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ENGAGEMENT 3.0

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Abstract..

1 Introduction and Motivation

Web 2.0 has radically changed our communication possibilities. More and more communication has been freed from the geographic barriers that formerly limited their speed and expansion. Active participation and interaction of users have created a new platform for people to communicate with each other [(1)]. This platform relies primarily on the actions and contributions of users to create “a rich, lively, useful, and enjoyable space which draws people back again and again” [(2)]. Considerable bargaining power has been shifted from the supplier to the consumer. Tourism organizations and enterprises, and particularly travel agencies and hotels, have been seriously challenged by this shift or “consumer revolution” [(3)], but at the same time enormous opportunities have been opened up. For tourism organizations the internet has become one of the most important marketing communication channels [(Wang and Fesenmaier, 2006)].

However, the boom of the internet, dubbed as “the growth of the multichannel monster” by [(Mulpuru et al., 2011)], has also raised questions about marketing, distribution channels, business management and efficient marketing research in the tourism sector [(Lui, 2005)]. Organizations of all sizes, commercial and not-for-profit, regularly face the challenge of 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 more complicated since the communication channels grow exponentially, shifting 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. Moreover, the contents of communication become more and more granular and increasingly dependent on the identity of the receiver and the context of the communication.

Obviously, consumers require new skills and more efficient access means to scale and filter the exponentially increased offer. Precisely the same is needed for our overall approach to online (or Internet-based) communication. 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. In principle, the hotelier is presented with three equally problematic alternatives:

- He does it on an ad-hoc basis by himself, as a side activity. This would work, however, the number of potential customers (and therefore business opportunities) that he is missing may be tremendous and could, in the long run, take him out of the market completely.
- He builds up a professional communication team by hiring a large number of social media experts and assigns them to manage his various communication channels. Actually, a large hotel chain may be able to do this. In the case of our hotelier, he would find himself even more quickly out of the market due to the high costs attached to this "solution".
- Finally, he could start to cooperate with an external marketing agency. This marketing agency must understand the domain (tourism, accommodations) and the various communication means available to disseminate the contents about our hotel in an effective and efficient fashion. These agencies have some IT support that supports multi-channel dissemination, however, they have to manually adopt, align, and define the content for these channels. In summation, these services are costly and only partial solutions (to limit the high costs of manual labor by dissemination experts).

Organizations of all sizes, commercial and not-for-profit, regularly face the challenge of 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 becomes more and more granular* and increasingly dependent on the identity of the receiver and the context of the communication.

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. Additionally, it may also help intermediaries such as marketing agencies to extend their business scope by increasing the cost-effective ratio.

The structure of the paper is as following. In Section 2, we define the different goals in online communication. In Section 3, we introduce various techniques to implement these tasks and we define criteria derived from them useful to compare existing tools implementing some of these techniques. We will list many of these tools in these areas using the criteria to describe and compare them. Sub-section 3.1 focusses on means to support publication of information. When starting to measure uptake and impact of published information we naturally evolve into the major topic of sub-section 3.2. Social Media Monitoring is about collecting, aggregating, and measuring content and activities in the online communication space. Both aspects become deeply interwoven when defining the implementation landscape of our Engagement 3.0 approach in sub-section 3.3. Engagement 3.0 requires a structured and systematic multi-modal communication approach enabling cooperation and transactional relationships. In Section 4, we provide a case study, the online campaign of the European Data Forum (EDF 2012) to illustrate our findings. Section 5 mentions some of the large amount of related works. Finally, Section 6 provides directions for future work and conclusions.

2 Goals of Online Communication

Scalable, multi-channel communication is a difficult challenge. In order to better understand it, we want to clarify the various underlying goals that it should achieve. In general, communication is a coordination means for cooperation and agents often connect (directly or indirectly) economic interests with their communication activities. In the following, we discuss different economic contexts for the communication approaches of organizations.

2.1 Yield Management

Yield or revenue management “is an economic discipline appropriate to many service industries in which market segment pricing is combined with statistical analysis to expand the market for the service and increase the revenue per unit of available

capacity” [(IDEAS, 2005)].¹ Short-term increase of income is a valid target for a business entity; however, it is quite tricky to realize in a multichannel world. For example, hotels are confronted with a multitude of online booking channels. Hotels should provide their available rooms and rates to most, if not all of these channels to prevent missing their potential customers. For many channels, visibility is achieved through low prices. However, channels also often require price constraints on the price offers of other channels. Some channels generate costs without guaranteeing actual income. Let us discuss some important issues: A hotel currently provides active booking facilities on its hotel website, through booking.com, expedia.com, Facebook, and Google Maps. It wants to increase the overall conversion rate for bookings in all of these channels, and therefore needs answers to the following questions:

- How is my price positioned towards the price of my competitors?
- What is my reputation in all of these channels? More than 90% of all Internet users are already reading product reviews and more than 50% have indicated that their purchasing decisions are based primarily upon them.
- Am I adequately represented in all these channels (comments, reviews, etc.)?
- The hotel could reduce its price in channel X to maintain visibility and to increase bookings through this channel. Due to legal constraints, it has to reduce its price in many other channels which leads to reduced revenues from those bookings.
- A hotel needs recommendations for what needs to be done and the support to do it, e.g. possible actions would be to reduce their price by 10% or to include more amenities and supplements, to be more active on Facebook in order to increase social media links and conversations, or if guests complain about the coffee it could therefore be alerted to improve this service.
- A hotel wants to announce rooms through Google Maps. It therefore starts to pay for each click through this search interface. If many clicks fail to lead to a booking, the hotel may begin to lose a significant amount of money.
- The same scenario could occur with static online coupons² that offer a 50% discount through a coupon platform that requests an additional 25% for each coupon. This can easily end in negative revenue and lacks dynamicity. Imagine a “magic” dissemination button for a bar owner that can announce dynamically a happy hour, special offers, interesting news etc. on-the-fly to the right circle of interested public, establishing the bar as a trendy place where a hip crowd is getting together.

Many solutions to yield management are based on complex statistical methods and complex domain assumptions on how variation of the price can influence the number of bookings of a service. However, a multi-directional multi-channel approach must also rely on *Swarm intelligence*³. Observing in real time the reaction of customers and competitors will be key to achieving online marketing. Adopting your offer and your

¹ http://en.wikipedia.org/wiki/Yield_management, and [Revenue_management](http://en.wikipedia.org/wiki/Revenue_management)

² <http://en.wikipedia.org/wiki/Coupon>

³ http://en.wikipedia.org/wiki/Swarm_intelligence

price dynamically in response to the behavior of your (online visible) environment will become critical to economic success.

