Enabling Customers Engagement and Collaboration for Small and Medium-sized Enterprises in Ubiquitous Multi-channel Ecosystems

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Abstract

Over the last few years, we have encountered an exponential growth in online communication opportunities. Organizations have more and more ways to connect and engage with their current or future customers. The existence of more opportunities in connecting to people can be both an enabler and a burden. Being present at a multitude of different channels requires the effective management of a very large number of adapted contents, formats, and interaction patterns fulfilling the communication and cooperation needs of distributed target groups. In this respect, we integrate existing fragmented communication and monitoring approaches into a full-fledged communication model as a basis for an adequate engagement approach. We describe applications of our approach in both the eTourism and manufacturing domain. In this paper, we introduce an approach that will enable communication, collaboration and value exchange of users through a multitude of online interaction possibilities based on the use of semantic technology. Finally, we also compare our approach with existing solutions with respect to the identified challenges in this subject.

Keywords

Semantic technology, communication, collaboration, engagement, small and medium enterprises, multi-channel ecosystems

1. Introduction

Recent technology trends and, especially, the emergence of social media have changed the face of online marketing over the last few years. The importance of social media to communicate with an organization's key stakeholders increases. In order to be able to use social media, organizations need to build up dedicated skills and resources. Thus, companies start to be present in multiple platforms and are slowly learning what the benefits and risks of their online presence can be. Nevertheless, the trend moves clearly towards the usage of new media possibilities, as in some branches customers start expecting a company to be represented in various online media. This demand for an online presence brought a manifold of free as well as commercial social media suites on the market, such as HootSuite (hootsuite.com) or SproutSocial (sproutsocial.com), among others.

Many of these tools also offer support for multi-channel communication via one click. The channels considered are Web 1.0 channels (email, blog) and Social Web 2.0 channels, e.g., Facebook, Twitter, Google+, Slideshare, etc. Such tools do not use, or in the best case, use simple mechanisms to adapt the content to fit the channel output. Additionally, most of the tools are able to process the content, allowing the user to create statistics and publish posts as well as

retrieve feedback. However, currently none of the tools really support the user in showing where to publish, when to do so, what content should be disseminated and how the individual channels should be used. Furthermore, current tools do not abstract and distinguish the communication or channel model from the conceptual descriptions of the information.

In this article we analyze both communication and collaboration in the current multi-channel ecosystem. Different types of dissemination, monitoring and listening activities are identified, showing their potentialities for small and medium-sized enterprises. Actually, the effective management of communication and engagement with clients and users becomes a real challenge, especially for that kind of enterprises. In order to overcome the issues that we identified, we propose in this article the application of our Semantic Communication Architecture Innsbruck (SCAI), a conceptual architecture that define the main components that a communication and collaboration management system has to contain.

Based on SCAI, we also present in this paper an implementation applied to the eTourism and manufacturing domains. Thus, we instantiate our conceptual architecture and evaluate its capacities to overcome our identified challenges, resulting in a scalable, cost-effective solution that can be personalized to a particular domain, enabling an efficient and effective communication that also facilitates engagement and feedback.

The rest of the paper is structured as follows. In Section 2, a motivating example serves the purpose of illustrating the problems and challenges ahead that small and medium-sized organizations face when attempting to manage an ubiquitous multi-channel ecosystem. Section 3 describes the process of communication and collaboration in this ecosystem. Then Section 4 discuss the conceptual architecture proposed for a generic semantic online communication engine as well as a concrete instantiation of that architecture, while Section 5 showcases two use cases and how to evaluate feedback obtained from our proposal. In Section 6, we discuss the related work on multi-channel communication and the advantages of our approach. Finally, Section 7 enumerates our conclusions and future work.

2. Motivating example and challenges ahead

The ever growing number of communication channels generates new challenges and obviously, consumers require new skills and more efficient access means to scale and filter the exponentially increased offer. In this scenario, assume the task of a small hotelier. How can it be ensured that the hotel is found by potential customers, i.e., how can he/she find them? The hotelier should have a website with high visibility on various search engines and must be present in a large number of online booking channels. We should find the hotel on the town's website, and the hotel should have a *Facebook Page*, perhaps with a booking engine included. Bookings made through mobile platforms are increasingly popular, and the hotelier would want to be found there too. Why not add a video about the hotel on *YouTube*, a chat channel for instant communication, fast email and fax response capabilities, the old-fashioned telephone, and occasional tweets and emails that are clearly distinguishable from spam? Preferably the communication should be multi-directional, i.e., the hotelier should realize when one of his posts gets commented on (up to a full-fledged impact analysis), or even more importantly, the hotelier should know when someone talks about the hotel, and how much the customer liked it. As much as this is needed, this obviously does not scale. We identify several challenges that can also be found in a more generic scenario involving any small and medium-sized enterprises:

- Scalability: The overwhelming and increasing amount of available channels to disseminate and engage customers makes inviable the self-management of the communication and collaboration strategies of companies.
- Costs: In order to properly handle the multi-channel ecosystem, companies could hire a large number of Social Media experts and assign them to manage their various communication channels. However, this solution is too costly for small or medium sized enterprises.
- Domain personalization: Although the externalization of marketing tasks to specialized agencies could save some costs for small to medium sized companies, these agencies still have to manually deal with adaptation, alignment and definition of the content for several channels. The intricacies of each domain have to be

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addressed, consequently there is a need for generic and automatic solutions that can be personalized to any domain.

- Bilateral communication: Feedback and engagement of customers have to be taken into account, in order to effectively manage the reputation of the company and its customer relationships, which are increasingly complex in this multi-channel ecosystem.

Organizations need an integrated solution that provides management and execution of communication goals in a mostly automated fashion, with costs equivalent to mass-media communication, along with the granularity of individual experts, and at the pace of real-time Social Media. In this paper we present a solution that tackles these challenges, taking a holistic approach that allows enterprises to effectively engage customers through a multitude of channels.

3. Towards online communication and collaboration in the multi-channel ecosystem

The importance of receiving, synthesizing and communicating information has increased dramatically in our current digital age. In this respect, we consider three main aspects of the communication paradigm; dissemination, listening and collaboration.

3.1. Dissemination

Dissemination, from a traditional point of view, refers to the process of broadcasting a message to the public without direct feedback from the audience (the term comes from the Latin word "disseminates" which means "sowing seeds" or "scatter wildly in every direction"). This "outdated" definition is based on communication which involves a single sender and a receiver. BusinessDictionary.com defines a communication channel as "a medium through which a message is transmitted to its intended audience, such as print media or broadcast (electronic) media" (BusinessDictionary.com, n.d). We consider a broad definition of a channel specialized for online communication: in the online-space, a channel is a means of exchanging information. A channel can, in general, be interpreted as a "place" where one can find or leave information, whether it is addressed through a service or unanimously referred by a URI (Uniform Resource Identifier). URIs are compact sequences of characters used to identify and abstract or physical resource (Berners-Lee et al., 2005).

Obtaining scalable dissemination is a difficult challenge. Therefore, in order to better understand it, we want to clarify why this process is so important for an enterprise. There are three main purposes for dissemination (Dissemination, 2012):

- Dissemination for awareness: The audiences are made aware of the product, innovation, idea etc., which is useful for those target audiences that do not require a detailed knowledge of the work. It helps the "word of mouth" type of dissemination and helps the disseminating company build an identity and profile within the community.

- Dissemination for understanding: It aims at a specific number of groups/audiences that need to be targeted directly. The target audience benefits from what the company has to offer and has a deeper understanding of the work.

- Dissemination for action: refers to "a change of practice resulting from the adoption of products, materials or approaches offered by your project" (Harmsworth et al., 2000). The authors mention that, in this case, the audiences targeted are the individuals who are in a position to "influence" the opinions of their peers, and "bring about change" within their organisations. Thus, these individuals must be equipped with the right skills, knowledge and understanding of the enterprise's work in order "to achieve real change" (Harmsworth et al., 2000).

