities and easy database interaction without having to use Java code;

- Model Layer: provides an abstraction layer that connects all the layers through ADF Binding;
- Controller Layer: uses ADF Controller in order to implement the flow of the web application;
- View Layer: provides the user interface of the application using the component ADF Faces.

5 Conclusions

The SMARTRADE prototype will be able to open new approaches, even after the project is finished, at the interdisciplinary level of the research field (informatics and energy) through models and proposed algorithms. Thus, each of the original models described will open new themes or approaches:

- Through the data model – because of the novelty character of the approached elements which derive from the Big Data paradigm for smart metering systems and IoT devices, we consider that the research in this field is still at its beginning, and the proposed model within the project can constitute a new ground point for the efficient and real time organization of data coming from smart metering systems;
- The estimation of prosumer/consumer behavior is an ever changing activity because of its equipment evolution, their possibility to generate power through own equipment, but also through the demographic and social changes. The forecast model proposed in this project will be subject to progressive improvements in order to keep pace with technical development and the evolution of prosumer/consumer behavior;
- The forecast model for energy generation will be subject to improvement in order to be also used by prosumers, so that they can estimate their self-generation capacity.

The virtual simulator of the prototype will be created on a flexible and scalable architecture, so that it can be further developed through the inclusion of components derived from technical improvements (as IoT devices), in order to satisfy the beneficiaries' requirements on the long run.

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Study on electricity markets in Romania

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In this paper, we detail about the components of the wholesale electricity market in Romania: Market for Bilateral Contracts (Central Market with continuous double negotiation of bilateral electric energy contracts (CM - OTC), Centralized Market for bilateral electric energy contracts), Day-Ahead Market (DAM), Inter-Daily Market (IM), Balancing Market (BM), Centralized Market for universal service (CMUS).
In addition, for each type of market we generated diagrams with the main business processes.

Keywords: *Electricity Market, Renewable Energy, Wholesale Market, Retail Market, Balancing Market*

1 Introduction

Electricity transactions between the various participants in the electricity market in Romania are carried out in two categories of markets, namely:

- **Regulated market** - the quantities and prices are set by the National Energy Regulatory Authority (NERA). Regulated contracts are used in its activity;
- **Competitive market** - uses the principle of supply and demand in the activity, being legislatively governed by NERA. This comprises:
  - **a) Wholesale market**, in which electric energy is purchased for resale or own use, by suppliers, from producers or other suppliers. Also, in this market, network operators buy electric energy for own technological consumption.
  - **b) Retail market**, in which end users or their aggregators purchase electric energy for their own consumption.
  - **c) Market of green certificates** envisages promotion of electric energy coming from renewable sources and is based on trading of green certificates and mandatory shares system.

From a theoretical standpoint, the regulated market operates until the competitive market reaches an opening threshold of 100%. Because of the difficulties of implementation, the low level of preparedness of small residential and commercial consumers, and providers and aggregators in the retail market, in Romania, the regulated market continues to operate.

In the competitive market, in order to trade electric energy, there are mainly used the following instruments: bilateral contracts between suppliers and local producers, concluded to ensure consumption of eligible customers; import contracts of local producers to ensure obligations in bilateral contracts; import contracts of suppliers; export contracts; contracts of transport and distribution operators; spot market transactions at closing market price; green certificates market transactions.

According to the legislation in Romania, in terms of the producers and suppliers, the electricity market has a competitive nature. The transport and distribution of electric energy are regulated and are considered a natural monopoly. Their regulation takes into account the compulsoriness of network operators to provide access to transportation and distribution networks for licensees.

The main actors that take part of the energy market are:

National Energy Regulatory Authority (NERA)- independent administrative authority with legal personality, under parliamentary control, entirely financed from own incomes, decision-making,

organizational and functional independent. Its main activity is developing, approving and monitoring the application of mandatory regulations at national level. They are necessary for the sector and market of electric and heat energy, and natural gas, in terms of efficiency, competition, transparency and consumer protection. In order to ensure the exercise of its powers in the territory, NERA has in its structure offices without legal personality.

Romanian Transmission and System Operator (TSO) "Transelectrica" - S.A., which is tasked to continuously keep functioning the national power system, in safety and in compliance with quality standards set out in the Technical Code of Electricity Transmission Grid. To this end, the Company uses its own resources, called functional system services, and purchases from electricity producers technological system services. Also for real-time balancing of production to consumption, the Company uses market-balancing mechanisms. TSO receives monthly, from the producers and the networks operators to which they are connected, notifications regarding the quantities of energy from renewable sources delivered over networks. It issues, monthly, green certificates to producers for renewable energy produced and delivered to the network in the previous month. The amounts corresponding to penalties are collected from suppliers who have not met the mandatory quota compliance at the end.

Electricity and Gas Market Operator in Romania (EGMO) - manages electricity markets and ensures the transactional thereof.

Producers, suppliers and consumers of electric energy that are NERA accredited and have commercial licensees.

2 The structure of the wholesale electricity market

The activity of purchasing power by the suppliers from producers or other suppliers, for resale or use for their own consumption, takes place in an organized way in Romania, represented by wholesale electricity market (WEM). Components of the wholesale electricity market are [1]:

- Centralized Market for Bilateral Contracts: extended auction, continuous double negotiation or through processing contracts;
- Day-Ahead Market (DAM);
- Inter-daily Market (IM);
- Balancing market;
- Centralized Market for universal service (CMUS)
- Technological system services market

In order to conduct transactions, producers, self-producers, electricity providers and network operators have access to the wholesale electricity market. Within this market, transactions are about sale and purchase of electricity and technological system services. Romanian and foreign legal persons have access to the wholesale electricity market if they are being recorded as participating in the Day Ahead Market (DAM), in the Centralized Market for mandatory balancing, in auctions or as parties responsible for balancing. License holders can engage in the Market for Bilateral Contracts with electricity in bilateral transactions, export and import of electricity, under the terms of specific legislation, the Commercial Code and the license. The conclusion of these transactions is achieved through contracts for purchase-sale of energy for certain periods of time.

3 Central Market with continuous double negotiation of bilateral electric energy contracts (CM - OTC)

Under the Central Market with continuous double negotiation of bilateral electric energy contracts, trading takes place online using the terminals of the participants enrolled in the market, this being carried out continuously. Regarding standardization of offers, this is done taking into account the daily profile of supplies, the delivery periods and offered power [2].

The main activities in the Central Market

with continuous double negotiation of bilateral electric energy contracts are detailed in [2] and consist of:

a) auction session opens;

b) auction session takes place;

c) pre-closing auction session;

d) auction session ends;

e) auction participation notes with final prices are sent to the participants;

f) conclude bilateral contracts.

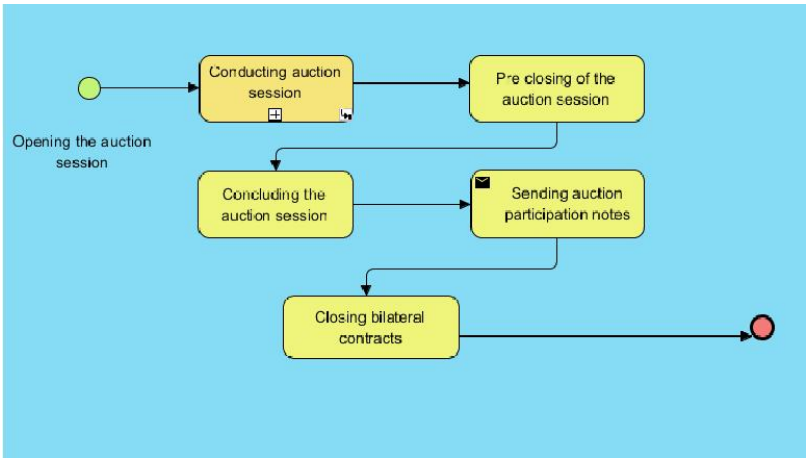

Fig. 1. Main activities on the CM - OTC

4 Centralized Market for Bilateral Electric Energy Contracts

By concluding bilateral electricity contracts, a trading framework for the competitive electricity market, based on compliance with conditions of non-discrimination, competition and transparency needs to be achieved [3]. In what follows, we present in detailed three types of bilateral contracts for electricity, according to the different ways of trading: by extended auction, by continuous negotiation or by processing contracts.

4.1. Centralized Market for Bilateral Electric Energy Contracts having as way of trading the extended auction (CMBC-EA)

CMBC-EA mechanism has the effect of identifying the identity and intentions of bidding of market participants for the whole business environment. In terms of deliveries profile, the offerings are standardized. For the auctions that are organized for the published sale offers, consider as opening price, the minimum price, and for the auctions that are organized for published purchase offers, consider as opening price, the maximum price.

The offers proposed for Bilateral Electric Energy Contracts having as way of trading the extended auction have as minimum delivery period a month. For any published initiating offer, there can be formulated co-initiative and respond intentions. If a participant wishes to withdraw an offer must comply with the provisions stipulated in [4] on a penalty payment. In setting transactions, the framework contract for the purchase-sale of electricity specific to CMBC-EA is used. On CMBC-EA, licensees can participate, that fall and respects [5]. Bidders list becomes public after closing auction takes place. The amount of energy that was contracted using as way of trading the extended auction can be proposed for the trading in subsequent session calls, but only until the entry into delivery of the contract.

In figure 2, there are presented the main business processes for CMBC-EA.

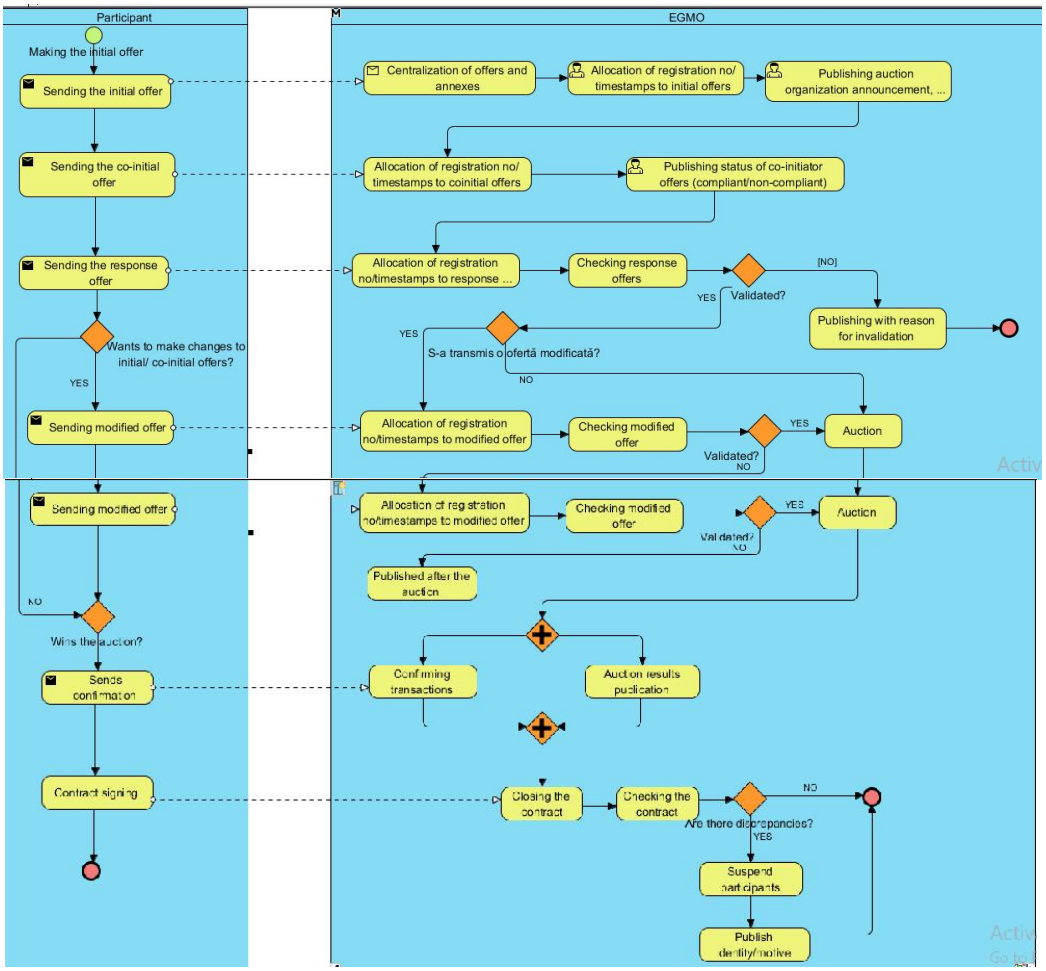

Fig. 2. Main activities on the CMBC-EA

4.2. Centralized Market for Bilateral Electric Energy Contracts having as way of trading the continuous negotiation (CMBC-CN)

Under this mechanism, trades occur on-line, each participant signed up into the market using their own terminal, subject to the terms laid down in trading published schedule. Every weekday trading sessions (between 12 and 14) are held. Throughout the trading session, participants' identity is anonymous and the trading system is available on the website of the Electricity and Gas Market Operator (EGMO) in real time. From the point of view of the offered power, of the daily profile of supplies and of delivery periods, the offerings are standard.