2.2 Brand Management

Yield management tries to maximize the immediate revenue of an organization. However, communication is also very important in relation to the long-term value of a company. Actually, the reputation of a company can be viewed as one of its most important assets. Proper management, such as managing the value of **brands**,⁴ may be essential for its long-term economic success. This may conflict with revenue management. In many cases, it may be useful for short-term income management to reduce the price of the offering, which on the other hand can diminish and undermine the long-term income that is generated through a general price profile indicating quality and exclusivity.

2.3 Customer Relationship Management

Customer relationship management (CRM) refers to a widely implemented company-wide model for reducing costs, increasing profitability and managing a company's interactions with customers and sales prospects by solidifying customer satisfaction, loyalty and advocacy, while using technology to organize, automate, and synchronize business processes [(Shaw, 1991), (DestinationCRM.com, 2010)]. The goals of CRM are to identify and attract new and former customers, nurture and retain the existing ones, and reduce the costs of marketing and client service[(DestinationCRM.com, 2010)]. By bringing together information from all data sources within an organization (or from outside the organization), a holistic view of each customer is created in real time, enabling customer facing employees (e.g. in sales, customer support, marketing) to make quick and informed decisions on actions regarding those specific customers. Initially regarded as a type of software, CRM has evolved into a customer-centric philosophy permeating the entire organization, with focus on three key elements: people, process and technology [(DestinationCRM.com, 2010)]. Therefore the advantages of such a strategy become transparent: quality and efficiency in customer relationships and interactions, decrease of overall costs, decision support, increased overall profitability, and improved planning and product development. However, the strategy also possesses a series of challenges: complexity (as the business gets larger, the processes and strategies employed, as well as the number of overall distinct customers increases), poor usability (technologies that enable CRM are often hard to use and understand, which leads to), fragmentation in implementations (isolated implementation that are

⁴ "The American Marketing Association defines a brand as a "name, term, design, symbol, or any other feature that identifies one seller's good or service as distinct from those of other sellers." <http://en.wikipedia.org/wiki/Brand>

specialized on a specific and very restricted set of needs arise – systems that begin disunited usually remain that way), business reputation (the specialized implementations presented before can affect the overall business reputation as there is a lack in understanding the users and their needs), and security, privacy and data security concerns (since the strategy involves collecting information about the customers, there is always the risk that that information is not handled properly – is misplaced or misused).

Online Customer Relationship Management (e.g., allow posts, measure importance of a posting or poster, react on a post, monitor the communication trace, strengthen the link with the guest, use crowd-sourcing to reduce cost and improve quality of help desks), provide such services with higher quality and lower costs.

2.4 Reputation Management

The economic impact of proper reputation management is evident when we talk about the reputation of economic entities. However, non-profit organizations also have a need for general *reputation management* and *public campaigns*.⁵ “Reputation is the opinion (more technically, a social evaluation) of a group of entities toward a person, a group of people, or an organization on a certain criterion. It is an important factor in many fields, such as education, business, online communities or social status.”⁶ Here, it is not the direct and intermediate economic income that matters. It is rather about maintaining or increasing the appreciation an organization, topic, or certain approach gains in the public eye. However, even a campaign on a public issue has an immediate economic dimension to it: trying to use the available budget for it in the most effective way. Therefore, providing means to increase the effectiveness and efficiency of public campaigns is of high value.⁷

2.5 Value Management

All of the issues above could be viewed as facets of Value Management, where value is defined as *the regard that something is held to deserve, i.e., its importance*. Online, multi-channel and bi-directional Value Management is about disseminating⁸, communicating, and interacting with large, online communities to increase the value of a certain entity or issue. The value managed could cover issues such as importance, economic short-term income, or long-term value. [(Kasper et al., 2010)] identifies the

⁵ E.g. http://www.readwriteweb.com/archives/how_to_manage_your_online_reputation.php.

⁶ <http://en.wikipedia.org/wiki/Reputation>

⁷ Also, in the case of political parties, the number of votes they collect can be seen as their “economic” value.

⁸ “To disseminate (from lat. disseminare „scattering seeds“), in terms of the field of communication, means to broadcast a message to the public without direct feedback from the audience.” <http://en.wikipedia.org/wiki/Dissemination>

following activities as part of an online based value management: Reputation management; Competitive Intelligence, i.e., Competitor Observation; Market Analysis; Influencer Detection; Trend Analysis; Market Analysis; Crisis Management; Issue Management; Campaign Monitoring; Product and Innovation Management; Customer Relationship Management; Risk Management; and Event Detection. Obviously, these activities overlap and share many common elements. It would be interesting to reduce these activities to the set of atomic tasks from which they are composed.

3 Communication Infrastructure

“A growing number of retailers are becoming increasingly multichannel as more of their sales are coming through their web divisions than ever before.”
[(Mulpuru et al., 2011)]

3.1 Publishing

“In telecommunications and computer networking, a communication channel, or channel, refers either to a physical transmission medium such as a wire or to a logical connection over a multiplexed medium such as a radio channel.”⁹ In online communication, we take a broad definition of a channel. A channel is a means of exchanging information in the online space. There is a close relationship between URIs and channels as each URI can be used as a channel to spread or access information. However, not each channel directly refers to an URI. For example, Facebook provides around forty different methods of spreading information not distinguished by a URI. Additionally, individual information items spread are not necessarily distinguished by URIs. In general, a channel can be interpreted as a “place” where one can find or leave information, whether it is unanimously referred by a URI or addressed through a service. However, even this is not broad enough. A channel can also be the URI of a vocabulary (or the formalisms such as RDFa or microformats) that are used to publish the information. Through use of this URI, only humans or software agents that “speak” this dialect are able to access this information. Here, the communication channel cannot be interpreted as a place, but rather as a way to express or refer to the information. In the following, we want to distinguish channels by the communication mode they support.