We classify the online channels based on the type of service they provide: static broadcasting, dynamic broadcasting, sharing, collaboration, social networks, internet forums and other forms of online group communication platforms, and semantic-based dissemination.

Static Dissemination. A major method of dissemination provided by the Internet has been the humble website, a method of dissemination that is still in use today. Websites were closed to external editing; therefore, the information was not dynamic – users could only consume the contents, not add their own, and websites required a webmaster to change their content. However, for proper dissemination, it is insufficient for an enterprise to post information on a single static website. An example is to have your enterprise included on websites such as Wikipedia (or, for instance, for travel specific enterprises or for leisure industries, on Wikitravel). Thus, in order to reach the highest target audience, enterprises must post the same information on hundreds of websites that are related to its business.

Dynamic Dissemination. Dynamic Dissemination refers to the online means that are dependent on requirements such as time and location (i.e. information that has "an expiration date"). The content is characterized by continuous change, activity or progress. Web 2.0 technologies added dedicated means for publishing streams and interacting with information prosumers . The term "Web 2.0" has been coined by Darcy DiNucci, in 1999 in her article "Fragmented future" (DiNucci, 1999): "The Web we know now, which loads into a browser window in essentially static screenfuls, is only an embryo of the Web to come. The first glimmerings of Web 2.0 are beginning to appear, and we are just starting to see how that embryo might develop".

DiNucci mentions that online content will no longer be visible only on the screens of computers, but also on TV sets (as interactive content woven into programming and commercials), car dashboards (as maps, Yellow Pages), phones (as news, stock quotes, flight updates), hand-held game machines (linking players with competitors over the Net), and "maybe even your microwave (automatically finding cooking times for products)". Therefore, she defines the Web 2.0 as a myriad of ubiquitous Internet-connected tools. The most important means of achieving dynamic dissemination are: news feeds, blogs, microblogs, email, email lists and instant messaging applications.

Dissemination through sharing. The Internet was originally designed to share information on research and development in scientific and military fields around the world (Howe, 2012). At that time, the focus was on the sharing of raw data but nowadays mainly text-, image-, sound- and video-files are shared. In the past, file sharing was mainly practiced through Peer-to-Peer software clients. Peer-to-Peer (short P2P) systems "are computer systems which are connected to each other via the Internet. Files can be shared directly between systems on the network without the need of a central server. In other words, each computer on a P2P network becomes a file server as well as a client." (as defined in http://www.techterms.com/definition/p2p). A special feature of current applications is the fact that they are usually specialized on single types of files, such as images, videos, slides, etc. Videos are an excellent method of presenting a company or a product to a wide audience in a highly interactive way and various platforms are available on the Web, i.e. YouTube, Vimeo for uploading any type of videos and VideoLectures.net for videos of academic talks. Image sharing channels are also very popular, like Flickr, Instagram, Pinterest, Panoramio and many more. An important dissemination format for research institutes are slides. Slides can be used to present a new technology, a new discovery or technique to an audience in a fashion similar to a lecture hall. Hosting services that allow the sharing of slides include SlideShare, MyPlick, Slideboom, SlideServe and Prezi.

Dissemination through collaboration. Collaboration means to work together, especially in a joint intellectual effort. In a collaboration effort, individuals are required to work together in a coordinated fashion, towards a common goal. For this purpose, a variety of collaborative software has been designed to help facilitate action-oriented teams working together over geographic distances, and by providing tools that aid communication, collaboration and the process of problem solving. Additionally, some collaborative software support project management functions, such as task assignments, time-managing deadlines, and shared calendars. In this scope, we could consider wikis as collaborative platforms. A wiki is a web platform where users can add, modify or delete content via a web browser using simplified markup language or a rich-text editor. Wikis serve many different purposes, such as knowledge management and note taking. Visitors/Users are involved in an on-going process of creation and collaboration that constantly changes the Web site landscape. Although primarily a means for internal collaboration, it can also become a dissemination channel if external visitors have read access (Fensel et al., 2012).

Dissemination through group communication. Group communication can be used to share and exchange information

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but also to collect feedback or discuss certain issues. In this respect, Social Networks provide an additional community aspect which is a community that multi-directionally shares news, photos, opinions, and other important aspects. Social networks are computer networks that connect people or organizations who share social relationships or common interests and goals (Garton, Haythornthwaite, & Wellman, 1997). Usually, the social network services can be accessed through a Website that provides means for users to interact over the Internet, such as email, instant messaging, posts, etc. Users are represented through their profile containing their personal information, as well as user-uploaded material, such as images, videos, etc. Users have their own personal contacts and their own methods for organizing them. For instance, one user may be included in the "Close Friends" category of another user, while the other might include him in the "Acquaintances" category. Content is generated in the form of posts, status exchanges, as well as through the documents that are posted or voted inside the user's profile. In some cases, the social network providers allow users to upload pictures, add multimedia content or modify the look and feel of their profile. Notice that Social Networks typically offer not only one, but several channels of dissemination. Facebook, Google+, LinkedIn and XING are some of the well-known Social Network platforms. Except for Social Networks, Internet Forums and Message boards are used for managing user-generated content. The main characteristic of such platforms is the fact that they governed by a set of rules, such as fixed discussion topic, membership requirement for read/write inside the group, etc. Moreover, users have a specific designated role, e.g. moderator, administrator, staff, user, etc. The largest unit of communication is the thread (a chronologically filtered list of messages) and the smallest is the post (a single message). In comparison with chat or instant messaging services a forum users do not have to be online at the same time to write or read messages (i.e. communication is asynchronous). Forums can be used to spread information on a certain topic, fitting to the general theme of the forum and so reach a potential target group.

Semantic Based Dissemination. The information available online is still mostly decentralized, largely unconnected, requiring a search engine to list pages based on a set of keywords (which are compared, most of the times, with the content of the website on a word by word basis and not on the basis of their meaning). Although such a solution works to an extent, the results offered are ambiguous as humans cannot communicate with a search engine as they would with another human. For instance, a computer cannot distinguish between the following two sentences: "I am a professor of computer science." and "I am a professor of computer science, you may think. Well …" (Antoniou & van Harmelen, 2005). In order to remediate these issues, the Semantic Web community have proposed solutions and languages designed to eliminate this gap. Although semantic publishing is not specific to the Web, it has been the driving force behind the development of the semantic web (the so-called Web 3.0). The main characteristic is the fact that the published information is accompanied by metadata describing the information (also called the "semantic context"). Search engines started to exploit the semantics that are integrated in the web pages in order to provide a richer search engine experience to the users. In this respect, Google introduced the Rich Snippets , which is an approach to enrich the few lines of text that appear under every search results with detailed information that is related to the query of the user in case the search engine can understand the content of the page. Figure 1 demonstrates how the Rich Snippets look like in the Google results' page. Thus, the Google crawler understood the data of those pages and extracted the review scores as well as the price range and represented them in the appropriate way.

Figure 1. Google Rich Snippets

However, communication is not only about spreading information but also about aggregating feedback and impact.

In this respect, impact describes the influence and effect of a dissemination process; it refers to the actions that followed the dissemination process and the effect the disseminated material had on the behaviour of the targeted individuals, as well as their reaction to it. On the other hand, feedback is the evaluative information derived from the reaction or response to a particular activity which is part of the dissemination.

3.2. Monitoring and listening

Giving the audience a chance to provide feedback is crucial for maintaining an open communication climate. Furthermore, it is important to measure the feedback to increase the understanding of the impact of the dissemination processes, to ensure that the message disseminated has been seen by the target audience, to verify whether the message has been understood by the target audience, and to quantify the reach of the dissemination. This need brings us to the requirement of materialising the listening phase in the spiral of online communication.