The CMBC-CN license holders can participate if they sign up for and follow [6]. At the end of the trading session, EGMO publishes the results of the auction: the characteristics of the traded products, the number of contracts that were traded, the price, the seller's and the buyer's identity. The amount of energy that was contracted using as a way trading the continuous negotiation may be proposed for the trading in further auction sessions, but only until the entry into delivery of the contract.

In figure 2, there are presented the main business processes for CMBC-CN.

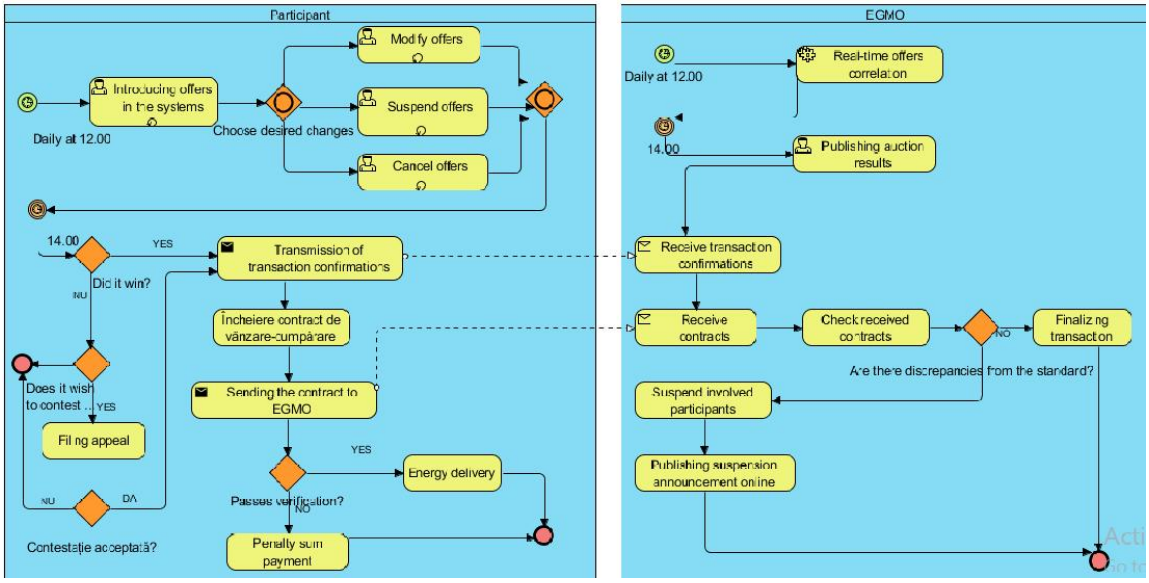

Fig. 3. Main activities on the CMBC-CN

The first day when the delivery is made must be at least 6 days after the closing session of the auction, of which 5 days should be working days. Invoice for this transaction must be issued in one of the first 3 working days of the following month from which the transaction was effected. The payment of this invoice is done according to [4].

4.3. Centralized Market for Bilateral Electric Energy Contracts having as way of trading the processing contracts (CMBC-PC)

This mechanism is used when the electricity market crises occur. CMBC-PC mechanism has the effect of getting to know the identity and bidding intentions of market participants for the entire business environment. Proposals of initiating offers may be made only by electricity supply license holders, while offers of response can be formulated only by license holders of commercial exploitation of electricity production capacity. The delivery period must be less than the energy market crisis period. For bilateral contracts of electricity that have as trading method the processing contracts, the opening price is considered to be the highest price of electricity resulting from processing, that the initiator agrees to pay. For any initiating offer that was published, response intentions can be formulated. If a participant wishes to withdraw an offer, he must comply with the provisions stipulated in [4] on a penalty payment.

In establishing the transactions, a framework contract for processing the fuel specific to CMBC-PC is used. On the Centralized Market for Bilateral Electric Energy Contracts having as way of trading the processing contracts, supply of electricity and commercial exploitation license holders can participate if they sign up and follow [7]. Bidders list becomes public after closing the auction takes place.

In figure 2, there are presented the main business processes for CMBC-PC.

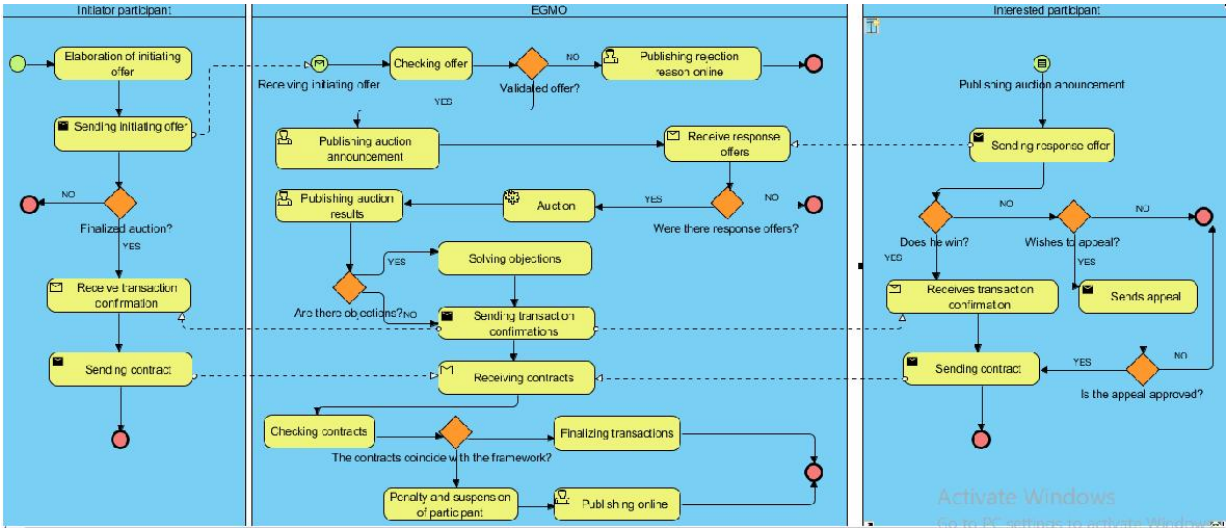

Fig. 4. Main activities on the CMBC-PC

The first day when the delivery is made must be at least 6 days after the closing session of the auction, of which 5 days should be working days. Invoice for this transaction must be issued in one of the first 3 working days of the following month from which the transaction was effected. The payment of this invoice is done according to [4].

5 Day-Ahead Market (DAM)

Component of the wholesale electricity market, the Day-Ahead Market (DAM) allows transactions with electricity to be delivered the day following the trading day. This market works in Romania since November 19 2014 through a price coupling mechanism, in a coupled regime with similar markets in the Czech Republic, Slovakia and Hungary. This project is known as 4M Market Coupling - 4M MC [OPCO16].

The trading program for the Day-Ahead Market is presented in detail in [OPCO16] and consists of the following main activities:

- Opening access to the trading system;
- Publication of available transmission capacities on the interconnections;
- Closing the bidding gates for the next day of delivery;
- Publication of transactions confirmations;
- Creation of physical notifications files;
- Closing access to the trading system.

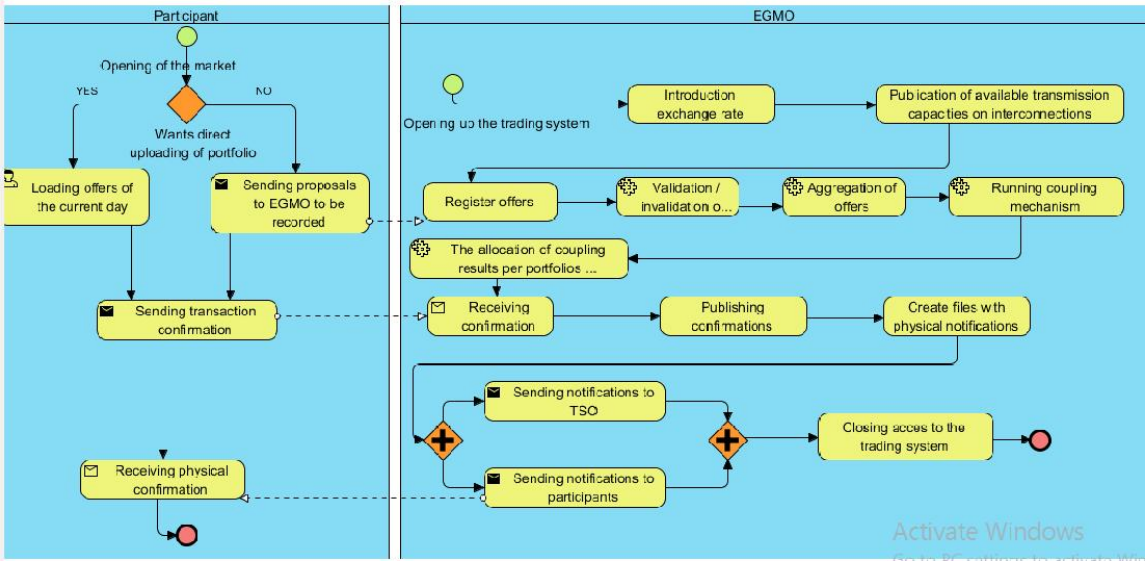

Fig. 5. Main activities on the DAM

If changes from the normal operation program are required, the procedures for operating on the Day-Ahead Market are applied.

The Electricity and Natural Gas Market Operator (ENGMO) established an agreement with Eurex Group - European Energy Exchange (EEX) and Power Exchange Central Europe (PXE)and obtained the right to use indexes of the ROPEX_DAM electricity spot market. These indices are useful for recording transactions with derivative financial contracts as well for the trading of products to reduce the volatility risk of Day-Ahead Market price.

6 Inter–daily Market (IDM)

The centralized framework for buying and selling energy created by the Inter-daily electricity Market is needed to create a wholesale energy market based on compliance with conditions of non-discrimination, competition and transparency and to establish in a transparent and fair manner the prices for trading energy. This market represents for participants a useful tool, which further facilitates adjustment of the portfolio of contracts for the delivery day, for each hour, in order to achieve a balance between bilateral contracts portfolio, consumption forecast and the technical capacity of unit's production, as close to the time of delivery as possible. By selling or buying electricity on the next day market, we can balance the deficit or surplus of electricity.

On the Inter–daily Market the participants can be license holders and operators, foreign legal entities that have obtained from NERA the right to provide or sell electricity in Romania and are registered market participants.

Applicants wishing to register on the IDM must conclude with the national transport and system operator (NTSO) an accountability convention regarding balancing or to prove that he has transferred this responsibility to a third party.

Also, applicants must sign participation on the IDM convention with EGMO, and to comply with obligations stipulated by this [9] [10].

In the Inter-daily Market a trading day is considered any calendar day, the trading interval is one hour and EGMO is this market counterparty for all trades concluded by market participants.

Each participant on the IDM can launch offers, both for sale and for purchase for each trading period. Participants' offers are validated or invalidated by the computer system, according to the procedures set out in [9]. Bids entered into the trading system by participants to the IDM end with the conclusion of transactions after the correlation conditions are met.

The criteria for arranging the offers of participants to IDM which are taken into account by the matching algorithm are considering ordering decreasing prices for purchase orders, ordering upwards for the sale offers and an order by timestamp, when orders have equal prices. By accessing the trading system, market participants obtain information on their transactions in the IDM. Following confirmation of transactions for each day, EGMO establishes physical notifications for transactions on the IDM, transmits them to the transmission and system operator (TSO) and make them known to Balancing Responsible Parties (BRP) of each participant.