Communication is based on the broadcasting of information. Therefore, we define the first category of our channel classification system as channels used for *broadcasting*. Here we make a distinction between the publication of mostly *static*

⁹ http://en.wikipedia.org/wiki/Communication_channel

information and *dynamic contents* that express the timeliness of an information item. One way of spreading information is to invite other people to use it. Therefore, *sharing* is another category we have identified. It reflects the insight that others are not passive consumers of our information but active prosumers that should be helped and supported in their information processing activities. Sharing is the first form of cooperation. Explicit *collaboration* through a shared information space is the next cooperation category we have identified. Collaboration between individuals leads to groups of people actively organizing their communication and cooperation. Social networking sites that support *groups of people* in their information needs are instances of this next category we have identified. Obviously, the boundaries between these categories are fluid and many channel providers try intentionally to establish services covering several of them. Still, it is often possible to identify a major category for them, often based on the major usage patterns of their users. An important approach to broaden the scope of a dissemination activity is to add machine-processable semantics to the information. With this approach, search and aggregation engines can provide a much better service in finding, retrieving, and directly using this information. A means of adding *machine-processable semantics* to information is our final channel category.¹⁰

3.1.1 Static Broadcasting

Websites are an established means of providing (mostly) static information. Information that reflects the structure of the contents is provided through websites and they offer a smooth way for users to access this content.

The typical tasks in this area are:

- **Generating Contents** through an authorship and editing process.
- **Publication of these contents.** An example in this category we have *content management systems* (CMS) that allow publishing, editing, and modifying content, as well as maintaining a website from a central page and enabling a collection of procedures (manual or automated) used to manage workflow in a collaborative environment. The advantages of CMS are clear: allows for a large number of people to share and contribute to stored data; role-based access control to data; facilitates data storage and data retrieval; ensure a level of control on data validity and compliance; reduce the number of duplicate inputs; simplify report writing; improve communication among users; and the ability to define data in any format (e.g. documents, videos, text, pictures). In this respect, examples of CMS are *Wordpress*¹¹ (which account for 16.4% of usage [(

¹⁰ [(Finzen et al., 2010)] propose a slightly different categorization of channels, however, call them different types of information.

¹¹ <http://wordpress.org/>

(W3Techs, 2012))), *Joomla*¹² (used by 2.8% websites [(W3Techs, 2012)]), *Drupal*¹³ (used by 2% websites [(W3Techs, 2012)]), *Blogger*¹⁴ (used by .9% [(W3Techs, 2012)]), etc.

- **Measuring of the uptake and impact of this information.** *Google Analytics*¹⁵ and *Yahoo! Web Analytics*¹⁶ are web analytics solution providing insight into website traffic and marketing effectiveness. F.e., Google Analytics provides analysis and optimization tools such as Urchin¹⁷, Website Optimizer, Webmaster Tool¹⁸, Insights for Search¹⁹, and further tools for improving advertisement and Search Based Keyword Tools included in your website. *AWStats*²⁰, *Open Web Analytics (OWA)*²¹ and *Piwik*²² are open source web analytics software with similar functionalities.²³
- **Optimization of uptake and impact.** Traditionally, this is the concern of Search Engine Optimization (SEO) that should increase the visibility of information. Additionally, analyze and improvement of web page design is typical a measurement for this.

An important addition beyond the dissemination through an owned website is an entry on other sites such as Wikipedia, the world's leading encyclopedia.

3.1.2 Dynamic Broadcasting, Sharing, Collaboration, and Social Networking

Broadcasting dynamic information. With Web 2.0 technologies, dedicated means for publishing streams and interacting with information prosumers have been added. A first step in this direction is the inclusion of a News section in a website using blogging tools such as Wordpress. Good practices for a news section on a website are:

- Each news item has its own URL, so that they can be returned in search results, bookmarked, shared etc.;

¹² www.joomla.org/

¹³ www.drupal.org/

¹⁴ www.blogger.com/

¹⁵ <http://www.google.com/analytics/>

¹⁶ <http://web.analytics.yahoo.com/>

¹⁷ Urchin helps website owners better understand their online marketing initiatives, website traffic characteristics, and visitors browsing experience.

¹⁸ Google Webmaster Tools provides you with detailed reports about your pages' visibility on Google.

¹⁹ With Google Insights for Search, you can compare search volume patterns across specific regions, categories, time frames and properties.

²⁰ <http://awstats.sourceforge.net/>

²¹ <http://www.openwebanalytics.com/>

²² <http://de.piwik.org/>

²³ Products in this area are *Compete*, *Coremetrics*, *Omniure*, *Optimizely*, and *WebTrends*.

- News should contain a pointer to a more detailed description about the information items they describe;
- each news item is archived;
- each news item can be indexed by search engines;
- each news item is typed (through use of the information model);
- each news item is categorized (through use of a folksonomy);
- each post can be directly shared, emailed, added to favorites, and liked;
- news can be searched, sorted, and filtered; and
- important news items stay at the top to highlight main announcements.

Such news can be further spread through a news ticker such as *RSS feeds* and *Twitter*. An RSS feed is used to broadcast news. Its purpose is to regularly remind the user of the existence of a particular activity and the fact that it is producing interesting results.²⁴ Twitter is a widely used means of disseminating news, however, significantly limits the length of it. Finally, *Email* and *Email lists* are also well established means for news dissemination. Especially the latter are a proven means of broadcasting information and facilitating group discussions. Other ways of spreading news are through social networking sites, which will be discussed below. *Chatting* is another form of instantly communicating and disseminating information, and a *blog* could be used to inform partners and members of recent trends in the field of semantic technologies.

Sharing. There are a large number of Web 2.0 websites that support the sharing of information items such as: bookmarks, images, slides, and videos, etc.

Collaboration. A *wiki* is primarily a means for project internal collaboration. However, it also becomes a dissemination channel if external visitors have *read* access²⁵. They may then follow the intensive internal interaction that can help to gain a better and more detailed understanding of externally published results and achievements.

Group communication. *Facebook* as a social networking site provides an additional community aspect, i.e., it forms a community that multi-directionally shares news, photos, opinions, and other important aspects. Notice that Facebook is actually not only one, but several channels. It offers more than 40 possibilities through which to disseminate information. These can also be tightly integrated into Web 1.0 pages, such as that of the New York Times.²⁶ *Google+* may have the potential to become a major competitor of Facebook. Therefore, it should also be included in a social networking site strategy. *LinkedIn* and *Xing* are focused on professional use and perfectly fit the purpose of research organizations.

²⁴ Content that is not streamed through such an mechanisms will be basically ignored by most social media monitoring tools (see Section 4). Therefore, there exists this growing tendency to artificially stream content to make it visible at that level.

²⁵ Write access cannot be provided due to spamming.