Companies cannot control what content customers generate; however, they can pay close attention to it and influence it to a degree (by providing customers with services and products that would satisfy them). Companies can influence consumer behaviour and opinions, as well as respond to the consumer insight they generate through Social Media monitoring and analysis, by modifying their marketing messages, brand positioning, product development, and similar activities accordingly (AberdeenGroup, 2008). For instance, the survey conducted by Aberdeen reported that more than twice as many companies with Social Media monitoring capabilities actively contribute to consumer conversations than remain passive observers (with 67% versus 33%). They state that over a third of all companies (39%) contribute to online conversations on a frequent basis and interact with consumers in order to sway opinion, correct misinformation, solicit feedback, reward loyalty, as well as test new ideas.

Communication with customers is vital for any enterprise. In this respect, enterprises utilize a wide range of traditional and non-traditional methods to listen to customers. On the other hand, in recent years, traditional methods have become more difficult to employ due to the decrease in landline telephone coverage and the willingness (or more exactly, lack of) of respondents to participate (Murphy et al., 2011). Moreover, traditional methods are also more expensive than monitoring and analysing free online sources of information, as well as more time consuming (due to the nature of traditional survey research which involves sample identification, question construction, contact attempts, and data collection prior to the analysis). As a result, recently more and more market tools and platforms have emerged to address the need for customer listening methods, as well as attempt to harness the wealth of information available online in the form of User Generated Content. Although not as reliable as traditional methods (User Generated Content is usually found in an abundance of irrelevant and "noisy" information), Social Media monitoring offers access to real customers' opinions, complaints and questions, at real time, in a highly scalable ways. The current section introduces the concept of Social Media monitoring by presenting its advantages, disadvantages, methods and tools required to achieve it. The main contribution lies in the overview of what the technology has to offer today as far as Social Media monitoring is concerned.

While Web 2.0 may represent the technological foundation of Social Media, User Generated Content or UGC consists of the sum of all ways in which people can use and contribute to Social Media (Kaplan & Haenlein, 2009). The term became popular in 2005 and is usually used to describe the various forms of media content that are publicly available and have been created by end-users. The Organization for Economic Co-operation and Development (OECD, 2007) argues that three main requirements must be fulfilled in order for content to be considered UGC (Kaplan & Haenlein, 2009):

1. it must be published either on a publicly accessible Website or on a social networking site accessible to a specific group of people (excluding content exchanges in emails or instant messages);
2. it has to show a certain amount of creative effort (excluding replications of already existing content, e.g. posting a copy of an existing article or blog post without any modifications or commenting); and
3. it must be created outside of professional routines and practices (i.e. all content that has been generated in relation to a market context).

User generated content is not a new concept strictly linked to the development of Web 2.0 techniques. The term "User Generated Content" was created to define user contributions to the new media environment. In some contexts, the term is also called consumer generated media (Alikiliç, 2008). The word-of-mouth marketing explores the increasingly important phenomenon of consumer recommendations and warnings. Studies show that when people have a good experience, they share it with five other people; if they have a bad experience, they tell ten (Tschohl, 1991). Thus, spreading positive word of mouth is much more difficult than negative. Sernovitz (2007) claims that people love to talk about products and services, about their cars, computers, favourite TV shows, restaurants and travel destinations. The comments can be either complaints or individual recommendations. In this respect, Sernovitz defines word of mouth as "giving people a reason to talk about stuff and making it easier for that conversation to take place".

Social Media sites host substantial amounts of user-contributed material regarding a wide range of subjects. However, tapping into these resources is not an easy task since content is presented in different formats (text, video, images, etc.), as well as in the natural language of the creator (which is not machine processable). In order to make sense of the abundance of data available, three main techniques have been created: Social Network Analysis, Web Mining and Natural Language Processing. Serrat (2009) argues that the main feature of Social Network Analysis (SNA) is the focus on the structure of relationships between actors, which can range from casual acquaintance to close bonds. SNA assumes that these relationships are important and maps them to understand what facilitates or impedes the knowledge flows (e.g. who knows whom, who shares what information with whom by what communication media) (Serrat, 2009). Web mining refers to the process of applying data mining techniques to the World Wide Web for the discovery and analysis of useful information (Cooley, 1997). Cooley (1997) splits Web mining in two categories: Web content mining and Web usage mining. Web content mining refers to the automatic search of information resources available online and Web usage mining refers to the discovery of user access patterns from Web servers. In this respect, Web content mining refers to the process of providing structural information, categorizing, filtering or interpreting documents found online (similar to the behaviour of current search engines) based on selected criteria. According to Kosala & Blockeel (2000) Web mining can be split in three categories: Web content mining, Web structure mining and Web usage mining. Web content mining refers to the discovery of useful information from online content, regardless of format (i.e. text, images, audio and video) and it includes resource discovery from Web, document categorization and clustering, and information extraction from Web pages (Chen & Chau, 2004). On the other hand, Web structure mining refers to the study of potential models underlying the link structures of the Web (Chen & Chau, 2004) and usually involves the study of in-links and out-links used in the results of search engines (Brin & Page, 1998). The last category, Web usage mining, focuses on using data mining techniques to analyse search or other activity logs in search of patterns, for the purpose of developing user profiles (Chen & Chau, 2004). Analysing such data can enable organizations to determine the life cycle and duration of brand loyalty, the effectiveness of marketing strategies and promotional campaigns, as well as aid in creating ads targeted at a specific group of users.

Natural Language Processing (NLP) refers to the automated process of analysing the meaning behind human language. In some contexts the term bears the names of text analytics, data mining or computational linguistics. The goal of the process is to design and build software that analyses, understands and generated languages that humans use naturally, in order to eventually enable users to address their computers as though they were addressing another person (Natural Language Processing, 2012). Very important branches of NLP are opinion mining and sentiment analysis. The process of discovering valuable information in user-generated data is titled opinion mining. Opinion mining includes sentiment analysis techniques in order to discover the attitude of the speaker. Opinions and sentiments are determined using elements of computational linguistics, text analytics and machine learning (e.g. latent semantic analysis, support vector machines, etc.). The sentiment score may be extremely important in evaluating the enterprise's brand in a large data set on user generated mentions, as well as enable the enterprise to filter the content based on positive and negative comments. This process additionally enables the enterprise to single out the themes and issues that have determined the development of the discovered sentiment. Although automated sentiment technology cannot reach the quality of a human annotator, it offers advantages such as speed (which is near real-time) and the ability to process a large quantity

of data. In addition, the techniques are tireless, fast, and consistent which can be improved over time (Kmetz, n.d.). The ability to capitalize on consumer-generated content implies utilizing the appropriate technologies, methods and processes. The options regarding Social Media monitoring tools range from simple automatic search engine alerts, such as the use of Google Alerts, to channel specific data queries and use of sophisticated specialized companies that offer broad datasets of information to mine, for a relatively expensive subscription. There are more than 200 tools (Stavrakantonakis et al., 2012) specialized on Social Media monitoring, and more than 150 companies (Liquid, 2011) that provide some level of Social Media monitoring services to enable enterprises to better understand the way their brand is viewed in the eyes of the consumers. Liquid (2011) argues that Social Media monitoring is an important emerging marketing research and brand management function. User generated content available on Social Media platforms is relevant to many different stakeholders in an enterprise. For instance, Social Media posts provide insight in the overall online reputation of the brands, competitors, products and services important for business leaders. Similarly, marketing can benefit from feedback on their campaigns, while service can use such insights to identify current issues and requests in the enterprise and product. Innovation management can utilize the results of Social Media monitoring to derive new ideas more suitable to their customers. Stavrakantonakis et al. (2012) mention the following application fields for Social Media monitoring: reputation management; event detection; issue and crisis management; competitor analysis; trend and market research; campaign monitoring; influencer detection; customer relationship management; product and innovation management.

