A Multi-Agent Technology Based Platform for Marketing Communication

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One of the most significant current discussions in marketing is related to personalizing and distribution marketing information content in order to promote services and/or products that will be sent to the customers with a specific profile. In this context, is becoming increasingly difficult to ignore the design process of the dedicated platforms built for composing and spreading marketing information. The entire involved communication process is also characterized by a set of specific tasks. However, a major issue with this kind of platforms is related to the identification of the clients groups (clients with similar needs), building clients' profiles, information personalization and distribution in an efficient way, collecting a relevant feedback from the clients. The purpose of this paper is to review recent research regarding marketing communication platforms (MCP) and to propose a platform architecture for MCP using intelligent technologies in several aspects specific to this kind of platform. For the proposed architecture each module will be described and also its particularities. In the end, there is outline a conclusion set regarding the platform and its functionalities.

Key words: marketing communications platform, personalizing information, intelligent technologies, client profile

JEL classification: M31, O30, D83.

1. Introduction

Marketing activity represents "the management process through which goods and services move from concept to the customer" (Business Dictionary, 2015). In this entire process there are 4 elements that are taken into account (known as the 4 P's of the marketing): the product, the price, the place, and the promotional strategy. The American Marketing Association defines the marketing as being "the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large" (America Marketing Association, 2015). In this context, the marketing research is defined as being "the function that links the consumer, customer, and public to the marketer through information". Proctor (2012), Smith (2012) and Malhotra (2013) are debating the marketing research topic, highlighting its importance and issues in their papers. Marketing communication in this context represents a key element that influences very much the success of a marketing strategy. Marketing communication is defined as "the mixt between advertising, sales promotion, public relations and publicity, personal selling, and direct marketing", being also "the means by which firms attempt to inform, persuade and remind customers – directly or indirectly – about the products or brands that they sell" (Kotler, 2002). For developing an efficient marketing communication, in the same source, there are mentioned some steps that must be followed. These steps are about: targeting the audience, communication objectives, message design, communication channels, communications budget, communications mix, communications' results, and managing the integrated marketing. One of the most significant current discussions in marketing communication is about the platform used because the accomplishment of the mentioned steps is relying on it. Stelzner (2014) and ComScore (2013) have both debated the platform aspect. ComScore, according to their own description, is an important company, leader in digital measurement and analytics, offering information about web, mobile and TV consumer behavior.

The marketing communication platform offers a special support for marketing communication overall from the most important objectives point of view. The objectives point to the extend marketing 7's P, meaning product, price, place, promotion, people, process, physical environment (Sage Design Group, 2015) and are related to the advertising, sales promotion, events and experiences, PR and publicity, direct marketing, interactive marketing and personal selling (eMarketing Consult, 2015). However, a major issue with this kind of platforms is related to the identification of the potential clients and client's groups (clients with similar needs), building clients' profiles, information personalization and distribution in an efficient way, collecting a relevant feedback from the clients. So far, there has been little discussion about the way that modern technologies like agent-based technology and data mining may improve the activity of a

communication marketing platform in several aspects. Samir and Habiba (2009) in their research have proposed a multi-agent system for personalizing information source selection.

The main issues addressed in this paper are marketing communication platforms overview and issues, aspects to be improved from the platform point of view by using a modern technology like agent-based technology and data mining technology.

The paper has been organized in the following way: in the first part it gives a brief overview of the main activities necessary to be done during a marketing communication process; in the second part, aspects regarding the marketing communication platform are presented, aspects like role, components, types and also some examples; in the third part there is proposed an architecture for a marketing communication platform that is based on an agent-based technology; in the last part are mentioned some conclusion and future work directions.