²⁶ <http://www.nytimes.com/>

Each of these channels come along with specialized measurements and tool to determine uptake and impact of posting at their platforms. Examples are

- *Facebook Insights*²⁷ provides Facebook Page owners and Facebook Platform developers with metrics.
- Similar service provides *CircleCount*²⁸ for Google+. *Google+ Ripples*²⁹ graphically illustrate the sharing of posts in Google+.
- *Twibes*³⁰, *Twitalyzer*³¹, *TweetLevel*³², *TweetReach*³³, *TwitterGrader*³⁴ provide means to analyze content on Twitter.

3.1.2.1 Dacodi

The large number of channels provides a challenge for effective and efficient publication. The core idea of Dacodi³⁵ is to introduce a layer on top of the various Internet based communication channels that is domain specific and *not* channel specific.³⁶ So one has:

- *information models*, that define the type of information items in a domain;
- a *channel model* (or communication model), that describes the various channels, the interaction pattern, and their target groups;
- *mappings* of information items to channels through weavers; and finally,
- a library of *implemented wrappers* for actual channel instances.

What is essential is to *distinguish* the communication or channel model from the conceptual descriptions of the information.³⁷ Currently, most other 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.

²⁷ <http://www.facebook.com/help/search/?q=insights>

²⁸ <http://www.circlecount.com/>

²⁹ <http://www.google.com/support/plus/bin/answer.py?answer=1713320>

³⁰ <http://www.twibes.com/>

³¹ <http://www.twitalyzer.com/>

³² <http://tweetlevel.edelman.com/>

³³ <http://tweetreach.com/>

³⁴ <http://tweet.grader.com/>

³⁵ *Reference Dacodi*

³⁶ See also as an excellent presentation on this idea: <http://www.slideshare.net/reduxd/beyond-the-polar-bear>

³⁷ In analogy to style sheets that separate the contents from its presentation.

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 the major contribution to the scalability of our approach. An information model is an ontology that describes the information items that are used in typical communication acts in a certain domain. Many methodologies for building such ontologies have been developed; compare [(Staab & Studer (eds.), 2009)]. Building ontologies can be a time-consuming and expensive process. Fortunately, we have a strong modeling bias that helps us to significantly guide and therefore reduce such an effort. We do not aim to model a domain as such, through a very deep model that allows arbitrary (transactional) applications. We can rather focus on the major and typical information items that are used in the online dissemination and communication processes.³⁸

The central element of Dacodi is the separation of content and communication channels. Separating content from channels also requires the explicit alignment of both. This is achieved through a weaver that connects information items with channels adding protocols, processing, scheduling, and implementation. First, the information types distinguish whether one wants to disseminate a general description of the information item, an instance of the information item, or a set of all instances. For example, we want to find an overall description of scientific presentations (what is their general theme) and a set of all presentations at a defined place on the web. The former may be placed on the project website and the later may be placed on SlideShare as a means to share presentations. Finally, a single instance may be broadcast as news through the various news broadcasting channels. Now, take a single presentation as an example. The title, author, abstract, and event it was given may form the news. The title, author, and a short notion of the event may define a tweet, and the slides themselves may go to SlideShare. That is, the information item must be processed to fit the various dissemination channels. A channel is a URI or an API of an existing web service. Scheduling information defines temporal constraints for dissemination in a single channel and for dependencies between multi-channel dissemination. For example, a new presentation will be announced once. However, an event may be announced as soon as it is defined and a reminder may be sent out when certain deadlines (for submitting papers or for early registrations) are near. News may first be published on the website. Then, an excerpt of the news together with its URI will be published as a tweet.

3.1.3 Publication of Semantic Information

Semantic Technologies (cf. [(Domingue et al (eds.), 2011)]) are a stream of research combining web technology, artificial intelligence, natural language processing, information extraction, database technology, and communication theory for empowering computers to provide better support for processing, combining, and reusing information represented as structured and unstructured data.

An important approach to broaden the scope of a dissemination activity is to add machine-processable semantics to the information. With this approach, search and aggregation engines can provide much better service in finding, retrieving, extraction, aggregating, combining this information and directly indecreasing them into services and transactional business. As a first step into this direction semantic annotations injected in websites are used by search engines such as Google to provide a structured presentation of the contents of websites, such as that shown in Figure 1, which can be analyzed by the format and vocabulary used. “This data may be embedded within enhanced search engine results, exposed to users through browser extensions, aggregated across websites or used by scripts running within those HTML pages.” [(Tennison, 2012)] Already more than 60 million web domains are using machine-processable meta data.³⁹



Figure 1. Structured content presentation⁴⁰

There are various *formats* of adding machine-processable semantics to data. First, there are three competing means of including semantics directly in HTML/XML files: (1) RDFa adds a set of attribute-level extensions to XHTML enabling the embedding of RDF triples; (2) Microformats directly use meta tags of XHTML to embed semantic information in web documents; (3) Microdata use HTML5 elements to include semantic descriptions into web documents aiming to replace RDFa and Microformats.⁴¹ For the moment, we have three competing proposals that should be supported in parallel until one of them can take a dominant role on the web.⁴² RDFa integrates best with the W3C meta data stack built on top of RDF. However, this also seems to hamper the uptake of this technology by many webmasters that are not familiar with this technology stack. Therefore, Microformats were developed as a

³⁹ Compare <http://webdatacommons.org/>

⁴⁰ Taken from <http://www.google.com/support/webmasters/bin/answer.py?answer=99170>

⁴¹ See [(Tennison, 2012)] for more details.

⁴² Compare <http://webdatacommons.org/>

competing approach directly using some existing HTML tags to include meta data in HTML documents. Actually, they overload the class tag which causes problems for some parsers as it makes semantic information and styling markup hard to differentiate. Therefore, Microdata instead introduce new tag attributes to include semantic data into HTML. Figure 2 shows that the use of RDFa has increased rapidly, whereas the deployment of microformats in the same period has not advanced remarkably.