Similarly, Lauren Fernandez, Agency Community Manager at Radian6 argues that Social Media monitoring brings five main benefits (Fernandez, 2010): (1) crisis management; (2) influencer identification; (3) building relationships with media and customers alike; (4) creative feedback and ad targeting; and (5) competitive monitoring. Creating a presence on Social Media networks will not stop customers from expressing their grievances with products or services, but will change the conversation from a one-way street (where the customer complains, and the company cannot defend itself), to a two-way street (that enables enterprises to execute crisis communication plans).

3.3. Collaboration

Enterprises use a wide range of traditional and nontraditional methods to determine what the customers believe about their products and services, how their brand and reputation are faring, as well as how successful or unsuccessful some of the products and services offered are. However, gathering such information through the use of traditional methods, such as telephone surveys, is becoming increasingly more difficult (as mentioned in the previous section). By using automatic Social Media monitoring tools on user generated content, the enterprises are not required anymore to hire experts to build up questionnaires, determine target audience and identify samples for the population suitable for the studies, spend a great deal of time on contact attempts and on gathering results prior to analysing them. The enterprises can now tap into the Social Media content provided willingly by the users and unobtrusively perform the required analysis. Therefore, enterprises have access to free sources of information and process them in almost real time. Moreover, the added value is that these tools have access to real customers' opinions, unhindered by any biases that might occur in traditional methods, i.e. they were not asked to provide the information, but willingly and truthfully posted it.

Collaboration refers to the process of more individuals working together to achieve a shared goal. The impact of Social Media websites, such as Facebook, Twitter, Wikipedia, Flickr, etc., is already evident, as people all over the world connect with friends and colleagues, organize events, and share ideas. Due to the advancements in technology these processes are more open and fluid. Just take the examples of Wikipedia which uses the collaborative effort of many users to create and correct its articles; or the Facebook Revolution that has taken the world by storm by proving that people can use Social Media tools to organize much more meaningful events than a simple get-together; or the massive power employed by charities to raise money for different causes (take for example Matthew Inman's efforts of raising

money for a Tesla Museum in New York on Indiegogo website). Indiegogo is an international crowdfunding site where anyone can raise money for film, music, art, charity, small businesses, gaming, theater, and more (www.indiegogo.com). And these are just limited examples of what Web 2.0 users can achieve by collaborating.

Porter (1985) defines value as "the amount buyers are willing to pay for what a firm provides them. Value is measured by total revenue [...] A firm is profitable if the value it commands exceeds the costs involved in creating the product". Porter and Millar (1985) argue that information technology aids in value generation by supporting differentiation strategies. Therefore drivers of product differentiation become sources of value creation, factors that enhance the total value created by a business (Amit and Zott, 2001). Drivers of product differentiation are policy choices (what activities to perform and how to execute them), linkages, timing of activities, location, collaboration and workflow management among business units, learning, integration, scale and institutional factors (Amit and Zott, 2001). However, information technology not only helps establish the drivers of product differentiation, but also enhance the value the customer perceives from the enterprise's services and products. In this respect, Ouschan, Sweeney & Johnson (2006) argue that customers, who perceive more value from their activities with the enterprises, are more content with their services.

Additionally, a key component in value generation is managing the enterprise's brand reputation. Reputation refers to "the collective representation of multiple constituencies' images of a company, built up over time and based on a company's identity programs, its performance and how constituencies have perceived its behavior" (Argenti & Druckenmiller, 2003). The brand plays a great role in how customers view the enterprise and its products; it provides consumers with expectations of what the company will deliver (Argenti & Druckenmiller, 2003). The advances in Social Media technologies have increased the importance of brand reputation as these advancements have created a situation where public confidence in business is low (as mentioned before, consumers trust more the opinions of other consumers, than those of the enterprise), and public scrutiny is high (Argenti & Druckenmiller, 2003). Moreover, these advancements demand from enterprises increased transparency and social responsibility (Argenti & Druckenmiller, 2003).

The core components of Web 2.0 are reading and writing. These two activities are interwoven and cannot sustain the new Web separately. Content producers are creating content; content consumers are reading the content and are providing back their view to the initial published content in such a way that the connection between the inputs from both parties is bidirectional and seamless (see Figure 2). The initial point of a bidirectional communication could be at each one of the sides, i.e. producer or consumer side.
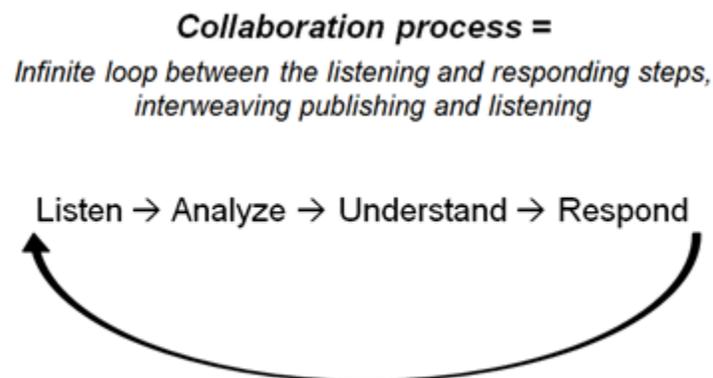

Collaboration process =
Infinite loop between the listening and responding steps, interweaving publishing and listening

Listen → Analyze → Understand → Respond

Figure 2. Interweaving publishing and listening.

A communication thread could start from an external agent (e.g. the client of a hotel). The initiator, the sender of the message is an external agent and the agent takes the role of the receiver, reacting on the received message. An example

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of this approach could be a customer review regarding a hotel on TripAdvisor.com. The external agent, in this case, the client, initiates the communication by presenting their grievances regarding the conditions of the room offered by the hotel. The agent (the hotelier) responds on the same channel, reacting to the customer message.

Moreover, in this spiral of communication and collaboration some prerequisites should be met, like the adaption of content in the appropriate way, keeping trace of the communication threads, the ability to have a multi-channel switch, a multi-agent mode, as well as predefined patterns that could be used in order to facilitate the communication procedures. Communication patterns can be understood as an implementation of business processes. A business process is a set of independent activities that need to be performed in response to a business event, to achieve a business objective (http://www.yawlfoundation.org/yawldocs/YAWLUserManual2.0.pdf). Furthermore, collaboration refers to the process of more individuals working together to achieve a shared goal. The impact of Social Media websites, such as Facebook, Twitter, Wikipedia, Flickr, etc., is already evident, as people all over the world connect with friends and colleagues, organize events, and share ideas. Due to the advancements in technology these processes are more open and fluid. Tapping into this wealth of information can prove very useful for an enterprise; however, managing it comes with its own set of challenges. Workflow management applications have become important tools in managing business processes and data flows in an ecosystem drowned by user generated content. The term "crowdsourcing", derived from outsourcing (Quinn & Bederson, 2011), was first coined in a Wired magazine article by Jeff Howe (Howe, 2006), and is defined as: "the act of taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in the form on an open call". Therefore, crowdsourcing replaces traditional human workers with members of the public. The idea around crowdsourcing is closely connected to the concept of collective intelligence, focused on the inherent decision making abilities of large groups (Levy, 1997) and the notion that large groups of loosely organized people can accomplish great things working together(Quinn & Bederson, 2011), as Malone (2009) puts it: "… groups of individuals doing things collectively that seem intelligent".). Drivers of product differentiation are policy choices (what activities to perform and how to execute them), linkages, timing of activities, location, collaboration and workflow management among business units, learning, integration, scale and institutional factors (Amit and Zott, 2001). However, information technology not only helps establish the drivers of product differentiation, but also enhance the value the customer perceives from the enterprise's services and products. In this respect, Ouschan, Sweeney & Johnson (2006) argue that customers who perceive more value from their activities with the enterprises, are more content with their services.