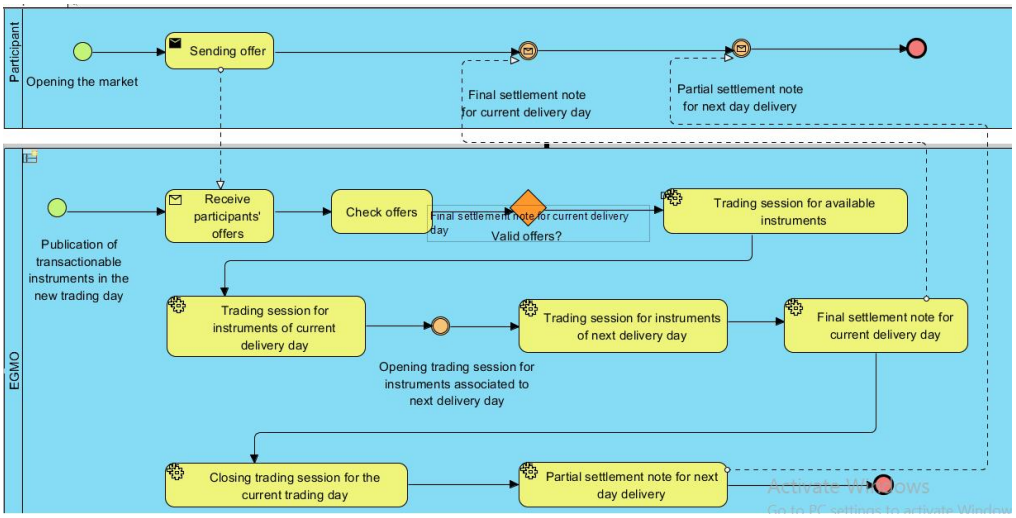

Fig. 6. Main activities on the IDM

7 Balancing Market (BM)

On the mandatory centralized Balancing Market, participants owners of dispatchable units sell (or buy) active electricity to (from) the Transmission System Operator. The purpose of these transactions is to offset deviations in production or consumption of electricity from the planned values.

Participants in the wholesale electricity market are forced to take responsibility towards TSO for deviations caused by imbalances between notified production / consumption and the ones achieved, or between the scheduled and actually performed transactions. To minimize these imbalances, participants can organize themselves in the form of Balance Responsible Parties (BRP). When there is a power increase, dispatchable producers are obliged to announce their offer in this market regarding the amount of additional electricity available in addition to the forecasted value. Similarly, if there is a reduction in power, dispatchable producers must offer on the market the amount of electricity notified. On this market, offers and transactions occur at the level of each dispatch able unit and market administration is performed by the Balancing Market Operator[1].

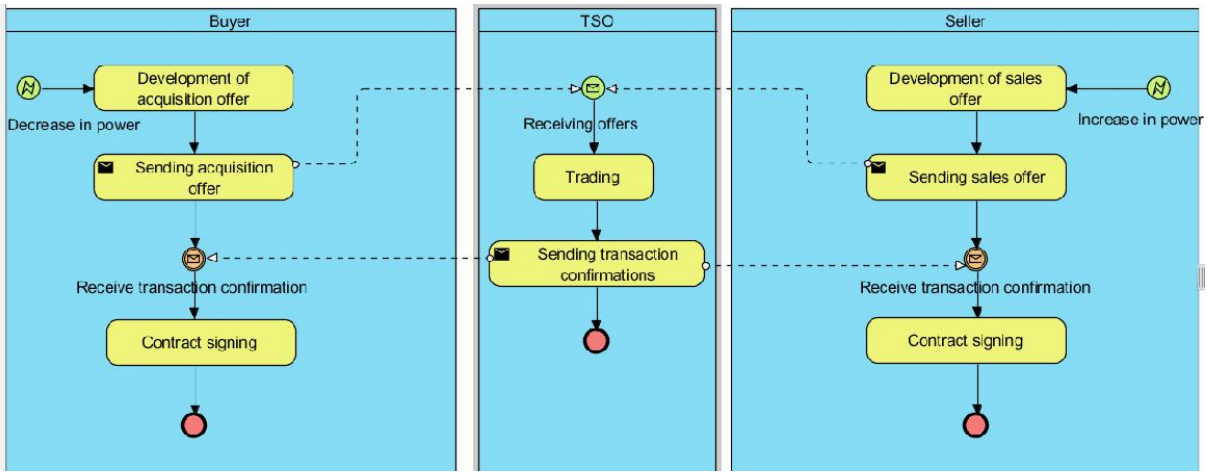

Fig. 7. Main activities on the BM

8 Centralized Market for Universal Service (CMUS)

In [8] the operation manner of the CMUS is presented in detail. Thus, in order to register of the CMUS the participants must provide the following documents:

- Letter of intent (except for the last resort supplier - LRS);
- Convention of participation on CMUS (2 original copies);
- A copy of the license issued by NERA (including license conditions);
- NERA's decision to grant a license or to be designated as LRS;
- Official document attesting to the legal existence of the company;
- Copy of the Certificate of tax registration;
- Transelectrica's confirmation on assuming balancing responsibility or transferring ownership of this responsibility;
- A summary document containing data necessary for registration in the trading register;
- Proof of payment of the regulated tariff (in case the CMUS is the first market to register on) that represents the enrollment component on the centralized markets;
- Bailment agreement for the token (2 original copies);
- Payment of the regulated tariff representing the management component of centralized markets.

If the applicant is already registered on another centralized electricity market it must submit the letter of intent, the participation agreement and an affidavit stating that the documents submitted in the enrollment earlier do not require updating, they are in force and in full applicable. Participants on the CMUS can be buyers through auction or participants with offers to sell at auction [8].

Buyers through auction are required to attend, as they are license holders appointed by NERA for the provision of LRS services. Bids are set in compliance with the Regulation. Auction buyers cannot enter bids in to CMUS's IT platform.

Participants with sale offers in the auction are manufacturers or suppliers of electricity (except for LRS). They are, due to the bailment agreement signed with EGMO, holders of a passkey to the trading system of CMUS, they hold the user ID, password and perform the input operations, update and cancellation of sale offers prom their own terminals.

They must sign the Convention to participate in CMUS at least 13 working days before the opening date of the auction session.

On the Centralized Market for Universal Service auctions are conducted quarterly, covering two or three specific products whose delivery is carried out in the following calendar quarter. NERA sets the number of products traded simultaneously and days / time intervals specific to each product. They may differ depending on the delivery period covered by the auction.

In order to participate in the auction license holders must be registered in a first stage on the CMUS and then to sign the convention of participate in CMUS at least 13 working days before the date of tender opening session. License holders must possess, as a result of bailment contract signed with EGMO, a passkey to connect to the trading system of CMUS and to have received their username and password from the administrators of CMUS. Also, licensees must constitute financial guarantee to tender and to submit indicative offers [8].

9 Conclusions

National Energy Regulatory Authority (NERA) is the main authority that acts on the Energy Contracts Markets and tries to establish the parameters for the auctions. This way the characteristics of the traded products, the number of contracts that were traded, the price, the seller's and the buyer's identity can be verified and approved.

Electricity transactions between the various participants in the electricity market in Romania take place on a competitive or on a regulated market.

Acknowledgment
This paper presents the scientific results of the project "Intelligent system for trading on wholesale electricity market" (SMARTRADE),co-financed by the European Regional Development Fund (ERDF), through the Competitiveness Operational Programme (COP) 2014-2020, priority axis 1 – Research, technological development and innovation (RD&I) to support economic competitiveness and business development,
Action 1.1.4 - Attracting high-level personnel from abroad in order to enhance the RD capacity, contract ID P_37_418, no. 62/05.09.2016, beneficiary The Bucharest University of Economic Studies

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A Survey of Network Based Traffic Classification Methods

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With the far reaching utilization of encryption systems in system applications, scrambled organize activity has as of late gotten to be an incredible challenge for organize management. These truths raise essential difficulties, making it important to devise viable answers for overseeing system traffic. Since conventional strategies are somewhat incapable and effortlessly circumvent, specific consideration has been paid to the advancement of new approaches for traffic classification. This paper focuses on different types of network classification approaches.

Keywords: *Encryption, Network traffic, Traffic classification, Quality of Service,*

1 Introduction

Movement order is likewise instrumental for all security operations, such as separating undesirable activity, activating cautions in the event of an abnormality has been identified. Movement grouping is essential to network administration and security, which can recognize distinctive applications and conventions that exist in a system. Most QoS control systems have a movement characterization module keeping in mind the end goal to appropriately organize distinctive applications over the constrained data transmission. To actualize fitting security strategies, it is fundamental for any system supervisor to get an appropriate comprehension of utilizations and conventions in the system activity. In the course of the most recent decade, activity characterization has been given a considerable measure of consideration from both industry and the scholarly community. The capacity to progressively recognize and characterize streams as indicated by their system applications is profoundly gainful for: 1) Estimating the size and birthplaces of limit request patterns for system arranging. 2) Adaptive, organize based checking of activity requiring particular QoS without direct customer application or end-have association. 3) Adaptive firewalls that can identify prohibited applications, Denial of Service (DoS) assaults or other undesirable activity. 4) Enabling negligibly obtrusive warrants and wire-taps in light of factual outlines of activity subtle elements. 5) Detect suspicious exercises identified with security breaks because of malevolent clients or worms. There are various determinations of bundle characterizations, which depend on how they are watched and investigated. This can incorporate the application by which the parcels are made for, execution measures, and distinctive fundamental conventions stacks being used. The data gave by activity order is to a great degree significant. For example, a point by point learning of the piece of activity, and the recognizable proof of patterns in application utilization, is required by administrators for a superior system plan and provisioning. Quality of Service (QoS) arrangements which organize and treat activity distinctively as indicated by various criteria, require first to separate the movement in various classes: recognizing the application to which parcels has a place is urgent when allocating them to a class. Similarly, activity characterization empowers separated class charging or Service Level Agreements (SLA) confirmation. At long last, some national governments anticipate that ISPs will perform Lawful Interception

of unlawful or basic activity, in this way obliging them to know precisely the kind of substance transmitted over their systems. Movement arrangement speaks to in certainty the initial step for exercises, for example, oddity location for the distinguishing proof of noxious utilization of system assets, and for security operation when all is said in done, similar to flame walling and sifting of undesirable activity. In the event that the utilizations of activity order are ample, then again, the difficulties classifiers need to face are not to be beaten. Initially, they should manage an expanding measure of movement and also similarly expanding transmission rates: to adapt to such speed and volume, analysts are searching for lightweight calculations with as meager computational necessities as could be allowed. The assignment is further exacerbated by engineers of system applications doing whatever in their energy to conceal movement and to escape control by administrators: activity encryption and exemplification of information in different conventions are only the initial two illustrations that ring a bell.

Since the last few years we were experienced with a number and variety of applications over internet such as real time, interactive, corporate and bulk data transfer application. These may cause some network security risks. Looking on one side, some applications require lot of bandwidth thereby congest the network and thus reduces the network performance. On the other side, some may result in the distribution of malicious codes such as Virus and Trojan horse. These may leak the privacy. So proper classification of network traffic according to their application that generated them should be done to such as to prioritize, protect or prevent some traffic. Network traffic identification is crucial due to various reasons such as security monitoring, accounting, forecasting long term provisioning, QoS measurements etc. It is also useful to address the security problems including lawful interception and intrusion detection. Accurate traffic classification is the keystone of numerous network activities. Techniques for traffic classification used for real-time processing of big amounts of data require affordable CPU and memory resources. Real time application classification has the ability to solve most of the network management problems for ISPs and equipment vendors. Classification is performed using different techniques.

Traffic classification is an automated process which categorizes computer network traffic according to various parameters (for example, based on port number or protocol) into a number of traffic classes.

Sensitive traffic: Sensitive traffic is traffic the operator has desire convey on time. This includes VoIP, online gaming, video conferencing, and web browsing. Traffic management schemes are typically customized in such a way that the quality of service of these selected uses is guaranteed, or at least prioritized over other classes of traffic. This can be accomplished by the absence of shaping for this traffic class, or by prioritizing sensitive traffic above other classes.