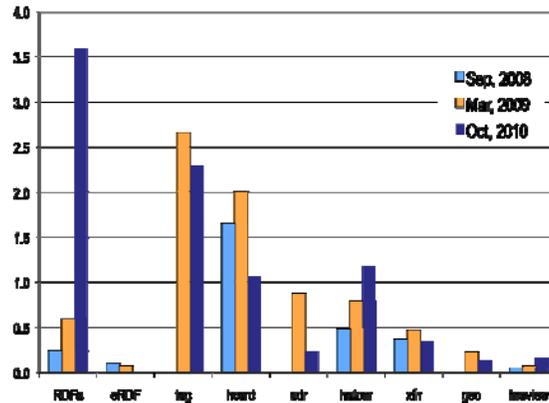


Figure 2. Microformats and RDFa deployment on the Web (% of all web pages)⁴³

Instead of including semantic annotations in XHTML documents, i.e., injecting machine-readable contents into content that is meant for direct human consumption, they can also be provided for direct machine consumption. A straight-forward way is to publish an RDF file containing the machine readable data. Instead of directly publishing an RDF file you can also provide a SPARQL endpoint allowing the querying RDF information. Instead of retrieving the entire RDF file, directed queries can be supported with this approach

In addition to predefined formats, we need to reuse predefined *LOD vocabularies* to describe our data to enable semantic-based retrieval of information.⁴⁴ Widely used vocabularies are:

- Dublin Core “... set of metadata elements provides a small and fundamental group of text elements through which most resources can be described and catalogued.”⁴⁵

⁴³ <http://triple-talk.wordpress.com/2011/01/25/rdfa-deployment-across-the-web/>

⁴⁴ More than a hundred of them are listed at <http://labs.mondeca.com/dataset/lov/index.html>.

⁴⁵ http://en.wikipedia.org/wiki/Dublin_Core

- “The Friend of a Friend (FOAF) project is creating a Web of machine-readable pages describing people, the links between them and the things they create and do”⁴⁶
- GoodRelations is a vocabulary for publishing details of products and services optimized towards search engines, mobile applications, and browser extensions.⁴⁷
- Schema.org “... provides a collection of schemas, i.e., html tags that webmasters can use to markup their pages in ways recognized by major search providers.”^{48,49}

We tend to interpret these vocabularies as channels. If we map information item in such a vocabulary at can be understood by other agents that are common with this vocabulary. Whenever we see a significant uptake of a vocabulary by a target group that we want to talk and disseminate to, we establish such a link. In the end, a term in a LOD vocabulary is treated similarly to a URI from our web pages. We export or import some of content to or from it. *Therefore, LOD vocabularies are means to disseminate and share information and not means to model information.* Ontologies are always on the brink of being a very specific and well-defined domain model derived from certain first principles, being very useful for a specific purpose in contrast to broadly used and consensually developed models used for sharing information between different viewpoints. Consequently, we live in a world of multiple ontologies. “We no longer talk about a single ontology, but rather about a network of ontologies. Links must be defined between these ontologies and this network must allow overlapping ontologies with conflicting – and even contradictory – conceptualizations.” [(Fensel, 2001)] We achieve this by mapping domain content with LOD vocabularies when we see a gain in broadening our range of communication through them.⁵⁰ The content itself is often better modeled in a well-defined and carefully crafted Ontology targeted for the specific domain and range of tasks it should support. “In contrast to the heterogeneity of the Web, it is beneficial in the application context to have all data describing one class of entities being represented using the same vocabulary ... it is thus advisable to translate data to a single target vocabulary”. [(Schultz et al., 2011)]

⁴⁶ <http://www.foaf-project.org/>

⁴⁷ <http://www.heppnetz.de/projects/goodrelations/>

⁴⁸ <http://www.schema.org/> and <http://schema.rdfs.org/>

⁴⁹ Further LOD vocabularies are Event Ontology, an Organization ontology, AIISO (Academic Institution Internal Structure Ontology), DOAP (Description of a Project), Project Documents Ontology, SIOC (Semantically-Interlinked Online Communities) Core Ontology, SWC (Semantic Web Conference ontology), SWRC (Semantic Web for Research Communities), and VIVO.

⁵⁰ “The way the Semantic Web works, and this is what makes it very different from everything else, is that you use a mixture of global ontologies like foaf:Person and dc:title and a number of other ontologies which are relevant, and then add on some more to make up what you need. If this sounds like a mess ...” Tim Berners-Lee, email communication, Mon, 20 Feb 2012.

We use content management tools such as Drupal7 to include RDFa, microdata, microformats, RDF, and a SPARQL endpoint in the web documents. The data will also be exported from Drupal into OWLIM⁵¹ to support direct RDFS and OWL reasoning over them (see Figure 3).

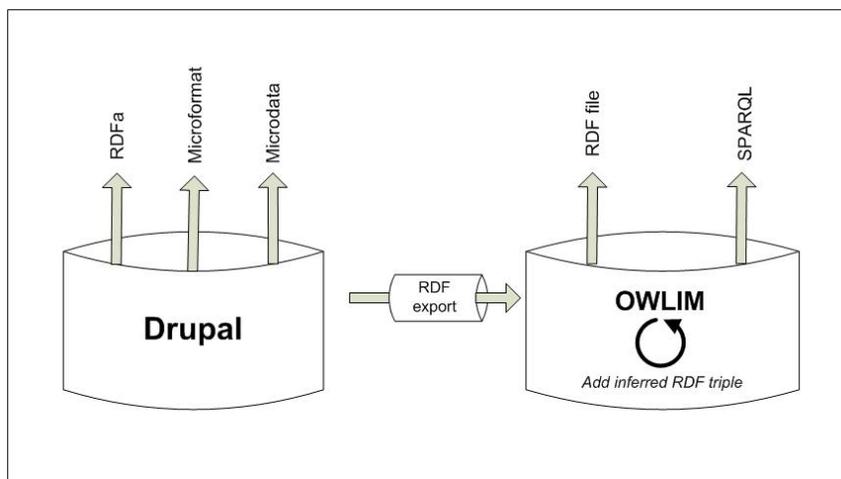


Figure 3. Technical means to publish Semantic Data

Many meta-data can be generated through Drupal7. Additional meta-data can be generated based on semantic interpretation techniques:

- *KIM*⁵² offers the ability to create semantic links between your documents, data, domain models, and linked data; find mentions of entities, relationships, and facts in texts; and search and navigate your information space in multiple ways.
- The *OpenCalais Web Service*⁵³ creates metadata for the content you submit. Using Natural Language Processing (NLP), machine learning and other methods, Calais analyzes your document and finds the entities within it. Additionally, Calais returns the facts and events hidden within your text. The metadata gives you the ability to build maps linking documents to people, companies, places, products, events, geographies, etc. You can use those maps to improve site navigation, provide contextual syndication, tag and organize your content, create struc-

⁵¹ “OWLIM is a family of semantic repositories, or RDF database management systems, with the following characteristics: native RDF engines, implemented in Java and compliant with Sesame, robust support for the semantics of RDFS, OWL Horst and OWL 2 RL, best scalability, loading and query evaluation performance” <http://www.ontotext.com/owlim>

⁵² <http://www.ontotext.com/kim>

⁵³ <http://www.opencalais.com/>

tured folksonomies, filter and de-duplicate news feeds, or analyze content to see if it contains information you care about.