2. Clients identification, profiles and information personalization

Recent statistics have shown that the online stores number is increasing. This entails a growing number of clients. In Romania, for example, according to Wall Street (2015), the Internet penetration rate in Romania will continue to grow also in 2015, heading for 60%, keeping in Eastern Europe average (mean Eastern Europe is well below the average of Central Europe, which was 78% in 2014). In terms of Internet usage in Romania, according to (Internet World Statistics 2015) in mid-2014, there were 11,178,477 identified users; this number represents 51.4% of the Romanian population and 1.9% of the Europe total population. The number of Romanians who buy online is expected to exceed 3 million in the year 2015 (Wall Street, 2015). In Figure 1 is mentioned the top 10 Countries in Europe regarding the internet user's number in mid-2014.
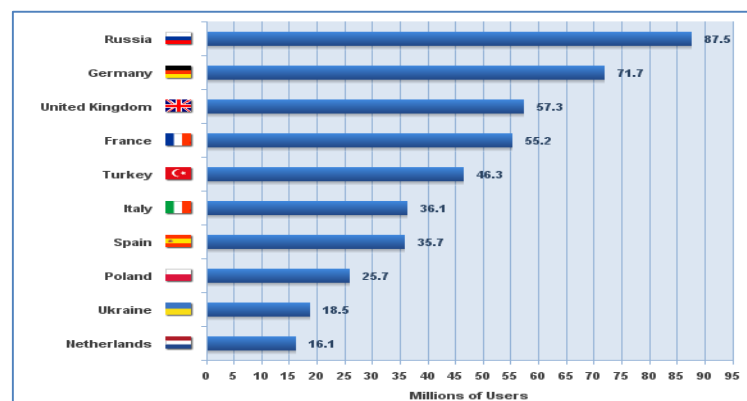

Figure 1. Internet Top 10 Countries in Europe (June 30, 2014)
Source: Internet World Statistics, 2015

Under these circumstances, activities such as customer management, identifying potential customers, creating customer groups with similar needs, making client's profiles, customizing the information sent to the customers and distributing it in an efficient way and also collecting feedback from customers are very important in achieving a successful marketing strategy. Therefore, in designing marketing communication platforms, these kinds of activities must be taken into account.

The importance of the above activities is shown briefly in the following:
- customer management - should be easily achieved in order to make possible client identification, updating and adding information about him in databases owned by the company;
- identifying potential clients - based on collected data, a customer may be selected. This customer (potential client) has a big probability to be open to marketing campaigns and offers made by the company;
- creation of groups of customers with similar needs – by using customer data and data mining techniques it is possible to group customers. Based on these groups a customized offer may be created, taking into account client's preferences. In this context, a created client profile must be very representative for the client's group that it represents;
- customize the information sent to the clients and distributing it in an effective manner as well. Once the groups are created, information or an offer should be personalized and sent to the customers who

are enrolled in a certain group of clients. Thus, the impact to customers or potential customers will be maximized. A direct communication with customers is indicated because they have the possibility to describe and detail their requirements regarding the product or service that they desire. Liu (2009) and Liu and Belkin (2014) are describing systems that aim information personalization subject;
- collecting feedback from customers - is an activity that aims to obtain an input for the entire chosen marketing strategy and for the process itself which includes the above mentioned activities.

In this context, all the specific activities must be performed within the used marketing communication platform.

3. Marketing Communication Platform

A marketing communication platform (MCP) it may be seen as a support that sustains all the specific activities related to the marketing activity, specially the 4 P's or more, the 7 P's. Depending on each market particularities, MCP's are designed to support manly the central ideas of the business type and its marketing strategy approach. In a big company, the product mixt consists of a large number of product types. If the company wants to promote product, it usually develops a basic MCP. After that, the company must to invest in the platform, to maintain it updated with some facilities demanded by the market. By doing that, the company increases its competitive advantage on the market. In most cases, the top management of a company considers enough to use the basic MCP and decides to not invest in it in order to add new communication facilities. Many companies have done that and have discovered after a while that their customer's number has started to decrease.

Companies must to maintain a good communication with clients, potential clients and with its stakeholders. The most important thing regarding the communication between a company and its collaborators is "what to say, to whom, and how often" and also what communication channel to use with each one? (Kotler, 2002).