4. Our approach for semantically-enabled online communication

In order to consider all the requirements and features needed for an effective online communication described in previous sections, we describe in this section a conceptual solution

4.1. Conceptual architecture

In the following we present SCAI (Semantic Communication Architecture Innsbruck), which consists on a conceptual architecture for a generic semantic online communication engine. SCAI aims at enabling the ubiquitous interaction, communication, listening, and collaboration needed for a fully-fledged solution to the challenges identified in Section 2.
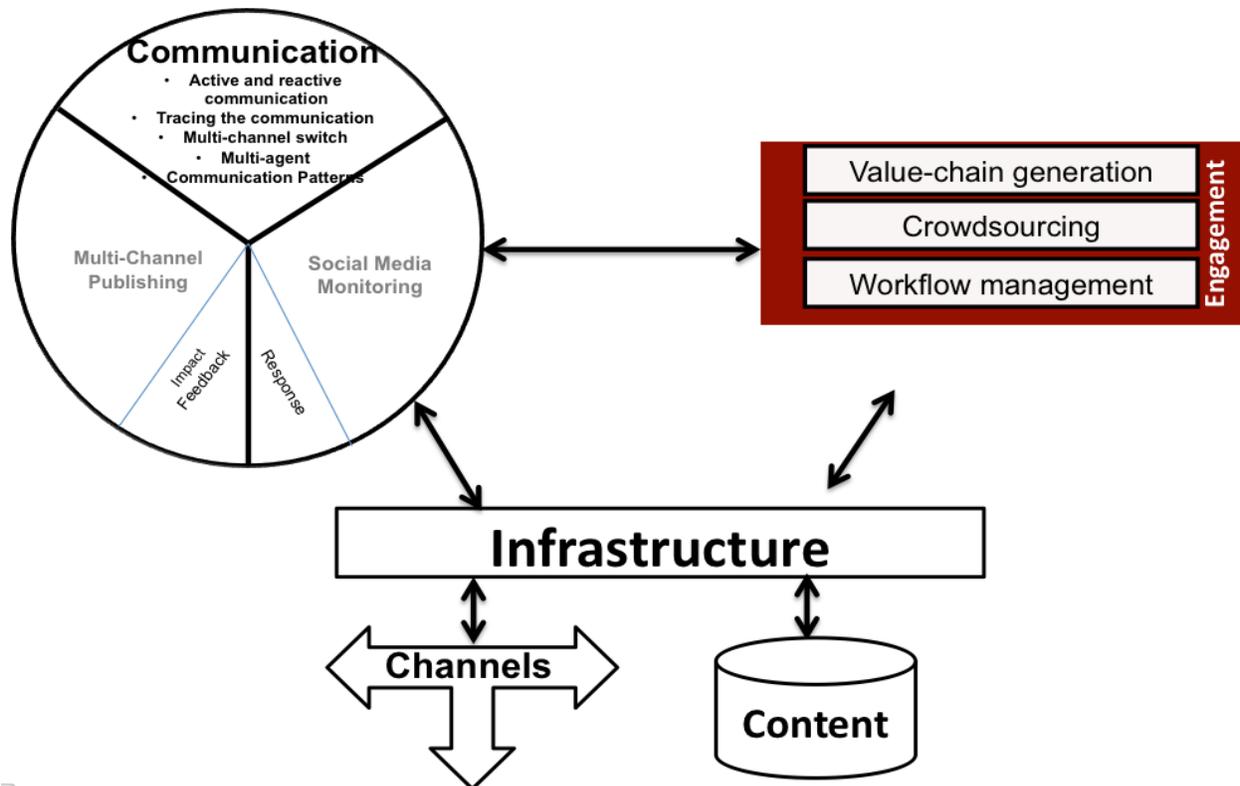
Figure 3. SCAI overall architecture.

Figure 4 showcases the overall conceptual architecture of our proposal that comprises three different functional blocks, namely infrastructure, communication, and collaboration or engagement. The core functionality of SCAI resides on the *Infrastructure* functional block. Components inside this block deals with the separation between content and channels, and support the online communication process. Precisely, this separation of concerns enables a high reusability of the generated content. On the one hand, the same information element can be reused for various channels through its channel independent formulation using ontologies. On the other hand, each domain ontology (e.g. tourist accommodations, gastronomy, medical doctors, etc.) can as well be reused by different agents acting in the same vertical domain. Moreover, the use of ontologies to represent the content provides a necessary level of abstraction to be close enough to the users for them to understand what they want to communicate.

Furthermore, there is an increasingly bigger set of channels where the information can be pushed. These channels are also modeled using ontologies (Fensel et al., 2012), so that we can easily adapt the domain specific content to the different channels where they are going to be published. We call this process the weaving process, as a mechanism is needed to *weave* (combine and adapt) the content on one side with the different channels on the other to achieve an efficient dissemination of the information.With these major principles in mind, we define the *Infrastructure* functional block as a combination of three components: (1) the content manager, which deals with the extraction and use of the content from different sources; (2) the channel manager, which provides a unified access to the different communication channels; and (3) the weaver, which performs the alignment of content and channels.

On top of the *Infrastructure* functional block, the *Communication* block incorporates all the functionality needed to support online communication, which often requires more than just a single and isolated act of exchanging information (see Section 3a). Different processes involving reading and writing information are required. More precisely the communication functional block supports active and reactive communication, trace, history and includes a multi-

channel switch. It also supports bi-directional and multi-agent communication according to communication patterns that are patterns of successful interaction styles (campaigning versus individual interaction, etc.).

Finally the *Collaboration* functional block is responsible for providing the means to take advantage of the online communication to create collaboration and engage target users. It is defined by three components: (1) the workflow engine, which is responsible for coordinating the different agents involved in predefined communication processes in the *Communication* block; (2) the crowdsourcing manager, which integrates crowdsourcing functionality in the platform, allowing target users to actively realize certain tasks that require human assistance; and (3) the value-chain integrator, which is entitled to provide connection point to the specific monetization strategies allocated for the online communication process.

In the following section we discuss an instantiation of SCAI conceptual architecture for the tourism domain, which implements described components.

4.2. Implementation

The implementation of our approach for ubiquitous interaction and collaboration for Small and Medium-sized Enterprises in the tourism domain was developed with the ultimate goal of enabling communication, collaboration and value exchange (i.e. booking). The multi-channel communication solution hereinafter called *dacodi* is used to distribute information in various channels, as well as collect and analyze feedback from those channels and actively engage in conversations (i.e. reply to comments).