Best-effort traffic: Best effort traffic is all other kinds of non-negative traffic. This is traffic that the ISP esteems isn't sensitive to Quality of Service metrics (jitter, packet loss, latency). A typical example would be peer-to-peer and email applications. Traffic management schemes are generally custom-made so best-effort traffic gets what is left after sensitive traffic.

Undesired traffic: This category is generally limited to the delivery of spam and traffic created by worms, botnets, and other malicious attacks. In some networks, this definition can include such traffic as non-local VoIP (for example, Skype) or video streaming services to protect the market for the 'in-house' services of the same type. In these cases, traffic classification mechanisms identify this

traffic, allowing the network operator to either block this traffic entirely, or severely hamper its operation.

2 Traffic Classification Parameters

Arrange activity parameters are generally considered in the investigation of bundle and movement characterization methods.

A. Packet Size

Bundle size is one type of movement characterization. The vast majority of the activity volumes on the Internet can be ordered into either little parcels or expansive bundle sizes. The vast parcel size is typically connected with higher connection use. Essentially 20% of the associations on the Internet are in charge of 80% of the activity, for the most part containing elephant bundles. Movement Engineering is a term connected to a precise procedure in which activity streams are orchestrated in "ordered" gatherings to rearrange their transmission all through systems and abatement the possibility of clogs. Traffic Engineering is all around situated to manage vast volumes through the conglomeration of traffics.

The impact of these parameters adds to the making of a middle time for the stream. This middle time for elephant streams (otherwise known as substantial hitters) will be higher since as indicated by reference, the more extended the association length (overwhelming hitters), the higher the likelihood for the connection to proceed with its association.

B. Duration

Term of bundle streams is another type of parcel arrangement. Contingent upon the application, a fleeting bundle can last from a couple of milliseconds up to a couple of minutes. Enduring parcels, then again, can last from a couple of minutes up to a few hours. There are immediate connections between bigger parcel sizes and longer lengths. In view of caught genuine activity from mixed media rich associations, most control bundles, for example, reference points, ACKs, CTSs, and so on, are light associations and different parcels framing associations are viewed as substantial hitters.

C. Confidence Interval (CI)

CI is a populace related parameter, which is an interim estimator. Certainty interims are utilized to give a gauge on how dependable an example is. For an outrageous various specimen space, for example, the activity designs on the Internet spine, it is possible that one needs to screen the lines for a drawn out stretch of time (e.g., months or years) and after that run movement order methods over the spared follows, or utilize little example space with a guide of a certainty interim estimator. A certainty interim of higher than 95% is a generally decent estimation. Bayesian and Gaussian interim estimations are cases, by which certainty interims can be evaluated.

The heterogeneity of methodologies, the absence of a typical dataset and of a broadly affirmed strategy, all add to make the examination of order calculations an overwhelming assignment. The vast majority of the correlation exertion has tended to the examination of various machine learning procedures, utilizing a similar arrangement of elements and a similar arrangement of follows.

3 Traffic Classification Methods

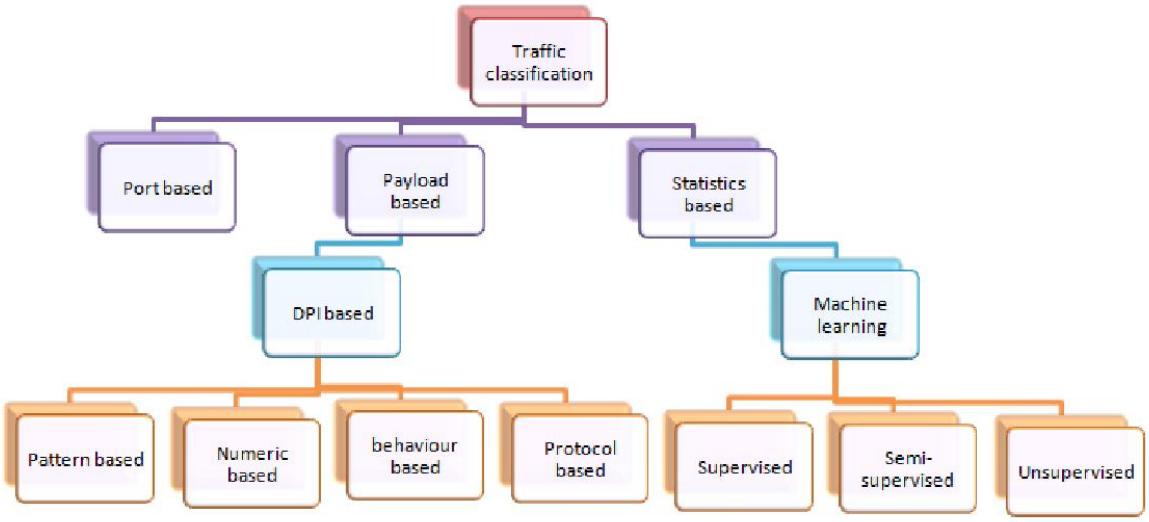

Fig 1. Traffic Classification Methods

A. Port Based Approach

Port-construct technique is situated in light of the element that specific application administrations utilize IANA relegated port numbers. This strategy experiences the accompanying inadequacies. In the first place, P2P applications utilize arbitrary or dynamic port numbers. Second, regular administration ports might be utilized by different administrations, for example, malwares. Third, there are port numbers other than the relegated. Fourth, it is coarse-grained. At last, port numbers can be covered up by transport layer or IP parcel encryption.

This technique utilizes port numbers to match applications where an application is connected with an all around characterized port number. For e.g. HTTP activity is connected with port number 80, DNS with port number 53, and so forth. This technique utilizes bundle headers as it were. Extensive number of uses "understood" port numbers to which different hosts begin correspondence. At that point, an identifier which is set amidst system sitting tight for SYN parcels which are TCP bundles utilized amid 3-way handshake process, to perceive server side of the TCP association; and since this bundle likewise contain target port number, the application additionally gets perceived by it. UDP additionally utilizes port numbers, despite the fact that it is association less administration.

Points of interest: It is quick approach as no estimations are included. Its execution is basic since it requires port numbers for new applications in database.

Restrictions: Some system applications, (for example, P2P) might not have their ports enrolled with IANA and use dynamic ports to speak with each other, and system streams among these applications can't be effortlessly identified by port based approach.

B. Payload Based Approach

Payload based strategy by and large alludes to the profound bundle review DPI system, which utilizes static application marks as a part of the payload to distinguish conventions. Stateful Packet Inspection which makes utilization of measurable properties of payload in packets.DPI is incredibly harmed by encryption since the plaintext marks turn imperceptible. Be that as it may, it can be utilized as a part of coarse grouping for certain scrambled activity, for example, SSL. With respect to SPI, it has the fine-grained arrangement capacity in principle since its elements are by and large particular for application-layer conventions. Be that as it may, measurable payload properties it depends on will be

significantly changed after encryption. It can be valuable when the encryption is fractional and organized.

This technique investigates the parcel headers furthermore into the bundle payloads. The parcel payloads are watched a little bit at a time to discover the bit streams that contain marks predefined byte arrangements of certain system convention. On the off chance that such piece streams are coordinated, then bundles can be effectively marked. At that point, put away marks are contrasted specifically with parcels of system applications keeping in mind the end goal to effectively perform arrangement.

Advantage: It can perform activity order reasonably precisely.

Confinements: (1) It can't manage scrambled application payloads. (2) Packet payloads confronted the issue on authenticity and protection. (3) It requires more opportunity to process and capacity limit. (4) It is unusable if payloads are not accessible. (5) It is not able to perceive the obscure application. (6) Signatures must be obtained ahead of time, and it might be modified alongside the evolvement of uses.

Because of number of impediments of conventional strategies, more current methodologies have been discovered, which depend on measurable attributes of movement to characterize applications. As of late, movement grouping techniques utilizing factual elements have pulled in a considerable measure of consideration, and numerous calculations, for example, machine learning and neural system have been utilized to recognize diverse classes of activity streams.

B.1 Deep Packet Inspection (DPI)

Right now IT industry is progressively perceiving and utilizing the esteem and utility of bundle level investigation additionally called Deep Packet Inspection, for rapidly and precisely distinguishing the genuine source, nature of system, application unwavering quality and execution issues. Deep Packet Inspection (DPI) is primarily used to audit the substance of bundle and arrange the system applications. DPI depicts the demonstration of catching information parcels in travel over a PC organize and putting away them on board memory for further review. It utilizes blend of profound bundle and profound stream assessment procedures. DPI is a refined technique for bundle sifting that works at the seventh layer (the application layer) of the Open System Interconnection (OSI) reference show. To give knowledge into client conduct and movement designs on the system at specific times of day, week, month or year. For to better comprehension of the system assets Deep parcel Inspection technique is valuable with examination of all system bundles parameter. This guarantees legitimate arrangement of system assets needs and gives a top notch understanding to all clients. Taking after initial two techniques are primitive strategies for bundle assessment. The third technique gives better comprehension of control framework with system payloads.

B.1.1. Mac Address Identification

In this procedure a Media Access Control (MAC) deliver is utilized to remarkably recognize hubs on an Ethernet organize. This strategy utilizes Media Access Control (MAC) address data of a gadget to shape a profile for the examined organize hub. In the most generally utilized standard today, IEEE802.3. Macintosh locations are 48-bit numbers that recognize the source and goal of an Ethernet information outline. Macintosh locations are ordinarily spoken to in a hexadecimal organization, for example, 00:C0:52:00:4D: 38. Producers are given an Organizationally Unique Identifier (OUI) to use by the IEEE. The OUI comprises of the initial 6 hexadecimal numbers, or the prefix, in the MAC address and remaining 6 hexadecimal numbers utilized for gadget one of a kind addition. This implies if the MAC address of a gadget is known, its producer can likely be reasoned.

Each Ethernet arrange gadget is given its own MAC deliver to distinguish itself. Acknowledgment of these MAC prefix output be a precise pointer of control gadgets.

B.1.2. TCP/UDP Port Number Identification

Port examining is a standout amongst the most prevalent methods to find benefits that can endeavor to break into frameworks. TCP/UDP port numbers can be utilized to perceive control framework applications. Each of these conventions contains a 16-bit source and goal port ID number. By this method frameworks associated with LAN one can get what administrations are running, what clients possess that administrations, whether certain system administrations require confirmation data about focused frameworks. In this way, acknowledgment of TCP ports utilized as a part of control framework correspondences can be a solid marker.

B.1.3. Arrange Payloads Identification

This method delineates organize proprietor to examine activity, through the system, continuously and to separate them as per their payloads. Payload is bits of important information that is being conveyed inside bundles to the end client over the system. Taking after process utilized for system payloads distinguishing proof. Catching information bundles in a PC arrange and putting away them on-board memory (working workstation) for further investigation. At that point recognizing the limits of bundle information outline with MAC address and TCP/IP port number. Revealed or separate the bundle information outline which contains genuine data transmitted by client.

C. Statistical Based Classification

Factual characterization basically alludes to the strategies in view of measurable properties of activity, in which machine learning is the most well-known one. The insights utilized can be generally isolated into bundle level and stream level. The previous incorporates parcel length, bundle interims and headings et al, and the last contains the check and proportion of the upstream and downloading in bytes and bundles, the span of stream, proportion of various sorts of parcels, and so forth. Despite the fact that encryption changes the insights of bundle and stream, there are frequently solid connections between's the decoded movement and unique scrambled one. This is the principle motivation behind why factual convention distinguishing proof is valuable.

It utilizes system or transport layer which has factual properties, for example, circulation of stream term, stream sit without moving time, bundle between landing time, parcel lengths, and so forth. These are remarkable for specific classes of uses and consequently recognize distinctive applications from each other. Some measurable elements of bundle level-follow are caught which are then used to arrange organize movement. For instance, sudden hop in rate of parcels might be an indication of P2Papplications or BGP redesigns or worm proliferation. This technique is attainable to decide application sort however not for the most part the particular application/customer sort.

4 Conclusions

Web movement characterization has been a field of escalated research since the production of the Internet itself. Encoded movement order is a standout amongst the most difficult issues in activity grouping field. A few philosophies were proposed during the time to address existing innovative issues. In this way, one might say that the advancement of movement grouping approaches went with the development of the Internet itself. Order includes legitimate distinguishing proof of various application streams and bundles in the movement and their fitting stamping. Once the bundles are grouped, the switch can apply suitable administration strategies

for those parcels.