Usually, an integrated MCP is design to contain and combine some main communication facilities (channels) like emails, television, social networks, websites, newspapers, articles, mobile web, personal relationship, news feeds, in-store experience (Bennett, 2015). An overview of such facilities is depicted in figure 2.

Figure 2. Marketing communication channels for a platform
Source: Bennett, 2015

Due to the main marketing aspects like sales promotion, public relations, personal selling, direct/indirect marketing, advertising, were developed several types of platforms. These are listed in Table 1. In terms of architecture, a MCP must include elements such as databases with appropriate software for data, rules, knowledge and multimedia management (Orzan 2007, Acatrinei 2014), documents management and their flows, to support the addition of new communication modules, provide user friendly interfaces (especially useful for retrieving data and for keeping in touch with the customer), the option to use modules for e-commerce and to offer online services. Because of new used technologies, issues such as the amount of collected information and its quality, level of detail, and the possibility of data analysis, have reached a very high level. Given this, companies can meet customers' wishes with much greater precision, thus increasing the chances that the investments made in a particular product or service to realize the expected profit.

Advertising	Sales Promotion	Public Relations	Personal Selling	Direct and Indirect Marketing
Print, broadcast, on-line ads Packaging Motion pictures Brochures, booklets Directories Billboards, posters Display signs Point-of-purchase displays Audiovisual material Symbols and logos Videotapes Web sites and banners	Contests, games, sweepstakes, lotteries Premiums, gifts Sampling Fairs, trade shows Demonstrations Coupons Rebates Low-interest financing Trade-in allowances Continuity programs Tie-ins	Press kits Video news releases Speeches Seminars Annual reports Charitable donations Sponsorships Publications Community relations Lobbying Identity media Special events	Sales presentations Sales meetings Incentive programs Fairs and trade Shows	**E-mail** Fax mail Voice mail Catalogs Telemarketing Electronic shopping TV shopping

Table 1. Marketing communication platforms
Source: Kotler 2002, p. 272

In recent years, a special place in marketing communication platforms is offered to the social media communication channels. These channels must be used as tools that might be used according to a special need. They offer changes for sharing discussing, playing games, staying connected with your mates, publishing, doing e-commerce, locating events/ places, etc. A company "must to identify and select the tools that are suitable and relevant for the communication with its stakeholders" (Tay, 2015). For example, in the same source is mentioned that you can "use Facebook to connect with your customers, use Flickr to share photos, use YouTube to share videos, or use LinkedIn to connect with your business partners and suppliers". It becomes difficult to be able to select tool because they are so many that are doing actually the same thing, each one in a specific way; you have to learn to work with it and to get the best of it. Designing a MCP means also to take into account and to implement facilities for those communication tools that have the biggest impact to the clients and stakeholders.

4. Developing a multi-agent technology based platform for e-mail marketing communication

New technologies enable the development of MCP in order to create a direct and efficient communication between the company and customers. Using such communication solutions, the customer's expectations can be recorded, analyzed and used to create customized offers. Based on these offers, it is a big probability for customers to react positively to them. A tool in direct marketing it is represented by the E-mail Marketing approach. The next section proposes a MCP architecture for email marketing, proposal that includes modern technologies based on software agents and data mining analysis.

4.1 Platform description

The proposed platform aims data acquisition from clients or potential clients, their processing and obtaining relevant information about analyzed clients. Using this information, it can be created customized offers (CO). When a client is receiving such a CO, the probability to react positively to open the email is very big. In Figure 3 is depicted a general architecture that captures the MCP essential elements. In this are represented clients providing information about products / services that are important to them. They send information via an interface (software agent). Once the information is submitted, it is stored and used to obtain customized offers, offers that will be sent to clients with similar expectations.
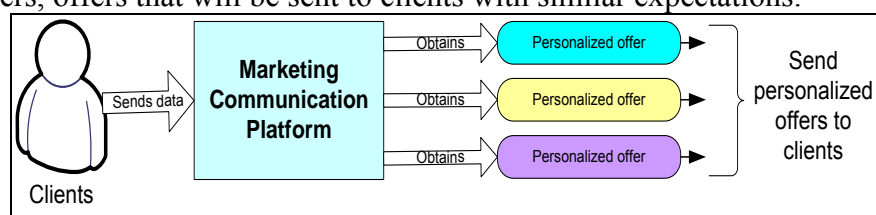