The *dacodi* platform is implemented using Ruby on Rails and is conceptually split into two different sub-components. One sub-component is the *Core* part that includes the REST API and the other is the *Adapters* that are responsible for the communication with the different channels.
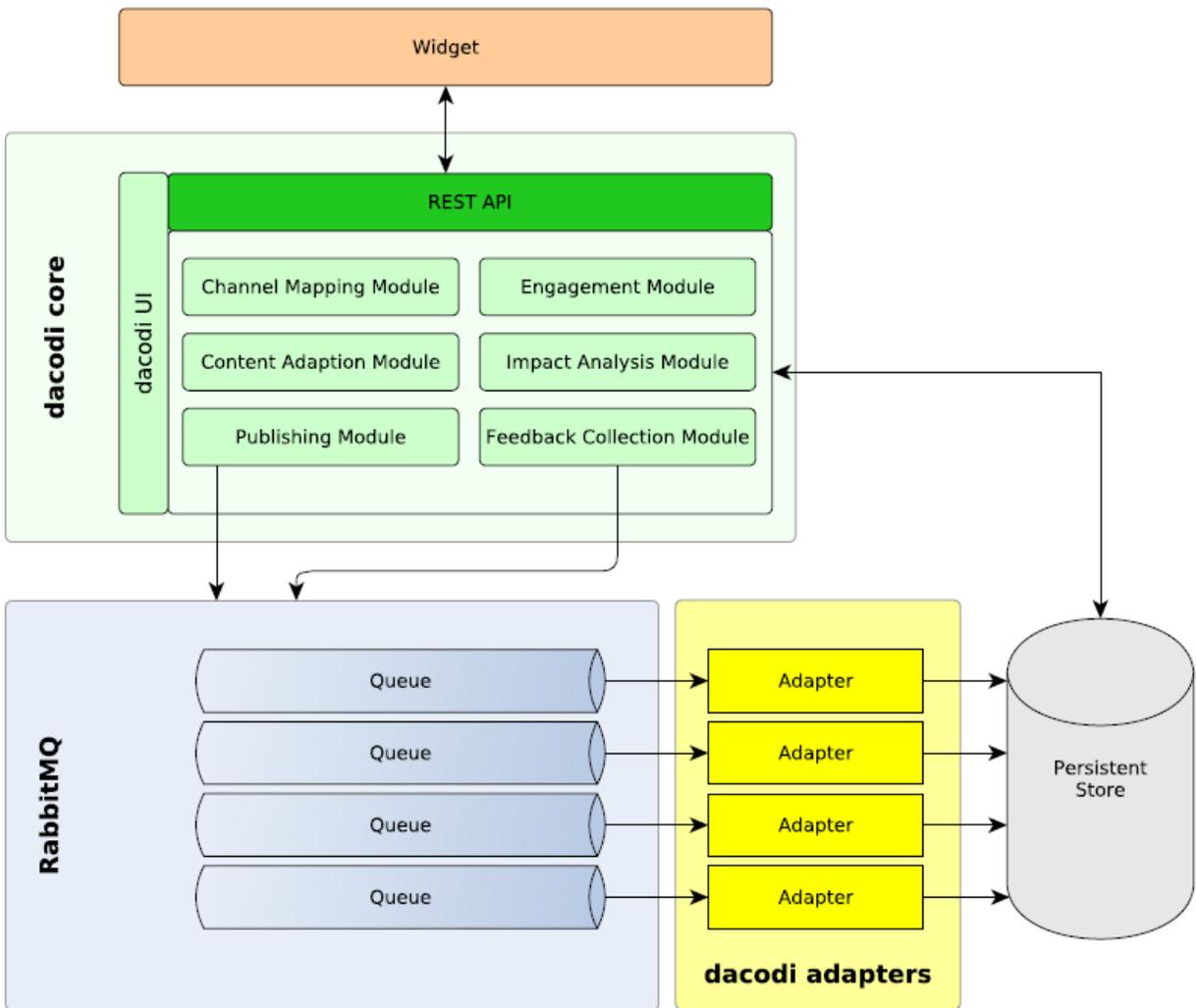
Reference: **Fensel, A., Toma, I., García, J. M., Stavrakantonakis, I., & Fensel, D. (2014). Enabling customers engagement and collaboration for small and medium-sized enterprises in ubiquitous multi-channel ecosystems.** *Computers in Industry,* **65(5), pp. 891–904.**

Figure 4. The "Big Picture" of the *dacodi* architecture. Arrows depict the data flow of the application.

The ***dacodi-core*** component is the main component of *dacodi*. It is responsible for the application flow and consists of multiple modules which have different responsibilities. The Publishing Module, for example, is responsible for publishing information items – which is done asynchronously via the RabbitMQ (www.rabbitmq.com) queueing system (see Figure 4). The Engagement Module is responsible for replying to posts, comments, tweets, etc.

The ***dacodi adapters*** represent wrappers to 3rd party APIs of the platforms that are supported by dacodi. For each channel an adapter has to be implemented. The architecture as shown in Figure 1 allows us to add adapters (i.e. add channels) without touching the other components of *dacodi*. Adapters can be run independently of the core component, even in a distributed fashion on multiple hosts, providing inherent scalability.

The ***dacodi model*** (not shown in Figure 4) is an ontological model which represents the data structures and entities that are manipulated by *dacodi*. Based on the ontological model, *dacodi* represents various conceptual objects so that they can be handled internally in a convenient manner. The model includes User models, Authentication models for single authentication of a user, Channel models for specific channels where content can be published or retrieved, ConceptToChannelMapping models used in the channel selection process, Remote models for entities published in

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the channels, Feedback models for any form of feedback, Publication models for information items that were published via *dacodi* and CommonWeaverModel models for weaving the content and channels.

The following functionalities are implemented in *dacodi*:

- *Role Management/Single SignOn*
  In order to support the different stakeholders different roles are introduced and supported in the system i.e. system *user* and *administrator*. These roles map the real world users to the platform.

- *Publication*
  The publication process dissemination adapted content to different channels. The adaption is made on the base of the channel capabilities, e.g. shortened messages are posted to microblog platform, such as twitter. The current implementation supports a number of channels including Facebook, YouTube, Twitter, Flickr and LinkedIn. To achieve scalability dacodi uses a message-oriented architecture to implement an asynchronous publication process. For this purpose the Advanced Message Queuing Protocol, short AMQP (amqp.org) is used.

- *Feedback Collection*
  dacodi is able to collect various feedbacks across multiple channels. Feedback can have different forms. It can either be textual (comments, replies, etc.), a certain amount of positive (like, +1, thumbs up, etc.) or negative feedback (thumbs down, bury, down vote, etc.), or some other measurement of a user's response to a published item. *dacodi* can collect all these different types of feedback using various polling strategies.

- *Front-end*
  The *dacodi* Front-end can be used to disseminate by one click different items like videos, microblogs, pictures, etc. through a multitude of channels including Facebook, Twitter, LinkedIn, YouTube and Flickr on the different integrated social channels, see the feedback their receive on these channels and actively engage with their customers.

dacodi provides a Web interface to manage social channels accounts and register them in the platform (See Figure 5), to create a publishing information item (See Figure 6), including various media types such as images, text and videos (See Figure 6), and to publish it with one click in multiple channels (See Figure 7).

Figure 5. Front-end for managing social media accounts

Figure 6 shows the dacodi front-end for creating the publishing information item. The user will have then the possibility to edit the post, modify it by adding or removing elements (e.g. images, videos), as also to see on

which channel the offer or the package is about to be published.

Figure 6. Front-end showing the creation of an information item

Figure 7 shows the set of published items. For each published the channel in which was posted, how old the publication is, etc.

Figure 7. Front-end showing the stream of published items

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The results of publishing information items in the channels become visible in the dissemination channels selected by the users e.g. Facebook and Twitter (See Figure 8). Furthermore, the feedback received on each published item, including number of likes, comments can be aggregated in time and displayed together with the feedback sentiment (See Figure 9). Last but not least the user can use our solution to engage with possible customers on the social channels. A live demo of our solution is available at dacodi.sti2.at.
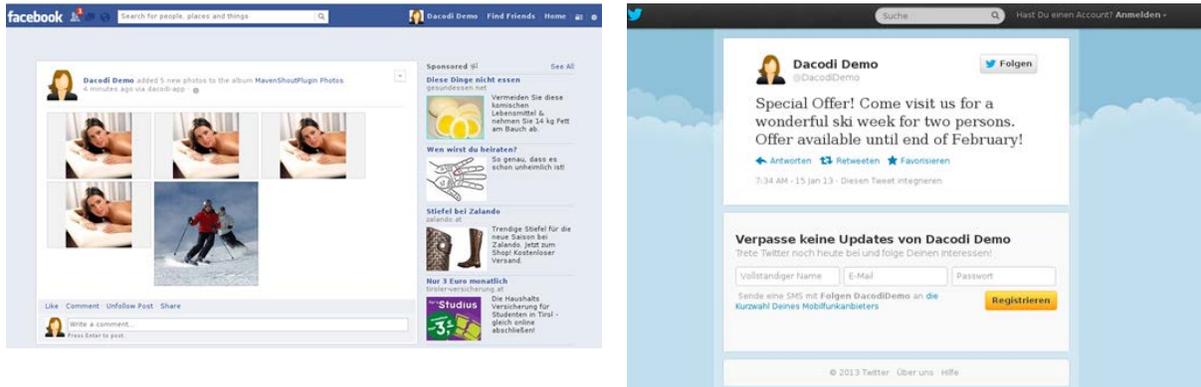