Overviews turn out to be then significant apparatuses for comprehension and breaking down such development. Regularly, QoS is utilized to give fitting treatment to various activities in light of the arranged approaches. Every application has its own particular qualities and prerequisites. With the restricted WAN transmission capacity, QoS arrangements help in giving diverse medicines to various movement classes. In this paper, we display the scene of scrambled movement arrangement exhaustively. Firstly, the need of scrambled movement characterization is presented. At that point, the premise of encoded activity is abridged, trailed by the characterization strategy and difficulties.

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Service-Oriented Architecture (SOA) and Web Services

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From a functional perspective, a service is a standalone unit, such as taking a request from an e-commerce site. By this definition, a service is an operation that can be invoked discreetly. Services can be combined to provide the functionality of a high scope software. SOA makes it easier for different software components on computers connected via a network to cooperate in order to accomplish a certain functionality. SOA comprises several dimensions that must work together effectively to be successful. The adoption of service-based technology itself will not allow organizations to achieve benefits associated with SOA.

Keywords: *SOA, Web Services, XML, WSDL.*

1 Introduction

The main advantages of the web services are:

Interoperability between applications; reusability of existing services; easy distribution of information between consumers; fast development.

The developed application is the key element but the technology used for the application server has a major impact on the results of the implemented application. A web container is a part of a server that manages servlets, Java Server Pages (JSP) as well as other web components. The technology of the web container has a very important role in determining the performance and adaptation capability of the web service components. The web services can be implemented by using different platforms. An example for this is Oracle GlassFish Server (Sun GlassFish Enterprise Server and, previously, Sun Java System Application Server) that represents a platform for delivering server side Java applications and web services. This is an application server Java EE6 certified and it represents an essential component of the Java Enterprise System, that supports the integrated development tools.

Oracle GlassFish Server provides an environment to develop and implement Java TM–XML applications as well as web services. GlassFish Server applications include standard characteristics for Java Platform, Java EE platform as well as specific characteristics for GlassFish Server. GlassFish Server includes the following modules:

- Web Module – represents a collection of servlets, EJB's, HTML pages and classes that can be implemented on a number of Java EE application servers.
- EJB Module –it's a software unit that is composed from one or more enterprise beans as well as an implementation descriptor EJB.
- Connector Module –it's a software unit with the purpose to offer portability to the EJB components for accessing the data and information system.
- Application Client Module is the client application module and it is that software unit composed of one or more classes and descriptors that have a role in implementing the client application.

- Lifecycle Module represents the module that has the functions to define the system lifecycle and it has the purpose to execute Java based tasks in the GlassFish server environment.

The principles of service-oriented architecture are independent from any provider, product or technology. According to OASIS (Organization for the Advancement of Structured Information Standards), Service Oriented Architecture (SOA) is an architectural style that supports service orientation based on a way of thinking in terms that are specific to services and development focused on services and the results of their implementation. As the name suggests, SOA also involves architecture [1-5]. The results of adoption and promotion of SOA capabilities allow:

- Increase speed of reaction of the users: service enables implementation of flexible systems, and architecture cantered on business and technology enables impact of changes to be isolated and business processes to be modified more easily and quickly in order to meet performance requirements;
- Simplify the delivery of enhanced services: SOA and business models based on "services" allow effective management of cooperation by simplifying access to services and value streamlined chains beyond organizational boundaries;
- Streamlining business administration: TO facilitate investment leading to reduced leverage level of public and private sector (legacy of the economic crisis) through a model centered on the reuse of existing capacities, eliminate undesired redundancies and existence of visionary project architects in the IT field;
- Share information: SOA offers a new and effective approach to implementing reusable data exchange, logic interoperability from multiple activities of faster data modeling evolving towards physical interoperability;
- Transparency, security and resiliency in operation: SOA has an infrastructure built on performant standards enabling consolidation, simplification and optimization of IT infrastructure, which in turn will allow a greater transparency and auditing capacity, as well as improving business continuity [6-10].

2. SOA architecture and design

SOA architectures depend on data and services, which are described by metadata that should meet the following criteria:

- The metadata may be used by other applications, such as a catalog service to perform automatic discovery of services without changing the functionality of a service contract;
- Metadata should be provided in a form in which system designers can understand and manage services at a reasonable cost and effort.

SOA services require independent connection to operation systems and other technologies that underlie applications.

SOA separates functions into distinct units or services, which developers make available through a network in order to allow users to combine and to re-use them in making applications. These services and their consumers communicate with each other by passing data into a common well-defined format, or by coordinating an

activity between two or more services, and these include the following [11-14]:

- Services of reusability - logic is divided into services with the intention of re-using them.
- Autonomy of services - services have control over encapsulated logic from design time and runtime.
- Services status - minimizing resource consumption produced by management of status information when needed.
- Contract of standardized services - services adhere to an agreement of communication and are defined collectively by one or more descriptors.
- Loose coupling service - service maintain a relationship that minimizes dependencies and only requires that they maintain a reference to the other.
- Abstraction of services - beyond their description in the service contract, services hide logic from the outside world.
- Discovery services - services are complemented with metadata through which they can be traced effectively and interpreted by different service registries.
- Services composability - services are participants to the composition of other services, regardless of size and complexity of composition.
- Service granularity - as design consideration it ensures the purpose and optimal level of granularity necessary to provide functionality in a service operation.
- In some cases, services are deformalized for different purposes (optimize performance, access, aggregation, etc).
- Services optimization - quite obvious that for effective implementation are preferred high-quality services to those of inferior quality.
- Services relevance - functionality should be present at a level of granularity recognized by the user as a significant service for him[13-14].

In the case of a reference model for SOA,OASIS has a standard Reference Model for SOA, shown in Figure 1, which is not directly tied to any standards, technologies, or other concrete implementation details.

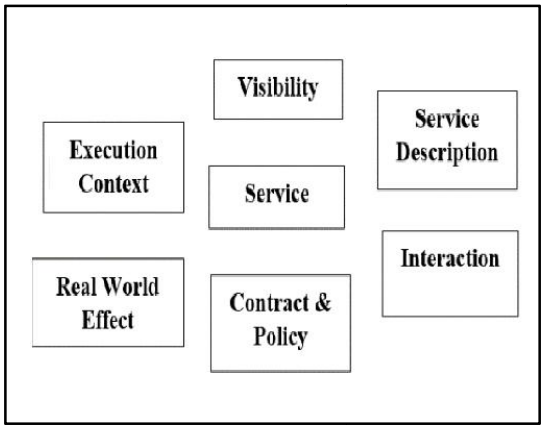

Fig. 1. The core OASIS Reference Model for Service Oriented Architecture

3. Approach of web-services

These services may be either new applications or encapsulate existing old systems to make them active on the network. Each SOA block can play one or both of the following two roles: service provider and /or service consumer according to Figure 2.

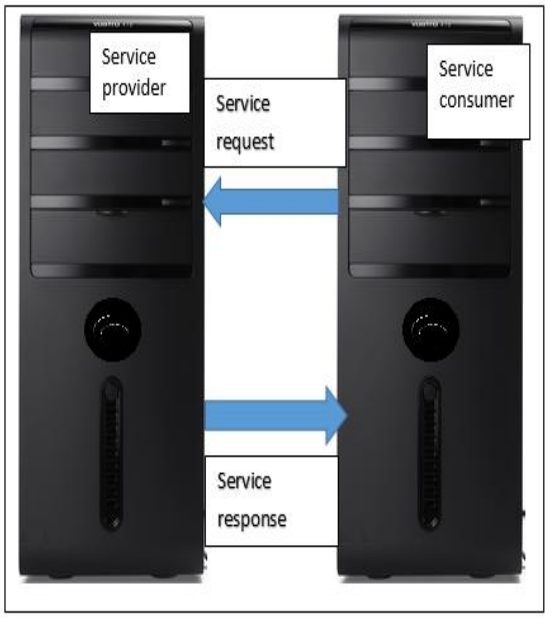

Fig. 2. Web Services

Service provider- the service provider creates a web service and, possibly, publishes interface and access information to the service register [10]. Each provider should decide what services exposes, how to compromise between security and easy availability, how to easily charge services, or (if no fee applies) how/whether to exploit them for other value.

Also, the supplier has the obligation to decide in which category services should be listed for a broker type service and what kind of partner agreements is the service required to use. Supplier records what services are available in the register and list all potential recipients of services. The implementing party then decides on broker incidence [12-15].

Public brokers are available on Internet, while private brokers are available only to a restricted public, such as the company intranet users. In addition, the amount of information provided should be decided from the beginning.

Service consumer - regardless of what service the service consumers want, they need to take it from brokers' register making a bind with the respective service and then using it. They can access multiple services if the service broker offers multiple services.

In the future you can deploy A Virtual Cloud Computing Provider for Mobile Devices [16]. Web Services Description Language (WSDL) is a format for describing Web services specifications. It is a way to describe services and how they should be related to specific network elements. WSDL have three elements: definitions, operations and services connections (bindings). Definitions are generally expressed in XML and include both data type definitions and definitions of messages, which use definitions of data types.

XML represents a condensed form for Standard Generalized Markup Language (SGML) that allows developers to create customised labels and provides flexibility in presenting information. XML is composed of 2 metalanguages, both described in the same document.

The first language is a set of rules for developing XML documents, and the second represents a set of rules to develop definitions for the type of the XML document, or DTD (Document Type Definition) with the purpose to allow validation of the XML document according to defined constrains.

Basically, XML has a dual nature, as a metalanguage that allows the description of new document and vocabulary structures as well as a language used to express the structure and vocabulary for a document. An XML document contains text, that is

usually composed of a number of marks and character data.

Vocabulary within an organization could be designed especially for that organization. It may or may not be based on an industry-wide vocabulary. If the definitions of the types of data and messages should be shared between organizations, then most likely an industry-wide vocabulary shall be used [11].

However XML language is not absolutely necessary for definitions. For example, OMG Interface Definition Language (IDL) could be used instead of XML. If a different definition language were used, senders and recipients should agree on the language and vocabulary. However, over time, vocabulary and XML-based messages have dominated. XML namespaces are used to ensure uniqueness between XML element names in definitions, operations, and service connections [17-21].

4. Metadata management

Metadata management includes information description about a Web service needed to build the body of the message (including data types and structures) and message headers, so that a service consumer may invoke a service. Public service provider posts metadata to enable consumer discovery and use them so as to build messages, which can be successfully processed by the supplier [12].

So when consumer invokes a service, it is important for him to understand not only the types and structures of data to send, but also understand additional qualities of the services provided, such as security, reliability, or transaction capacity. If one or more of these features are missing from the message, this can hinder the successful processing of the message.

Specifications for metadata include:

- XML-Schema - for the expression of data and more important for structuring and expressing a policy.
- WSDL – for the combination of messages and message exchange patterns with names and addresses of network services.
- WS-Addressing – for addressing an endpoint and reference properties associated to that endpoint. Many of the other extended specifications require WS-Addressing to define endpoints and reference properties in models of communication [7][19].
- WS-Policy - for associating quality of services with a WSDL definition. WS-Policy is a framework that includes policy type statements for various aspects of security, transaction capacity and reliability.
- WS-Metadata Exchange - to interrogate and discover metadata associated with a Web service, including the ability to bring a WSDL file and associated WS-Policy [22-25].

5. Ensure SOA security

Ensuring SOA security in an ecosystem of covered regulated services has implications over distributed policy and nature of the mechanisms used to secure SOA [8].

Security expressed through security policy messages should follow the same architectural implications for policies and contracts involved. Security policies should have support, storage, and distribution mechanisms for describing them. The descriptors of services should include a sufficiently rich meta-structure to indicate clearly which security policies are

necessary and where policy options are possible.

The mechanisms that make up the context of execution in SOA-based systems should: protect privacy and integrity of message exchanges; messages should be distributed so as to ensure the availability of policy-based identification, authentication and authorization; ensure the availability of services for consumers; be able to scale to support safety services to a growing ecosystem of services; be able to support security between different means or channels of communication; contain a framework for resolving conflicts between security policies.

Security issues apply to every level of SOA stacks and require a variety of mechanisms of protection against the many challenges and threats coming (some of them) from distributed computing architectures.