Figure 3. A general MCP architecture

In the MCP detailed architecture (Fig. 4) are presented the platform specific components. The platform aims to identify potential clients, to group customers based on their preferences, to take into account the feedback that customers provide based on received offers, to distribute the personalized offers based on customer profile and chosen device and communication channel. Therefore, within the architecture, initial customers have no color, meaning that they are not identified as belonging to a group. They can use various devices (smartphones, PCs, laptops, etc.) and various communication channels (email, social networks, etc.) for sending preferences about the products / services you want.

Each client is represented by a software agent (SA-C – Software Agent - Client) used to send data to the server and local databases. Within each local database there is a software agent (SA-LDB - software agent for Local Database) that receives information from SA-C agent, stores it in the local database, and sends the latest updates to the central database. In the central database, there is a software agent (SA-CBD - Central Database for software agent) that takes information from all the agents.
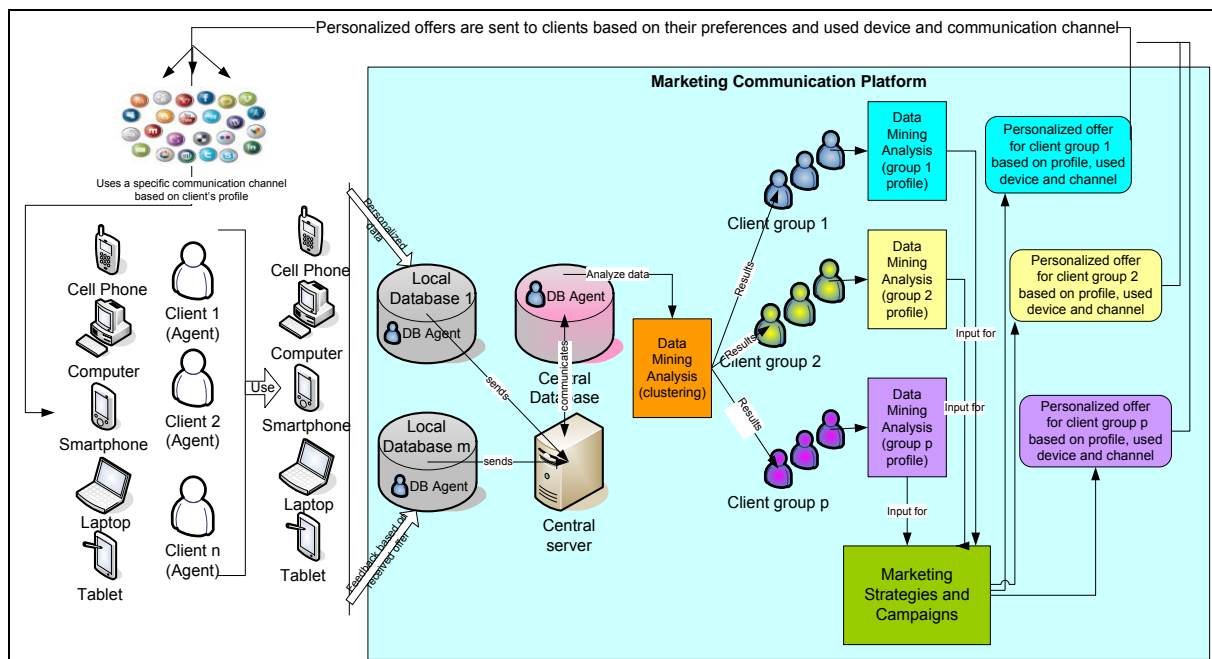