- *Zemanta*⁵⁴ is a platform for accelerating online content production for any web user. It searches the web for the most relevant images, smart links, keywords and text, instantly serving these results to the user to enrich and inform their content.

Up to now, little work has been done to measuring take-up and impact of these channels beyond simple web crawling and counting the number of instantiated terms of a vocabulary.

3.2 Online Space Monitoring (Social Media Monitoring)

Social Media (cf. [(Kaplan & Haenlein, 2010)]) is a term used mostly for web-based techniques of human-to-human communication that stresses the social, topical, and contextual relations between communicating individuals, allowing real-time interaction with a large, yet specific audience of partners. Social Network Analysis emerged from the area of sociology that studies specific social phenomena. More recently, it was carried out under the umbrella term of complex network analysis, a field that studies properties in large, complex graphs. It became increasingly more popular through the huge success of social networks such as Facebook, Twitter, Flickr and others (cf. [(Bonchi et al., 2011)]). Web mining [(Kosala & Blockeel, 2000)] is the use of data mining techniques to automatically discover and extract information from web documents and services. Machine learning, a branch of artificial intelligence, is a scientific discipline concerned with the design and development of algorithms that allow computers to evolve behaviors based on empirical data, such as from sensor data or databases. Major subtasks of Social Media Monitoring are Collecting, aggregate, and measure

Originally, collection was basically web crawling. A difference made by Google was the clever ranking algorithm that put it a head of its competitors. Meanwhile, “static” web sites are mostly a site issue. Only news site that indicate changes through means such as RSS are still on the radar of approaches that want to timely monitor trends and issues. For example, the *MediaMetrics*⁵⁵ tool suite monitors RSS feeds, News sites of Mass Media, Video Streams of Television stations (not yet of youtube due to the size of the source), Blogs, Foren, Micro blogs (twitter, tumblr), and social network sites such as Facebook and Google+.

After collecting information from various sources they have to be interpreted. Counting of terms go along with named entity extraction, relationship extraction (identify the relationships among named entities), sentiment analysis that extract subjective information, and automatic summarization that produce a short summary of a chunk of text. Measuring uptake and impact can be counted by the number of

⁵⁴ <http://www.zemanta.com/>

⁵⁵ <http://www.media-metrics.de/>

references, however, these references should be calibrated by the relative importance of the place and author using network analysis techniques.

There exist a large number of tools in this area and we mention only some of them⁵⁶:

- *Appinions*⁵⁷, *Empire Avenue*⁵⁸, *PeerIndexes*⁵⁹, *Proskore*⁶⁰, and *TRACKR*⁶¹ identify, rank, and score online “authorities”.
- *Boardreader*⁶² is a search engine for Forums and Boards.
- *Google Alerts*⁶³ are email updates of the latest relevant Google results (web, news, etc.) based on your choice of query or topic.
- The *ComScore Media Metrix Suite*⁶⁴ project is a framework for web traffic measurement that is able to provide traffic statistics along several properties (age, region of users, etc.). Therefore, Media Metrix uses a representative set of Internet users, a weighting algorithm, and enumeration surveys to statistically make a projection of the whole population of Internet users. Additionally, ComScore introduced other tools such as mobile Internet traffic measurement and advertisement impact analysis software.
- *Google Trends*⁶⁵ analyzes a portion of Google web searches to compute the number of searches that have been done for the terms you enter, relative to the total number of searches done on Google over time.
- *Klout*⁶⁶ and *Kred*⁶⁷ measures influence and impact of communication acts on social media.
- *Open Status Search*⁶⁸ finds out what people on Facebook are talking about in public.
- *Social Mention*⁶⁹ is a social media search and analysis platform that aggregates user generated content into a single stream of information. Social Mention monitors 100+ social media properties directly including: Twitter, Facebook, Friend-Feed, YouTube, Digg, Google etc.

⁵⁶ See also [(Kasper et al., 2010)], [(Solis, 2012)], [(Stavrakantonakis et al., submitted)], and <http://www.somemo.at/?p=474>.

⁵⁷ <http://appinions.com/>

⁵⁸ <http://empireavenue.com/>

⁵⁹ <http://www.peerindex.com/>

⁶⁰ <http://proskore.com/>

⁶¹ <http://www.traackr.com/>

⁶² <http://www.boardreader.com/>

⁶³ <http://www.google.com/alerts/>

⁶⁴ http://www.comscore.com/Products_Services/Product_Index/Media_Metrix_Suite/Media_Metrix_Core_Reports

⁶⁵ <http://www.google.com/trends>

⁶⁶ <http://klout.com/home>

⁶⁷ <http://kred.com/>

⁶⁸ <http://www.openstatussearch.com/>

⁶⁹ <http://www.socialmention.com/>

- *Technorati*⁷⁰ helps bloggers succeed by collecting, highlighting, and distributing the global online conversation. Founded as a blog search engine and directory, Technorati indexes more than a million blogs. Technorati tracks not only the authority and influence of blogs, but also the most comprehensive and current index of who and what is most popular in the Blogosphere.
- *Twazzup*⁷¹ operates a real-time news platform.
- A non-exhaustive list of proprietary social media monitoring tools includes: *Alterian-SM2*, *Brandwatch*, *Converseon*, *Cymfony-Maestro*, *evolve24-Mirror*, *Meltwater-Buzz*, *NM Incite-My BuzzMetrics*, *Radian6*, *Systemos* and *Visible Technologies-Visible Intelligence*.