6. Conclusions

Most times it is necessary for protection mechanisms to be used in combination with specific solutions to protect against a specific threat or combination of threats.

In the world of Web services and SOAs it is particularly important to assess the need for protection at network and transfer of messages level, as well as data contained in the message [26].

Basic security mechanisms are built around encryption, authentication mechanisms, and authorization mechanism and usually they include extensive logging and audit methods to detect potential problems. Industry has reached consensus around a single framework of specifications, WS-Security, although efforts continue to complete the profiles and related additional specifications.

Providing specialized experience often requires intensive interaction of data and introduces new challenges in managing data between client and server levels. Data synchronization is a key concept and requires users to work within a distributed system. Such services allow developers to focus on applications on business logic instead of bothering with infrastructure issues.

Modern service orientation and server-based infrastructures enable automatic management of temporary disconnection, ensuring secure delivery of data to and from client application.

Some services offer data-push functions, allowing data to be pushed automatically to the client application, without a prior query.

This can be achieved through intuitive or deductive methods to ensure provision of data according to customer requirements. This very scalable capability allows to push simultaneously data to thousands of users, for example applications of stock traders, human resource monitoring or automating various logistical activities.

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Radio Data System-Platform for traffic and travel information services

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In the current National and European context where the public information is simultaneously spread on multiple channels and especially through mass-media channels, the text messaging services from public radio channels proved to be very useful and efficient for this purpose. Over the years, the use of a warning system like Radio Data System (RDS), at a global level shown, through text message or sound alarms is useful for the drivers to know the traffic, as well as for being aware of any emergency situations (fires, floods, earth-quakes). In this paper we present the characteristics of an RDS system with the Alert feature, as well as the study of radio covering of four from the Romanian National Radio News network's broadcasting points.
***Keyword**: RDS, RDS-TMC, Alert, radio coverage, emergency systems*

1 Introduction

The distribution systems of the analogic and digital radio signal are well known in nowadays, although the technical solutions are being generally landed as "classics". The frequency band used for a FM radio receptor is encountered in the range 87.5 – 108.0 MHz (also named "the CCIR Band") or in the range 67 – 72 MHz (also named "the OIRT Band"). In Europe, the "88 – 108" MHz band is used, all radio stations (local or national, public or private) deploying their activity in this band [1].
The data transmission system in radio channels of public broadcasting bands (RDS) is able to ensure the traffic information and to deliver them to users. The transmission of text messages regarding the description of events, status and location it is used. Information is transmitted through existing FM radio networks. This enables highly accurate, relevant and timely transmission of information, using the language chosen by the user and without interrupting normal services [2].
The RDS protocol allows the transmission of traffic messages like urgent messages, in cases of natural disasters [3,4,5].
The European Memorandum (MoU), published in his final form in 1997, presents the premises of the standard services and equipments of the data transmission System in radio channels in public bands and the specifications of the traffic channels for messages (Radio Data System, Traffic Message Channel- RDS-TMC) [6].

2. Depiction of the RDS-TMC System

- **Depiction "Alert"**

Within the Alert System, throw harmonization and interconnecting of the services, any user can employ the same receptor of any UE country and, also, can receive the same type of services, no matter the country he cross. Alert is a service which is based on the Alert-C broadcasting protocol and is free of charge for the user.
All the memorandum chapters acknowledge the right of introducing and establish services regarding the installation, distribution and maintaining equipments, taking into account the national statute, including the license, in accordance with the EU resolutions.

- **The attainment of the services platforms**

The parts that accept RDS-TMC and by default affiliate to the Memorandum are in

agree to create services platforms that include the public authorities, road infrastructures operators, information providers, broadcasters and broadcast network operators [7]. This platforms will ensure the base for the European coordination and will allow introducing the services operated by the corresponding parts. Also, they represents tools for performing and maintaining the services suitability, in accordance with the standard RDS-TMC, including the Alert functionality.

In 2003 was adopted the ISO 14819-1.2.3 standard, that defines the Alert-C protocol used by RDS-TMC [8,9,10].
The ISO 14819-1 standard defines the Alert-C protocol and the format of the data groups, necessary for transmitting RDS-TMC information:

- 3A group – information regarding the TMC application and it parameters
- 8A group – information regarding the services provider and traffic information.

The format of the 8A[8] data group is presented in **Fig. 1**.

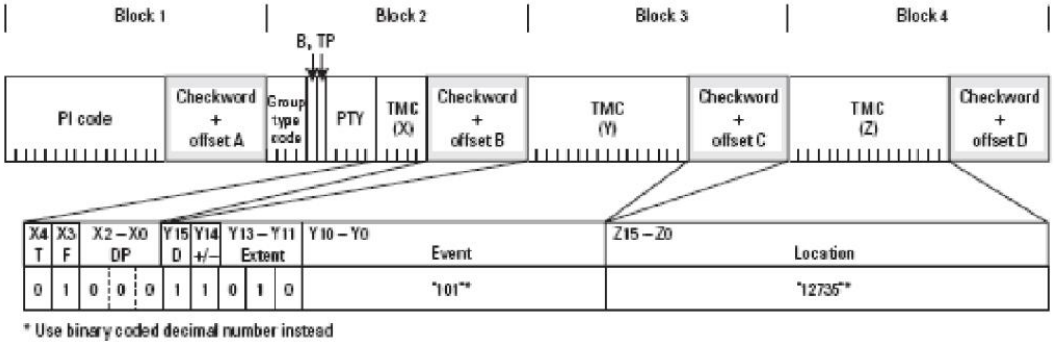

Fig. 1. The format of the 8A data group

The RDS-TMC posts contain coded information regarding the event, location, etc [9].

The format of the standard RDS-TMC post is presented in **Fig 2**.

- Event (11 bits): coding set by ISO 14819-2.
- Location (16 bits): location established by the national table of locations as depicted in ISO 14819-3.
- Direction (1 bit): direction +/- meaning toward street (predefined)
- Extent (3 bits) defines the next location.
- Duration (3 bits) – the estimated duration of the problem.

Event	Location	Direction	Extent	Duration / Time
1	20047	0	001	001

Fig. 2. The format of the standard RDS-TMC post

The message is coded when is transmitted, resulting in a coded message, previously defined. The TMC receptor/navigator decodes the initial message and it is provided to the user as text. One of the advantages of the coded message, above the text one, is that it can be presented to the user in the selected language.

- **The table of RDS-TMC Locations** [10]

The location is transmitted throw a 16 bits code. Each country must define a table of RDS-TMC locations, which is able to correlate the location code and the location itself. The following information will be provided: location, geographical coordinates, name of the location, etc.
The table of TMC locations is the starting point for the destination of the transmitted messages by the encoders of the radio stations. Specific codes that select locations from the events areas are transmitted.
Each country has a unique table of RDS-TMC locations, which needs to comprise all locations necessary for the TMC system to work properly. The maximum number of locations defined using a table is 65200.
The ISO 14819-3 standard requires that one country can assign maximum 4 tables of locations.
The ISO 14819-3 standard defines the mode in which the locations must be chosen and how the location table can be defined (made of 22 different tables). In the EU, there is a certification body format for the table of RDS-TMC locations, which checks the compliance with the standard, regarding the TMC table content for each country that desires the TMC system implementation. This certification body is TMC Forum.
After certification, the location table of the specific country is becoming public, in order for the navigator manufacturers to use in their navigation papers.
This process of certification is made when defining the TMC locations table and also when the later versions are elaborated.

At the physical level, there is a table named "header" and 22 tables that can make possible the locations descriptions.
Hereby are a few of the most important tables:

- table SUBTYPES – it contains the RDS areas subtypes (Area – A, Linear – L, Points –P)
- table LANGUAGES – information regarding the language
- table NAMES – the locations names
- table README – characters and other information regarding the local standard
- table ADMINISTRATIVE AREA
- table ROADS – roads table
- table SEGMENTS- the table that defines segments
- table PONTS – the table that defines points (P)
- table INTERSECTION – information about the intersections

Radio stations traditional are limited by two factors: the transmission power of a station on a certain frequency (normally limited to a radius of 150 km, but can be more or less depending on antenna height, relief, power emission) and the number of frequencies available that vary by state and country.
To achieve RDS-TMC services are required to implement broadcasting networks so as to allow their radio coverage of radio reception in good condition highway road (at least European corridors and subsequent national roads). The location of radiant systems is performed in accordance with radio coverage studies, best results give radio systems developed by one of the following strategies:

- choosing for each large area (hundreds of kilometers) of a major operator to ensure that the transmission of radio and RDS-TMC through multiple transmitters own it and having total

management of the network and messages sent

- harmonisation RDS-TMC services that can be provided by all local broadcasters by making working arrangements between them and RDS messaging center. Through this agreement they must ensure public services equivalent RDS.

An ideal solution would be to adopt an implementation techniques using services of only one radio operator, large-scale, it has the ability to cover the geographical areas as large as possible.
Another solution would be to create a directive antenna systems, which provides a radio field asymmetrically oriented areas of interest.

Directive antennas are the ones that mainly affects the radiation diagram to a certain direction of orientation. A directive antenna works focusing the signal on a certain direction with the others, and known as antenna "beam".
One of the great advantages of encapsulated antenna beam (typical installation method for broadcasting antennas) is that it is not affected by rain, snow, sand and electrostatic loads. Rain or storms charged electrostatically atmosphere resulting the increased noise band antennas vertical and horizontal. .As a special feature, asymmetrical antennas (generally made on the basis of multiple vibrating element) are totally immune to this type of noise (**Fig. 3**).

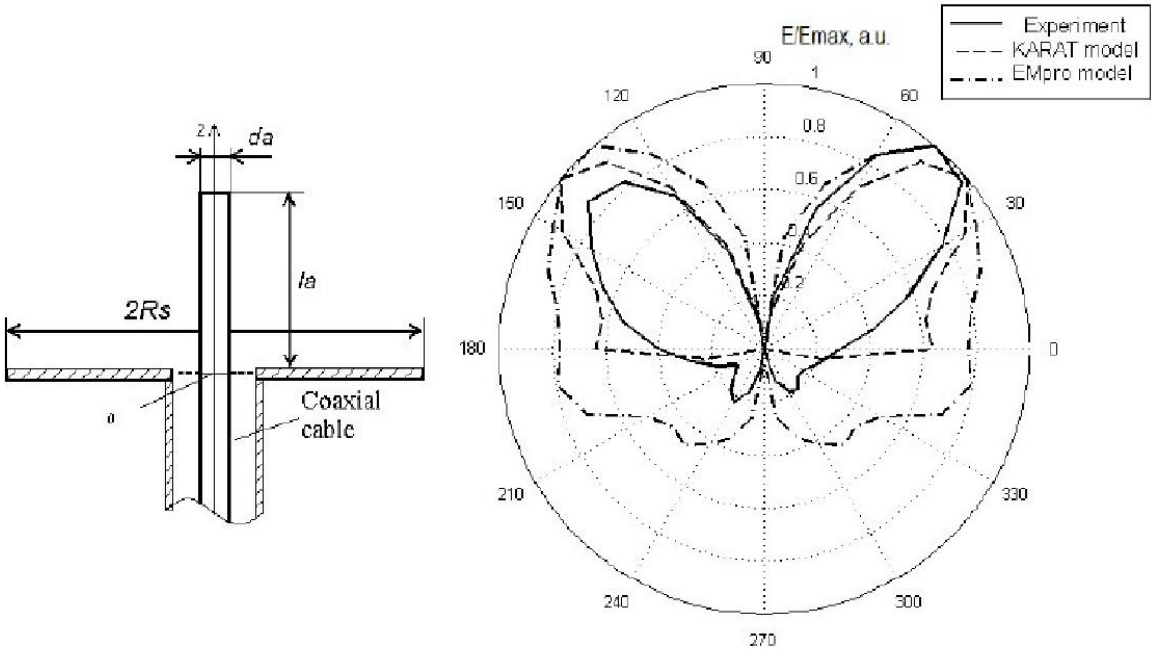

Fig. 3 Asymmetric dipole antenna radio and symmetric dipole antenna radio [11]

Another solution would be to create a passive repeaters placed along roads. These repeaters have the advantage that allow to re-route the signal characteristics influence without having on emission and radiation originating signal systems. Also, due to the transfer characteristics of the radio band, the systems allow the guidance of more frequent, corresponding to several public radio operators.