Figure 4. A detailed MCP architecture

SA-CDB has the ability to process data from the central database using data mining techniques. The algorithm used is Simple K-Means and it groups the analyzed clients in several groups based on information collected from the system by the SA-CDB, and also it may build customer's profiles. The set of profiles will represent an input for the design of strategies and marketing campaigns. Taking into account the specific of the strategies and campaigns and also the information that must be included in the offer (CO), the used device and communication channel, the MCP through the SA-CDB agent will send the proper offer. The client will receive the email in a suitable format for his devices or, if necessary, through a communication channel (e.g. Facebook). After reading the offer, the client will have a reaction (positive or negative); this reaction may be considered as a feedback that the company will use as an input of data / information / knowledge in the MCP.

It is advisable to create an offer that it addresses a group of clients than to create an single offer for a single client, because:
- It is very difficult to customize offers for each client;
- Customers can view products / services that they didn't think of till then and consider them as more useful than what they initially selected;
- The client will feel like part of a community who likes and wants the same products / services (or similar), this is giving him a clue that his choice is good.

Regarding the offer design, there will be considered issues such as:
- What makes the client more to open the email?

- What he would like to contain the offer (through e-mail);
- How much time he is able to spend for reading such an e-mail offer;
- What products / services to be promoted?
- What characteristics to have that product /service to be attractive for the client?

4.2 The multi-agent system and the MCP functionalities

The platform main core is sustained by the software agents that belong to the multi-agent system. Each agent accomplishes some specific tasks. The multi-agent system architecture is depicted in Figure 5.
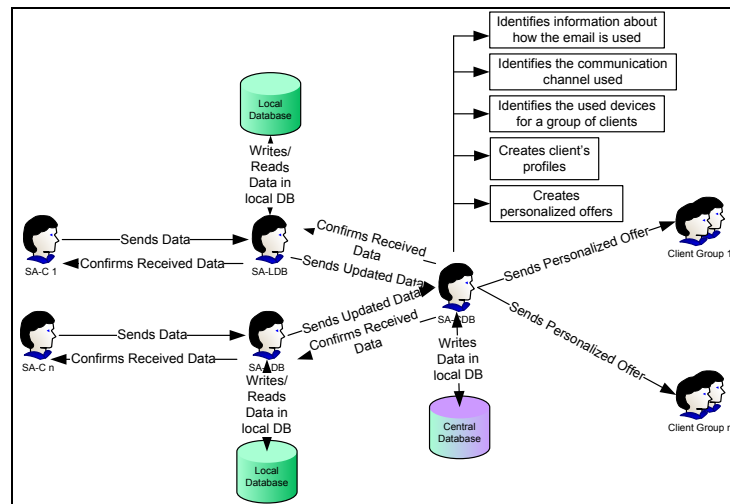

Figure 5. Multi-agent System Architecture

a) SA-Cs (Software Agent - Client) - agents that represent the clients (each client has an agent) and maintain direct contact with agents of the MCP. They offer to the customers the opportunity to personalize the criteria of the desired product /service. The agent provides an interface in which each attribute targets an aspect of the product/service and it is fulfilled by the client. SA-C activity consists of:

-Sending client fulfill data to the SA-LDB;
-Receives confirmation from SA-LDB for received data.

b) SA-LDB (Software Agent - Local DataBase) - agents that take information from SA-Cs agents and write them into the local database. Each location has a local database and a SA-LDB agent managing data. SA-LDB agent activities are:

- Writing / reading periodical information from local database;
- Sending a confirmation to the SA-Cs agents;
- Sending updated information to SA-CDB.

SA-CBD (Software Agent - Central DataBase) - software agent that runs on the platform the most complex activities. Its tasks are:

- Data acquisition (new or updated records) from AS-LDB agent;
- Storing received data in the central database;
- Intelligent data analysis using data mining techniques (Simple K-Means algorithm) to accomplish the following tasks:

• To extract information about how email is used
• The used communication channel
• The used devices
• Creates a client's profiles
• Creates a personalized offers

- Sending personalized offers to customer groups taking into account the used device by customers and the communication channel.