Currently there are more than 200 available social media monitoring tools on the market, thus making an educated choice about which tool to use has become increasingly difficult. Moreover, creating an evaluation framework for such tools has been a challenge for many reviewers and market research enterprises. For instance, Forrester [(8)] assesses tools based on three criteria: current offering (services and features offered), strategy (how they address enterprise-level needs) and market presence. However, the proposed criteria are insufficient. In the papers [(Kasper et al., 2010)] and [(Stavrakantonakis et al., 2012)] the authors have tried to create more detailed evaluation frameworks that focus on the basic features of a social media monitoring tool, as well as on the technology and user interface features. According to the [(Stavrakantonakis et al., 2012)] the main features that a tool should provide are the following:

- *Listening Grid*: The listening grid focuses on three main aspects: (1) the channels that are monitored (e.g. blogs and micro-blogs, social networks, video and image websites, etc.); (2) which countries and languages the tools provide support for; and (3) the topics relevant to the enterprise.
- *Analysis*: The social media monitoring tool selected should be able to gather data from many sources and in different forms (e.g. posts, pictures, videos) and to establish a listening grid to capture such data. Having established a listening grid that captures data and posts around the topics the user is interested in, the next step is to analyze the data and produce actionable reports and insights for the user of the tool.
- *Engagement*: The engagement concept refers to the ability of the tool to support reaction with the social media posts.
- *Workflow Management*: Workflow refers to the process of assigning, tracking and responding to social media streams, usually in a team environment in order to prevent double responses and missed opportunities.
- *Near real-time processing*: It is crucial for enterprises to follow up potential customers or customers' complaints, questions and thoughts well in time.

⁷⁰ <http://www.technorati.com/>

⁷¹ <http://www.twazzup.com/>

- *API*: The social media monitoring tool should provide an API solution in order to make feasible the integration of the social media monitoring with other tools (e.g. customer relationship management tools).
- *Sentiment Analysis*: The effort of finding valuable information in user-generated data is called opinion mining. Sentiments are determined using elements of computational linguistics, text analytics, and machine learning elements, such as latent semantic analysis, support vector machines, Natural Language Processing.
- *Historical data*: Access to previously captured data is required in order to compare the current metrics and reports related to the monitored topic with any previous state of it.
- *Dashboard*: The dashboard offers users graphical representation of the raw data in the form of charts, listings, and historical graphing of queries and phrases.
- *Export results*: In order to comply with their customers' needs, some social media monitoring tools developers enable users to download the results of their tool's analysis in different formats such as excel workbook or CSV format.

3.3 Engagement - Layered Spiral of Online Communication, Cooperation, and Business

Up to now, we discussed the online publication of information which also includes measuring the uptake and impact of these publication statements and we introduced the activity of listening, analyzing and understanding of relevant communication acts at various places in the internet, i.e., monitor social media in their broad range. Communication, however, is the structured potentially infinite process of read and write and write and read. Up to now, we have discussed both core elements mostly in isolation, trying to identify the key techniques required for them. The true purpose is, however, not viewing them in isolation but rather in their necessary reference to each other. We start to take the view on interaction and communication, i.e., about allowing other agents to post to us and us to post to communication pieces of others. Therefore, the concept of customer engagement comes to play.

We have seen from the previous sections that the environment in which businesses have to operate has radically and rapidly changed along with the proliferation of the Internet and Social Media – we are living in a knowledge-driven economy, where the management of knowledge and intellectual assets is a must to firms who desire to survive in the global business environments. As the customers' awareness of competing products in the market has risen dramatically, enterprises must ensure that the products and services offered accurately fulfill the various needs of the customers, as the consumers are easily able to find other alternatives. The method employed to ensure brand loyalty is engagement, achieved by tightening the relationship between the enterprise and their customers, and by creating and making use of virtual communities in order to foster the collective creation and sharing of knowledge.

Defining engagement is a difficult task as it can be used to refer to anything grow what the consumer feels when they see an add, the degree of interest, to the way the consumer will respond to advertising. In some cases, engagement has been considered

to represent all of the above, plus many other qualities. Numerous definitions for engagement already exist and even more are emerging. The first definition for engagement has been given in 2006 by the Advertising Research Foundation: "Engagement is turning on a prospect to a brand idea enhanced by the surrounding context." [(Advertising Research Foundation, 2006)]. Additionally, James Speros, the Chief Marketing Officer at Ernst & Young defines engagement as "all about making it relevant to the consumer" [(magazine.org)]. Engagement has been associated with a wide range of terms, including "involvement", "experience", "connection", "wantedness", "resonance", "relationship", and "stickiness" [(magazine.org)]. The creation of a "one size fits all", universal definition for engagement seems unlikely, particularly in the ever emerging environment of Web 2.0; however, much can be learned by looking at the focus of recent engagement research and by studying the strategies employed in achieving it. Several working hypothesis for engagement have been investigated, including [(magazine.org)]:

- Engagement is dependent on both consumers' opportunities to see advertising and their connection with the advertising itself.
- Engagement with a medium does not necessarily mean engagement with advertising in the medium.
- What affect engagement may differ by market segment, medium of genres within a medium or a category?

Creating customer engagement depends on the enterprise's ability to develop customer loyalty, deliver customer service and anticipate customer needs. To achieve customer engagement, organizations must align themselves around the idea of building a base of high-value, committed customers, as these customers are less likely to switch when a competing offer comes along. Stronger customer relationships can be used as the foundation for building lifetime customer value.

One main motivation for enterprises to promote customer engagement is the fact that businesses are losing power to dictate the communications agenda. The fragmentation of the social media channels has created smaller and more specialized customer audiences, reducing the effectiveness of the traditional advertising models. Moreover, customers are no longer simple listeners but also broadcasters – their ideas, desires, and complaints are no longer contained just in their minds, but shared with their peers using social media channels. Moreover, the low costs of switching from one brand to another as well as the widening of the market due to the boom of the Internet and social media has increased the competition and has lowered the brand loyalty.

In the following sections we will present the methods required to achieve customer engagement in an enterprise, as well as the measures and metrics that have to be considered in order to quantify the impact of the strategies employed. In a nutshell, we must ensure that we semantically include publications possibilities for the listeners/readers. Thus, these channels no longer remain static "write mediums", but require us to read. As a direct consequence, the need to enrich and use the channels as means to collect feedback and information arises. In order for customer engagement to be truly effective, we, as the enterprise, must allow other people to post messages to us and put information on our dissemination channels. Complementarily, Social

Media must not be used only as a means for dissemination, a place to read, but as a place to publish and respond to user generated content, either through private messages or public response. Therefore, three main requirements must be taken into consideration: (1) we must provide a smooth integration of write and read activities in both respects; (2) we must ensure that we implement the process character of communication that is based on a chain of combined read-write processes to achieve interaction; and (3) we must support cooperation based on online communication that allows engagement, transactionality and economic cooperation following successful online interaction.