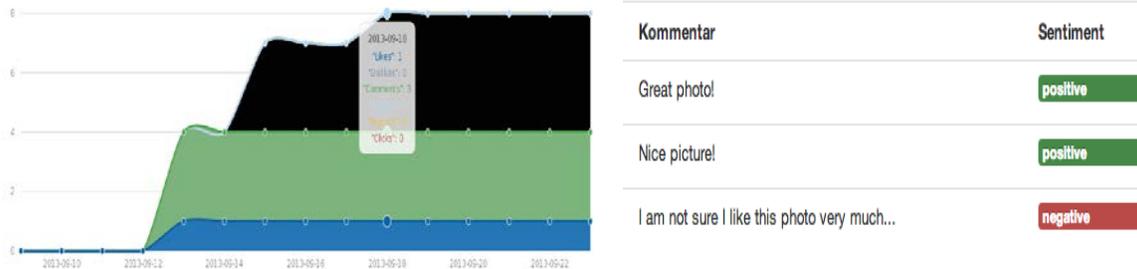**Figure 8. Information item published on Facebook and Twitter**

Figure 9. Feedback for a published information item

5. Use cases and feedback evaluation framework

This section revisits our specific use case, from the eTourism area, where our system is of an added value, and, further, discussing the evaluation approach. Furthermore, we discuss the application of our solution to other domains, such as manufacturing businesses.

5.1. eTourism Use Case Challenges

Nowadays it has become much easier, and at the same time mandatory, to listen and engage in dialog with customers, to promote brands and offerings, and to conduct business transactions through an ever-

increasing number of communication channels. In this article we focus on implementing a solution in the eTourism domain, where the challenges are clearly identified in Section 2.

According to our previously identified challenges, competence in online communication and marketing as well as online sales is crucial for ensuring the competitiveness of any organization. Solutions are required to address the challenges of communication that organizations of all sizes, commercial and not-for-profit, regularly face when communicating with their stakeholders using a multiplicity of channels, e.g. websites, videos, PR activities, events, email, forums, online presentations, Social Media, mobile applications, and recently structured data. The Social Media revolution has made this job much more complicated, because:

- the number of channels has grown exponentially;
- the communication has changed from a mostly unilateral "push" mode (one speaker, many listeners) to an increasingly fully bilateral communication, where individual stakeholders (e.g. customers) expect one-to-one communication with the organization, and the expected speed of reaction is shrunk to almost real-time, and
- the contents of communication become more and more granular and increasingly dependent on the identity of the receiver and the context of the communication.

As we concluded before, organizations need an integrated solution that provides management and execution of communication goals in a mostly automated fashion, with costs equivalent to mass-media communication, along with the granularity of individual experts, and at the pace of real-time Social Media. We are aiming to mechanize important aspects of these tasks, allowing scalable, cost-sensitive, and effective communication for small-or-medium sized business units and comparable organizations for which information dissemination is essential but resources are significantly limited. In the following, we present our approach to evaluate the success of our dissemination solution described in Section 4.

5.2. Evaluation metrics and process

In order to evaluate, and particularly, measure the feedback of a dissemination campaign, the following questions must be answered:

- *Social Media Exposure*: How many people were reached with your message?
- *Appeal of message*: How many people listened to the entire message? If the majority of people stopped listening to the message, when did they stop? Was it due the content, the implementation or the medium?
- *Engaging and collaborating*: How many people actually reacted to the message?

A variety of syntactical and concrete units for measuring feedback and impact are available. Examples of criteria for measuring feedback and impact can be seen in *Table 1*.

Feedback Type	Description	Degree of measurability	Example
Unary Feedback	Users show their acceptance of a post via one click mechanism.	Easy	*Facebook* "Likes"
Binary	Users may like or dislike a	Easy	*YouTube*'s "Thumbs up" or

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Feedback	post.		"Thumbs down"
Rating Feedback	The post is rateable via a graduation.	Easy	*Amazon's* 1-5 star ratings
Textual Feedback	Users comment a post textual.	Hard	*YouTube's* comments section:
Sharing Feedback	Users copy the same post on their wall or post it again under their name.	Moderate	*Twitter's* "retweet"
Views Feedback	Number of users that have viewed a post. Social Media sites statistics.	Moderate	*YouTube's* "video views", picture downloads, views in the last week, etc.

Table 1: Feedback types

In feedback analysis of static websites, a set of measurement units must be taken into consideration, including:

- *Number of hits* (www.motive.co.nz/glossary/hits.php) – the number of file requests from a server which is available in log analysis. It should be noted that his measurement should not be used as a standalone indicator of website popularity as the number overestimates the popularity of a website.
- *Page view* (www.opentracker.net/article/hits-or-pageviews) – a request for a file or a mouse click inside a page (Burby et al., 2006) for a particular time period (an hour, a day, a month, or for the duration of a session) .
- *Visit/Sessions*- series of requests by the same uniquely identified client. A visit is an account of a user interaction with a website consisting of one or more units of content (page views) (Burby et al., 2006) in a certain time period. On the other hand, the unit cannot be used on its own as it does not show whether the client spent all the session time on the webpage of interest or if the client had switched to other websites.
- *Absolute Unique Visitor* (analytics.blogspot.co.at/2007/01/absolute-unique-visitors-versus-new.html) – counts each visitor only once and then classifies the visitor as either "First Time" or "Prior Visit";
- *Unique Visitor* (www.pcmag.com/encyclopedia_term/0,1237,t=unique+visitors&i=53438,00.asp) – uniquely identified (through the IP address) client that is generating page views and hits within a specific time period. The identification is performed using a persistent cookie placed on the computer by the site page code. It should be noted that the current unit is not completely accurate as one IP address can mean many users.
- *Repeat/Returning Visitor*- as the name suggests, a user that has made at least one previous visit on the website.
- *New visitor* (webdesign.about.com/od/analyticsglossary/g/repeatvisitor.htm) – a user that has visited the website for the first time.
- *Single Page Visit (One-Page-Visits)* (www.webtrendsoutsider.com/tag/single-page-visits) – a visit in which only a single page had been viewed.

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- *Bounce Rate* (www.kaushik.net/avinash/standard-metrics-revisited-3-bounce-rate) – the percentage of visits that are single page visits or who spend a small amount of time (usually 5 seconds or less).
- *Average Page View Duration* – average amount of time that visitors spend on average on a page of a website (measured as the difference between the time of the page request and the time of the next page request).
- *Click path (Clickstreams)* (www.opentracker.net/article/clickstream-or-clickpath-analysis) – the routes users choose when clicking or navigating in a webpage within a visit or session. A *click* (www.articlealley.com/what-you-need-to-know-about-website-stats-2430576.html) refers to a single instance of a user following a hyperlink from one page to another (in the same website).

Nowadays, websites no longer retained their static character, but acquired a dynamic. For instance, a static website could lose its character and become a dynamic means of dissemination with just the simple inclusion of a "News" section. Also, as social networks appeared, a great deal of dissemination nowadays is made via sharing.

The evaluation framework should be generic enough to allow comparison of our new system with already existing dissemination approaches. Therefore, the evaluation metrics would be the standard regarding the exposure and outreach to the information consumers. Further, for use cases, connected with the sales of the products (e.g. hotel rooms) or service, the impact on the sales has to be taken into account.

5.3. Application to other domains

Our approach is domain independent and can be applied in various domain in which multi-channel communication is a challenge. Besides tourism, another domain in which we are currently deploying and testing our approach is the manufacturing domain. In today's highly connected world, being close to the customers, understanding their needs and especially responding timely to their requests and comments is of most importance for enterprises in order to keep their reputation and stay in the market. For manufacturing enterprises in particular, knowing the "pulse" of the market and customers is important for shaping strategies both for existing and new products and services. As part of the MSEE project (http://www.msee-ip.eu/) we work together with TPVision (http://www.tpvision.com/), the smart TVs division of Philips, to enable them to diseminate information about their products (smart TVs) and services, to collect feedback about them and to react through a proper engagement strategy. Figure 10 shows the use of our solution in the TPVision use case.