3. The structure of the broadcasting stations

The RDS message will be in the location where the broadcaster is located, which is basically RDS radio interface. Interconnection interface is provided for compatibility standards imposed by RDS radio standards.
RDS encoder output will connect to one of the entrances mixer / modulator FM broadcaster.

The interconnection scheme is shown in **Fig. 4**:

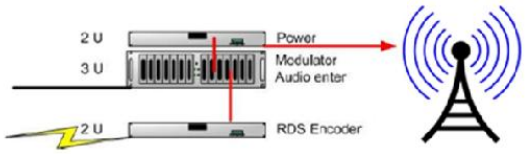

Fig. 4. The scheme interconnection stations broadcasting

In order to increase overall system reliability, encoder connects directly to data transmission networks, without need of intermediate equipment. Equipment used for radio equipment at each station fit entirely in RDS standards, the equipment have very good quality with very good reliability and excellent quality signal. These devices are integrated (virtually the entire local system is included in one physical equipment), standard and professional radio transmitter connects to any standard. From a physical perspective, they are modular rack .Thus is minimal installation effort and also local area connectivity is near. Physical connections are avoided for very long or terminating successive fields which could induce foreign radiant with undesirable effects on the local system. Connecting encoders RDS broadcasting systems involves their installation near transmitter module (whether the power amplifier is at the same location or not), as annexed to the way existing broadcast system. The connection is made directly through wiring and a sleeve locally standard, so that operations should not involve disconnection or disruption of local broadcasting.

In terms of the RDS-TMC system overall the technology aim is to achieve a wireless network with data transmission in the form of RDS to ensure radio coverage in all areas of interest, regardless of the strategy adopted or radio implementation territory.

For this purpose, the implementation of a national or local (but over wide areas) is necessary to undertake studies of radio coverage for each geographic area in part.

4. The coverage of the network broadcasters Romanian Radio Broadcasting Corporation

I used the software ICS Telecom and realized full coverage network of stations where RDS encoders were installed. (**Fig. 5-8**)

Locations of these stations are:

- **Costila**, 45.427161N, 25.48708E, Radio România Actualități 102.20MHz, 100kW;

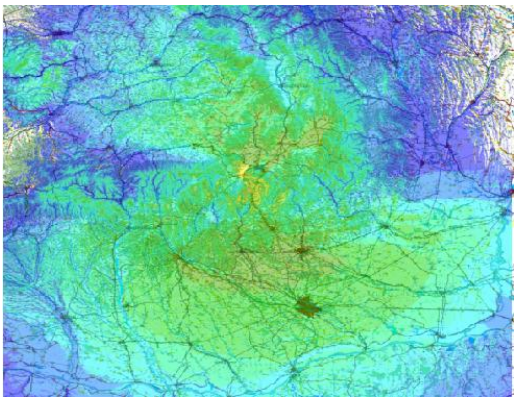

Fig. 5 Map representing the range of the transmitter from the network of Romania Actualitati installed at Costila (operating frequency = 102.2 MHz)

- **Herastrau**, 44°28'37" N / 26°03'00" E, Radio România Actualități 105.3 MHz, 10kW

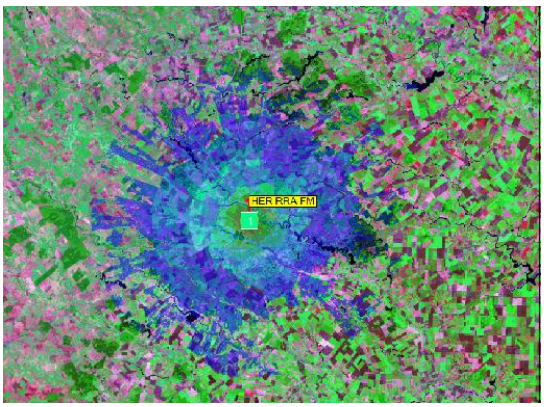

Fig. 6 Map representing the range of the transmitter from the network of Romania Actualitati installed at Herastrau (operating frequency = 105,3 Mhz)

- **Cozia**, 45°19'16"N / 24°19'46"E, Radio România Actualități 103.40 MHz, 10 kW;

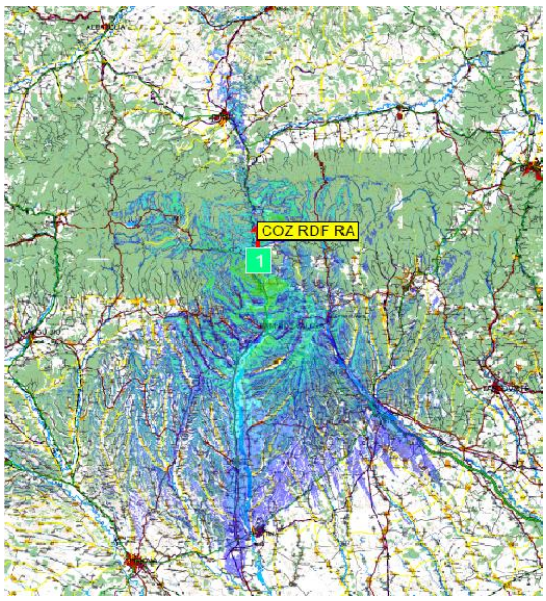

Fig. 7 Map representing the range of the transmitter from the network of Romania Actualitati installed at Cozia (operating frequency = 103,4 Mhz)

- **Vacareni**, 45°19'39" N / 28°10'36" E, 45.3277379N, 28.1768203E, Radio România Actualități 106.40 MHz,10 kW

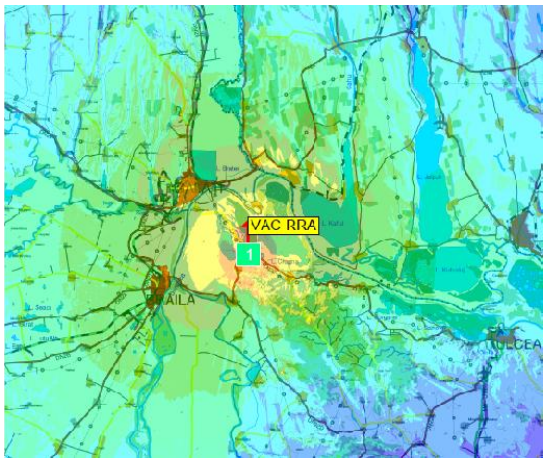

Fig. 8 Map representing the range of the transmitter from the network of Romania Actualitati installed at Văcăreni (operating frequency = 106,4 Mhz)

The study reveals that using maximum performance of the network of transmitters to this radio station obtained large areas of coverage so that it can achieve an early warning system RDS whose beneficiaries are drivers (System Alert) as and population exposed to risks the calamnitate (text and audio).

5. Conclusions

The RDS system is taking ground by its many possibilities of low implementation costs and various applications, known for its rapid development especially in the automobile traffic. On the other hand, because of its low implementation costs (despite the service's quality and efficiency) and its high increase in national radio network coverage, the system can be developed in future for other purposes too, such as emergency situations awareness. This system's main advantage is that it offers a reliable and secure information system without major maintenance and user expenses, the latter taking the entire benefit of it directly and transparently. Because of the almost inexistent user costs, the RDS based warning systems prove to be the most efficient and with the largest reach-out to its consumers

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Graphical interface for eCall incidents

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Using data on incidents eCall in traffic control center I have designed a graphical interface between PSAP 112 and national traffic control center. The interface is modular, each component is implemented as a separate module, of which architecture respects the design pattern MVVM (Model View View-Model). This will get a timely response for traffic management in the area and obtain traffic information in the area.
Keywords: *eCall, graphical interface, traffic management, traveler information services, Model View View-Model*

1 Introduction

The single emergency service, call 112, was conducted in Europe. This is a practical way to make the free movement of European citizens to safer.
Important efforts have been made in the European Union that, in case of crash, 112 can be automatically dialed from inside the car, In this context all new cars should be equipped with the automatic emergency call system eCall - Emergency -*eCall* [1,2,3]
The instalation of the ECall based on the service 112 in types of vehicles which are to be manufactured after March 31, 2018 should be promoted to increase the degree of system implementation. Regarding the types of vehicles type-approved before 31 march 2018, the subsequent installation of an Ecall system is possible [4]
There are serious and very serious accidents when people's lives depend on alarm systems such as eCall [5,6,7]. The service is automatically activated and calls the European emergency number 112 by transmitting information about the accident to dispatch 112 [8]. The eCall system allows the generation of a 112 emergency call and sends a set of data on the vehicle, where the accident occurred, etc. [9]. The request can be performed manually or automatically [10,11]. When there is no data necessary for solving the case, it can appeal to a European database.
eCall is a European Commission project that will carry out road safety through rapid intervention specialized services in case of an accident anywhere in the European Union.
ECall is an open system platform, will send other useful information to beneficiaries such as traffic management centers. These are based on logging the incidents submitted by eCall platform to inform road users and other media communications on the incident location to avoid congestion and affected accidents routes. In this context we designed a graphical interface that allows data exchange between PSAP 112 and the national traffic management center.

2. Design interface

I used Composite Application Library [12] to design the interface, which helps architects and developers to develop applications with Windows Presentation Foundation (WPF). Composite WPF applications consist of separate "tracks", fully functional, which creates a single unified user interface. Composite Application Library accelerates composite application development using design patterns to help them.

Composite Application Library is designed to address the demands from developers and architects that create WPF client applications and need to solve the following:

- Developing clients composed of independent but cooperative modules.
- Separating development modules from a

framework for integration (shell framework); In this way teams can focus on developing specific modules but not the entire architecture WPF

- Using an architectural framework for embedded applications to produce consistent and high quality results.

3. Interface description

The interface messaging application eCall (Figure 1) is divided into three distinct areas (called regions): the upper - the toolbar (Type Toolbar / commandbar) area, the center - contains components the main interface (Overview, message Board, Search) you can select independent by changing tabs (type Content Tab) and the right - the quick access to important messages / urgent (watchlist) and statistics (statistics), each of these two are separately encapsulated in an expandable list (Expander ViewList).

Interface Overview. The application starts with reports on the status of all messages (Message Status Report Chart) and the intervals of the faults (Chart incidents Report). The first graph shows the number of messages recieved (incoming), completed (finalized) or ongoing / settlement (pending). The second graph shows the number of incidents per time of day, to detect the most dangerous period (with the highest risk level).

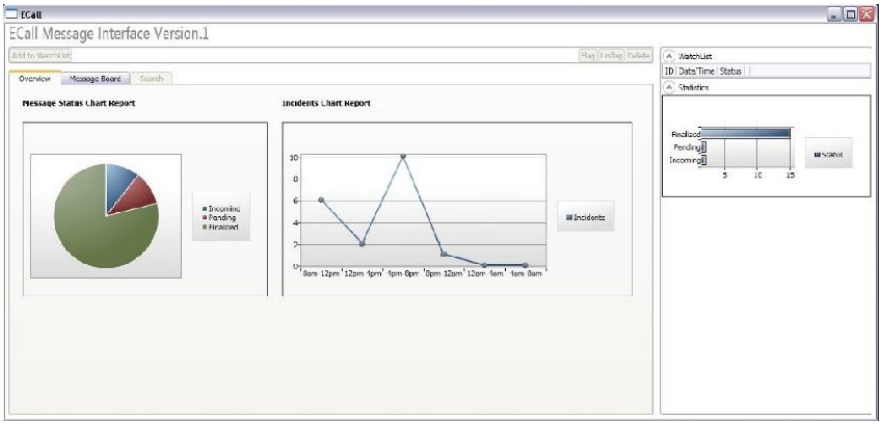

Fig. 1 – ECall interface messaging application (overview)

Component selection can be changed by another component, such as Table messages (Message Board) shown in (Figure 2). In the right will always appear the chart with statistics on the current number of active incidents (pending receipt or pending scroll / settlement) and the list of important messages that require supervision (Watch list).