Simple K-Means Algorithm. Data mining analysis represents that analysis type that can discover patterns and knowledge that exists in big data sets. A cluster represents a group of instances that are quite similar based on their values. A short description of the Simple K-Means algorithm is depicted as follows

(Clus 2015):
- *Choose the initial values for the centroids: **set_value 1**, **set_value 2**, ..., **set_value k***
- *Repeat until there are no modification for any group (cluster) repartition*
  - *Use the estimated values to classify instances into groups (clusters)*
  - *For i from 1 to k*
    - *Computes the distances between set_values sets to each instance*
    - *Replace **set_values i** with the mean of all of the samples for cluster i*
  - *End_for*
- *End_until*

Some advantages of the algorithm are based on the clusters computing time (Simple K-means is more efficient than the hierarchical grouping algorithms for a small initial cluster number), the clusters are more accurate than the ones created by the hierarchical grouping algorithms (Play, 2015).

Based on how customers react to the received email offer, a feedback it may be obtained and used as an input for data analysis.

After submitting the personalized offers, the MCP platform will analyze customer feedback related to the submitted customized offers. This will be done based on several criteria such as the channel of communication (email, social networking, device used, and the moment of time the message is sent to promote the product / service).

4.3 Platform results

The intermediate result given by the platform is to achieve customer profiles. Based on these profiles, a number of client's groups will be created. Each group will receive a personalized offer. The clients from one group will receive the same personalized offer.

The final result achieved within the platform consists in personalized offers that will be created based on the information stored in the central database and targeting issues such as:

- Which features the customer wants to have the product / service that they desire;
- Operating system that has been used for sending the information regarding the characteristics of the product / service and also about the used device;
- Time spent by the customer for reading the offers from the past;
- What was the element that has sparked interest of the client to opening the e-mail with the offer?
- How clients would like the information to be organized in the received e-mail.

The advantages of such approach are:

- Customers will receive offers via e-mail (or through the preferred communication channel) in accordance with their expectations. The probability that they open the e-mail offer and to respond also positively is high;
- Sending a personalized offer only to a group of customers will reduce the network traffic. In this situation, the number of error messages will be lower;
- By sending periodic emails with customized offers with content relevant to the client, it creates a stable connection in time between client and the company that wants to promote its products/services.

5. Conclusion and future work

Communication activity in the marketing field is one of the main activities, with a particular importance. To achieve a successful marketing communication it must take into account a lot of aspects regarding the target customers. Therefore actions such as identifying information about how e-mail is used, the communication channel, identifying the used devices, creating client's profiles, creating personalized offers, provide a great support for a success marketing strategy and/or campaign designed to promote a product/service.

In the present paper is proposed and described a platform for marketing communication that takes into account the above mentioned elements and uses modern technologies such as agent-based technology and the data mining based technology. There were also described the multi-agent system architecture, mentioning the role and tasks of each agent and the data mining algorithm used within the platform.

Future research. Possible research directions may consist in designing an intelligent software agent in order to automatic fulfill the data about a product / service approved by the client, based on the

information about previous fulfills. The platform also can be optimized in terms of multi-agent system by adding special properties to some agents (e.g. the mobility property - for SA-CBD, the agent can visit local databases and extract new information and the updates one), some services (such as the use of the database) may be included in cloud (data maintenance in these conditions is no longer a major problem for the company, this task will be done by the data storage service provider).

Limitations. The platform main limitations consist from the fact that without a client agreement, it cannot be install a software agent on a particular device (agent that will allow data sending, data that describes the products/services from the client point of view) and the disadvantages of using the K-Means algorithm Simple (is difficult to choose the initial values for the centroids, the cluster must be uniform).

Acknowledgment

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