Figure 10. Publication Item and feedback in the TPVision usecase

6. Related Work and Approach Advantages

Most of the current approaches and tools for multi-channel communication can post in many channels via one click. They usually consider Web 1.0 channels (Email, Blog) and social Web 2.0 channels, e.g. Facebook, Twitter, Google+, Slideshare, etc. Such tools generally use simple mechanisms to adapt the content to fit the channel output. Additionally, most of the tools are able to process the content, allowing the user to create statistics and publish posts as well as retrieve feedback. However, currently none of the toolkits really support the user in showing where to publish, when to do so, what content should be disseminated and how the individual channels should be used. Furthermore, current tools do not abstract and distinguish the communication or channel model from the conceptual descriptions of the information. Some of the most important tools for multi-channel communication available on the market are as follows. Revinate (www.revinate.com) is a multi-channel communication tool particularly designed for the hospitality industry. Revinate is suited for wide adoption, from front-desk staff to sales and marketing executives, and from general managers to corporate users. The tool is able to take unstructured guest feedback and turn it into crucial business and competitive intelligence. Sentiment analysis for competitive benchmarking is also provided. Last but not least, Revinate is partnering with TripAdvisor.

Tools such as Virtue (www.vitrue.com), Direct Message Lab (www.directmessagelab.com), CrowdFactory (crowdfactory.marketo.com), HubSpot (www.hubspot.com), ShoutLab (shoutlet.com), ObjectiveMarketer (www.emailvision.com), WildeFire Interactive (www.wildfireapp.com) and Awareness (www.awarenessnetworks.com) give brands and agencies the means to execute their social marketing strategies, including social media promotions and contests, advertising, measurement and analytics. Such tools make possible consolidated publishing activities for channels such as Facebook, Twitter and Google+, monitoring of ROI for social campaigns and interaction with customers.

Tools such as Radian6 (www.radian6.com), MeltWater Buzz (buzz.meltwater.com), SpreFast (www.spredfast.com) and Sprout Social (sproutsocial.com) put a strong emphasis on Social Media monitoring and management. They provide means for listening to social media, analyzing and measuring the raw data, producing insights based on Natural Language Processing and engaging with the streams of posts across multiple social media channels.

Most of the multi-channel communication tools provide complex dashboards that integrate, visualize and report on social activities in a unified display. Radian6, Virtue, Syncapse (syncapse.com/platform),

@ThisMoment (www.thismoment.com), Collective Intellect (collectiveintellect.com) and Hootsuite (hootsuite.com) are some of the tools that offer social media dashboard for managing social content and engagement on multiple networks with team workflow and statistics.

Further, for the other communication parts such as online impact and reputation management, the "Fraunhofer Institut Für Arbeitswirschaft und Organisation IAO" analyzed in 2010 social media monitoring tools available on the market (Fraunhofer, 2010). They took a close look at 22 vendors. The main findings include that current solutions greatly vary in functionality and costs, with prices ranging between 500€ and 10.000€ per month. A more recent study (Stavrakantonakis et al., 2012) performed by our team in cooperation with IAO reinforces the conclusion that there is a great variety in functionality and cost of social monitoring tools, none of which, however, comprises the intelligent information processing core of our approach.

Our approach advances the state of the art on multi-channel communication by using processable *semantics* in order to provide a scalable and efficient multi-channel communication solution. In comparison with existing tools, our approach introduces a layer of abstraction over all communication channels and will facilitate the task of specifying communication content using customer domain information based on semantic technologies. We explicitly separate and interweave content and communication channels as a central means for achieving reusability and thereby scalability over various heterogeneous channels. As presented in Section 2, eventually the approach has to outperform other solution in terms of scalability, costs, domain personalization and bilateral communication. The following characteristics of our solution compare our approach positively to the other solutions:

A custom version for each industry sector: Our tool is neither a one-size fits all solution nor strictly adapt to a single branch which makes our product rather flexible and powerful through enabling the adaptation of the underlying information and channel model, thus fitting different verticals.

The communication is based on concepts and not on channels: the conceptual layer abstracts communication from the channels. The tool users merely operate on concepts of their domain, for example a research institute promotes a video lecture, a hotelier a package deal or summer offer. They do not have to deal with the peculiarities of each channel, e.g. that Twitter only accepts short messages or images and YouTube only videos.

Weaving the content and the communication channels: The central element of our approach is the separation of content and communication channels. This allows reuse of the same content for various dissemination means. Through this reuse, we want to achieve scalability of multi-channel communication. Separating content from channels also requires the explicit alignment of both. This is achieved through a weaver, which formally includes a set of tuples that define the weaving process, an execution engine capable of processing these tuples, a GUI to enable the definition of these tuples and a management and monitoring component to supervise the execution of the weaver. Based on these features, the publication process can be formally defined in a way in which the multi-channel publication is managed automatically.

Currently, all (commercially) available solutions are only channel centric and do not provide any built-in support for what needs to be disseminated or where to disseminate what piece. In our approach, a knowledge-model is built and explicitly linked with the channel model. This must be done once for a hotel, and can then be reused for millions of them. That is, we aim for the major elements of reusability:

1. The same information element can be reused for various channels through its channel independent formulation using the information model.

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2. The information model is developed as domain ontology for a certain vertical area such as tourist accommodations, gastronomy, medical doctors, etc. Therefore, it can be reused for various agents active in the same vertical domain.

These elements of reusability deliver a major contribution to the scalability of our multi-channel communication approach.

Smart channel selection and discovery: modeling channels, organizations, information concepts and the domain allow for rule based, declarative channel and concept interweaving. This means that whether a channel is relevant for publishing can be decided automatically. Moreover, as soon as a new channel is added to the model, the relevance for users will be automatically updated. In a further step relevant channels can be suggested to the user. This flexibility helps dealing with the constantly changing online communication landscape and promotes our solution as a future-proof product.

Automated content adaption: working with structured information and applying semantic technologies enables the automatic adaption of content to various representations. Each representation is suitable for a certain type of channel, e.g. video channel, short message (microblogging) channel or classical full text blog channel. For example, a video lecture may consist of a title, a video, a summary, a date and a lecturer. The title and the video form the video representation of this concept, title and the link to the video - the short message representation and title, description and link to the video - the blog representation. The video representation may then be forwarded to video channels such as YouTube or Vimeo, the short message representation to Twitter and the blog representation to a specified blog channel.

7. Conclusions

Nowadays, the ever increasing amount of communication channels provides opportunities for enterprises not only to reach a wider audience, but to engage their target community. However, these opportunities also conveys several challenges in order to effectively manage them, concerning scalability, costs, personalization, and bilateral communication. Therefore, organizations need an integrated solution to overcome these challenges. In this article we present both a conceptual architecture (SCAI) and a specific instantiation of that architecture (dacodi) that aim at solving the identified issues. Our solution offers a scalable infrastructure that is able to manage multi-channel, bilateral communication, based on semantic technologies that provides an interoperable and automatic approach to disseminate any content information through an extensible number of channels. Furthermore, we provide a generic evaluation framework to assess the feedback obtained from dissemination campaigns. Comparing our approach to existing related solutions we conclude that semantic technologies can play an important role in enabling an effective and efficient online communication, as proven by the two use case scenarios we presented on eTourism and manufacturing domain.

We are currently working on extensions of our approach, as it is going to be applied in different scenarios that include public sector organizations and charities, for instance. Several components of our conceptual architecture are also going to continue being developed, such as the infrastructure components, so that they will conform a generic solution to be applied to those different scenarios. Finally, feedback metrics will be measured in order to evaluate the impact of our proposal in the eTourism and other application domains.

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