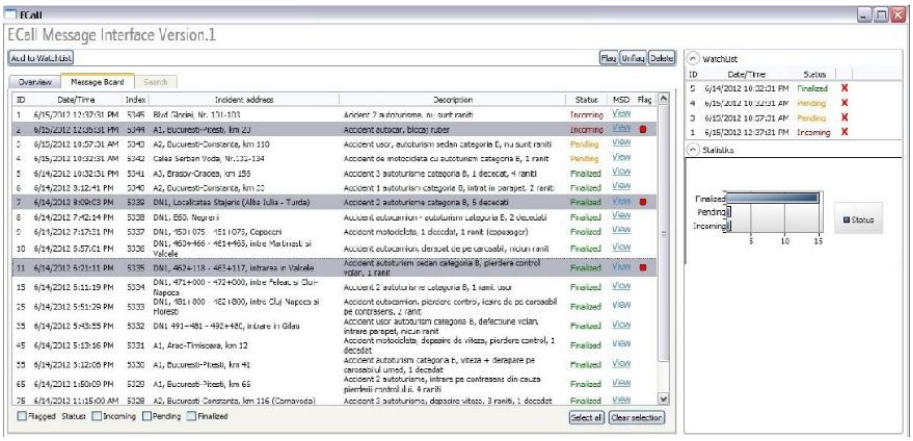

Fig. 2. Messages table

Within the Message Board component, we find all messages sorted by lowest ID. We can mark / unmark / delete / add a message to our watch list (watch list) or more, through their normal selection and proper actuation. For example, if a message has been selected and sent to the watch list, will appear in the appropriate box. Subsequently, if the message no longer needs necessary supervision, it can be deleted (even the table posts, but obviously this is just an interface, there is a deletion in the database).

Each message in the Messages table is accompanied by a package MSD (Minimum Set of Data) which can be viewed by the action command View from desired message. A window will open (Figure 3) where we have information on date / time, location, direction (GPS coordinates) and last known locations. Also, within this window we can locate the incident location using an interactive map to locate the action (Locate incident).

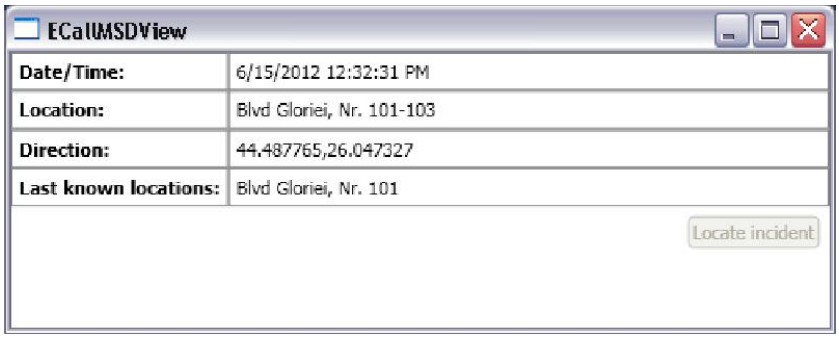

Fig. 3. View information MSD

Possible actions:
1. Change component
2. Cloning MesageBoard message to the watchlist (Add To Watchlist)
3. Delete the message from the message board or watchlist
4. Filter according to selectable options
5. Select / deselect messages
6. Select / deselect all messages
7. Mark / unmark (Flag / Unflag) posts
8. View MSD (per message)
9. Expand list in the right area

4. Interface components

The interface has a modular design, where each component is implemented as a separate module. These modules are loaded at runtime (using the advantages of .NET Framework) along with the data model used to describe the messages. The communication between modules is achieved through a range of services available to all modules [12,13].

The application's architecture respects the design pattern MVVM (Model View View-Model) which means that each module has three separate levels: model-data (Data Model - common to each mode), view-model (View-Model - way a parse and identify how data model specific to each module), graphical view (View - way data is represented graphically model for user interaction).

The interface can identify six components / modules: General Overview, Message Board, Search, Watch List, Statistics and the Toolbar. The data model behind the visual interface describes all the content of a message eCall transmitted to the central server (abstracts a message eCall) and notifies any changes made to it (is an observable data model - any change in the model will synchronize and will reflect the changes). Each module interprets this data model differently, depending on its purpose and function performed by the View model (ex. the Statistics module uses only the

number of posts under three conditions mentioned above).

Model data

The database is accessible through service modules. These services inspect public properties exposed by the model, thus filling in the description field values. The data, as I mentioned, is observable and the interface notifies when changes occur (data model implements INotifyPropertyChanged interface exposed in the .Net Framework). When you start the application, the data model is initiated with content. So we will have a list of messages where each message is defined by the data fields present in the model. When we interact with the data model we actually interact directly with the content of the messages. To change the content of a message, we call all the properties exposed by model. Once we have achieved the desired change, the property will notify this to the interface, at which time it will reset the level of View.

The data model has the following fields (exposed via public property):
id: ID of the message is the registration number in the database

- associated property: ID
  - Time: the time and date the message was recorded
- associated property: Time
  - Index: Index message Event index (derived from the database of incidents, selected by the operator)
- associated property: Index
  - incidentAddres: address on the scene
- associated Property:IncidentAddres
  -freeText: text space for notes, incident description
- associated property: FreeTex
  -status: status message - resolved, pending, ongoing allocation
- associated property: Status
  - flag: marking message
- associated property: Flag
  -MSDtime: time and date on which the incident occurred
- associated property: MSDTime
  -MSDlocation: address details about the incident, GPS positions
- associated property: MSDLocation
  -MSDdirection: directions to the place of incident (position before the crash- GPS coordinates)
- associated property: MSDDirection
  -MSDlastLocation:new locations (the last two, three GPS position) - associated property: MSDLastLocation

Components / Modules

- General Overview (Figure 4)

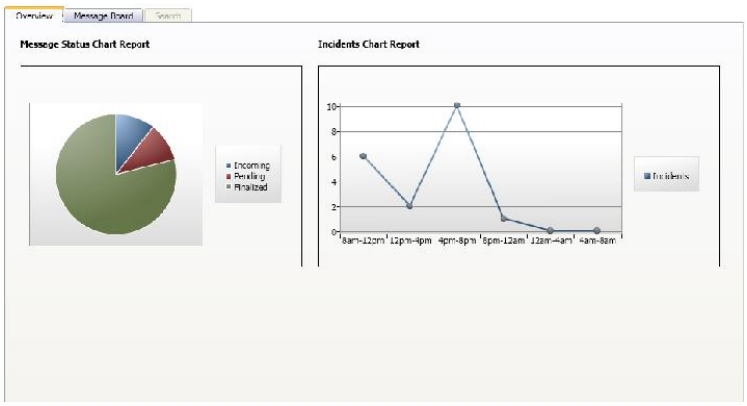

Fig. 4. Components / modules (overview)

This module exposes two graphs / reports on the number of posts, under three states (pending allocation under finalization / settlement and completed) and the number of incidents in a ll intervals of a day (24h). These calculations are performed only on messages found in the table, so a r c h i v e d messages will not be considered (only local posts).

- Message Board

The message board (Figure 5) lists all the messages that the user wants to view. Each message is defined in the data model, the fields are visible in the form of table heads. Only the MSD (minimum set of data) is visible separately when choosing to View the selected message. At the bottom we have two buttons - selection of all messages or reset selection, and two filtering options - after status (Incoming, Pending, Finalized) or only marked messages (Flagged).

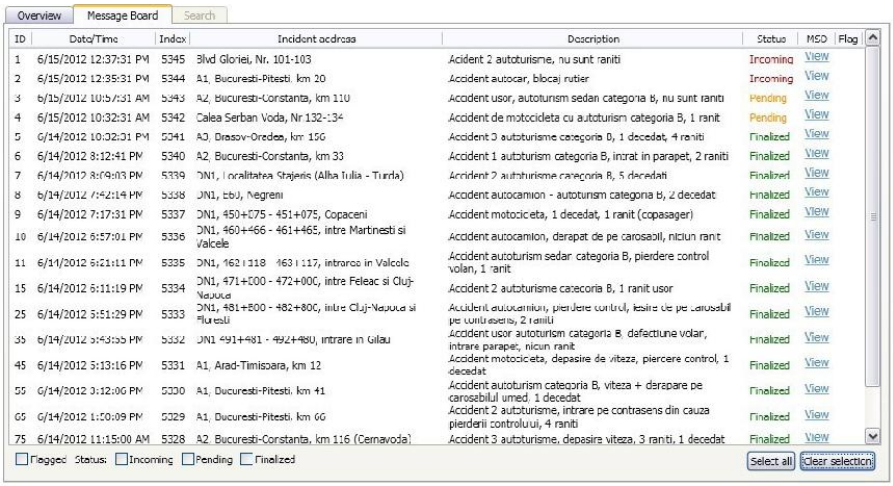

Fig. 5. Table messaging

When we select a message, or more, and choose to add them to the watch list (Add To Watch List), these will be added (as cloned messages) in the appropriate box (Watch List) located in the right region. The message board can be monitored throughout the entire activity as they are notified in case of data content changes (ex: change the message with ID 2's status from Finalized to Pending) and therefore the behavior is observable in real time.

Thus, through this list, we can isolate high priority messages and monitor them separately. If we want to delete messages from the list we just do it by pressing X, colored in red (Figure 6)

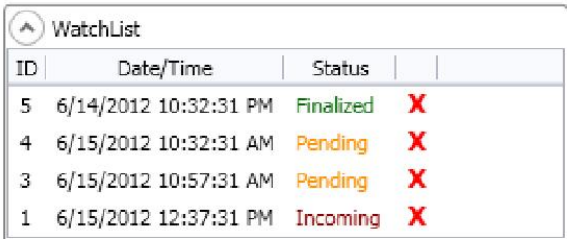

Fig. 6. Watch List

- Statistics

Statistics module (Figure 7) shows the number of messages that are in the three states (completed, pending, pending allocation) as a bar graph. This graph is always visible in the right region and is also notified when changing data content (ex.: longer resolve an incident).

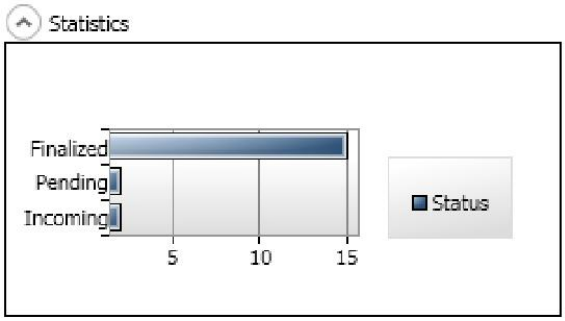

Fig. 7. Statistics module

- Toolbar

This module contains all commands that can act on a message in Message Board (Figure 8)

Fig. 8. Toolbar

- Add to WatchList
  By selecting a message or several messages and using this option, we are copying those messages in the watch list (right list, the shortcut).
- Mark (Flag)
  By selecting a message or several messages from the board and using this command, we will be able to mark those messages through a red warning sign.
- Unmark (Unflag)
  Mark is the reverse order, removes the selected messages' warning sign.
- Delete
  By selecting a message or several messages making and using this command, we will be deleting messages. Erasure occurs only at the interface level; messages remain in the database and can be part of the archive. Every command is implemented independently, in this way using a design-pattern type Command, and command action is a method call made by the mediator - contains services implemented at the application level that can manipulate data content.

5. Interaction between modules

The interaction between modules is achieved through a mediator containing a list of services implemented at the application level that can manipulate data content:

- *Message XML Reader*- Reads and parses the data stream coming from the database; stores into a collection data.
- *Message Control Service*, implements the following functionality on data collection:
- *Set Message Board Collection*: this functionality is achieved through a connection (data binding) with the data collection that contains instances of the data model complemented with information obtained from flow database.
- *Add To WatchList* : this functionality assignes a message to the watchlist,
- *Flag/Unflag Message*: This functionality is assigned to the command Flag / Unfla - in toolbar
- *Delete From Message Board*: this functionality is assigned to the Delete command - the command bar
- *Delete From Watch List*: this functionality is assigned to the command "X" associated with an element of watch list
- *StatisticsService:* Based on the collected

data, the statistical/analytical computation is needed to build the graphs of the two components, Overview and Statistics. This service has methods (visible from outside mediator) to call the calculation of statistics on new data and get those calculations to build graphs.

6. Conclusions

ECall application messaging interface allows quick access to important messages / emergency type eCall and statistics.
The data model used in the design of the interface shows all the content of a message sent by the eCall PSAP 112 and notify any change is made on sa. In conclusion, we get useful data in real time on the incident eCall

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