A **first important requirement**, for a proper communication tool support, is that it must provide a smooth integration of write and read activities in both respects. That is, including (1.1) publication means for others in our publication channels as well as (1.2) easy means to publish at external publication places of others. In Section 3.3.4, we will discuss different tools and techniques to turn both publication and listening channels into places supporting interaction (such as a like button on our web site or a reader's letter posted on the wall of newspaper site).

A **second major requirement** for a proper communication tool support is that it implements the process character of communication that is based on a chain of combined read-write processes to implement interaction. This requirement has several sub-features. We must be able (2.1) to trace the history and state of a communication. For example, in a CRM system we must provide workflow and information sharing facilities to allow several employees to properly implement the sequential steps of a communication. We must be able to support (2.2) multi-channel communication. A communication may start with a public tweet, a private re-tweet, and further email communication, etc. Finally, communication is not sequential. In essence it is parallelized interaction of various agents taking the role of a publisher or listener. Supporting (2.3) multi-agent communication, where larger numbers of agents orchestrate a multi-directional communication process in parallel is another aspect of this requirement. The original basic Sender-Message-Channel-Receiver (SMCR) model of communication⁷² is unidirectional. A sender sends a message through a channel to a receiver. The direction of the communication and the different roles are fixed. Actual communication is more complex. Agents interact and communicate in parallel, permanently alternating their role in these acts of communication. Therefore, we have adopted the *transactional model* of communication and its underlying premise that individuals are simultaneously engaging in sending and receiving messages (cf. [(Barlund, 2008)]).⁷³ In Section 3.3.4, we will discuss different tools and techniques to support the publication and listening process as a trace over multiple places and players orchestrating community interactions.

⁷² http://en.wikipedia.org/wiki/Models_of_communication

⁷³ Or in Web2.0 terms, users are *prosumers*, i.e., consumer and producer of information.

Communication is potentially an infinite process, however, only when driven by an underlying purpose using it as a means to an end. A **third major requirement** is support cooperation based on online communication allowing engagement and support transactionality and economic cooperation following successful online interaction. Moreover, it is very important to define and specify the different characteristics of the engagement approach regarding the needs of an enterprise. This perspective of the engagement process comprises the **fourth major requirement**. Each single enterprise and organization has a different business plan and the nature of the offered services and products is unique. It is crucial to know where, when and who will communicate in response to the feedback that is being collected from the social media ecosystem. Basically, this refers to the engagement activities that take place as a follow up and response to the communication that has been started from the side of the customer and is directed towards the enterprise in a direct or an indirect way, which means respectively, mentioning clearly the receiver of the comment/post (e.g. in twitter via the mention mechanism - @) or talking without providing a technical connection. These parameters define a three-dimensional space in which all the engagement threads of the enterprise and customers can be mapped to. For example, considering a hotel customer that is expressing on twitter his dissatisfaction for the hotel that he is currently staying in his trip regarding the hygiene of the room, the response of the hotelier should be instant and offline. Thus, the hotelier should force an immediate investigation and reaction of the room service to his room in order to manage and resolve the issue. The response time in this example should be in terms of a few hours, the responsible group of responding and being assigned the issue is the room service and the place of response is offline, at the room of the customer. The outcome of the story would be a really happy customer, who would feel that he is important for the hotel and could definitely choose that hotel again in the future, as the hotelier takes care of his needs and any problems that could ruin his trip. Hopefully, the customer would tweet as a follow up to his story that the problem was realized by the hotel's staff without even complaining and he is really happy for their professionalism. That repositioning of his opinion would affect all his followers in the same positive way.

A proposed solution to achieving customer engagement is to tighten the relationship between the brand and the customers by creating and making use of virtual communities in order to foster collective creation and sharing of knowledge.

3.3.1 Interweaving publishing and listening

Engagement takes place online. The main activities under the engagement umbrella is writing and reading. Write and read activities are interweaved. 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 input from both parties is bidirectional and seamless. The

initial point of a bidirectional communication could be at each one of the sides, i.e. producer or consumer side. We have already discussed that all the stakeholders in the engagement ecosystem could be considered as prosumers as they are producing and consuming content the same time. However, by referring to content producers we mean the party that is producing in the majority of time or it is producing with some specific goal that comprises a strategy, e.g. the hoteliers, a blogger or an enterprise.

Adapting content. Adapting content is a two-part problem - converting an information item into different formats or automatable transformations such as extracting images, videos or extracting and shortening web links from pieces of content, and transforming multimedia content into a different format. Both of these problems can be commonly solved, however, adapting content in a way that requires creativity and human intelligence is still a challenging problem that reaches the borders of computability. Examples of such adaptations are shortening or translating an essay, or rewriting a text in a way that matches the target group it addresses.

3.3.2 Interaction as a social process

Social media has emerged and continues to be a cultural phenomenon, a phenomenon that has started to completely shape the way we do business. Peer-to-peer or customer-to-customer communication is sometimes happening instead of the customers contacting the company for information. Thus, a great shift has been put on the customer and on his relationship with other customers, i.e. on the customer interaction. Customers with a history of positive interactions are more likely to consider new products and services from their existing service providers.

Interaction can be classified in two main categories: (1) interaction between the customer and the enterprise, and (2) the interaction between a customer and another customer. Each category is vital in the establishment and sustainability of customer engagements.

The first category, **interaction between the customer and the enterprise**, refers to the relationship and communication established between the client and the service/product provider. Every interaction with customers (or lack of interaction) shows them how important they are for the enterprise, how much they are valued. Moreover, interaction ensures the customer that the promises made by the company will be honored, as well as informs the enterprises about the customer's needs, desires, how they think and feel at every stage of the relationship. However, interaction with positive clients is not the only source of feedback an enterprise can have. Similarly, interaction with unsatisfied customers may become an enterprise's greatest source of innovation and help establish products and services that revolve around the customer and not the processes.

(CES Inc, 2006) states that there are four stages of customer interaction: (1) initiation, (2) integration, (3) intelligence, and (4) value creation (CES Inc, 2006).

Initiation refers to the active management of welcoming new customers to the organization and establishing a relationship with them. On the other hand, *integration* refers to the active management and assessment of the offered product or service after completing the initiation stage, whose ultimate goal is to achieve operational excellence. *Intelligence* refers to the active management of accumulating the information learned in the previous two stages, conducting additional fact-finding and research assessing the performance of the customer and the vendor, while *value creation* refers to the active management of developing a partnership with the customer in order to become an inextricable part of the customer's performance, find opportunities that drive innovation, create new value and gain recommendations from the customers (CES Inc, 2006). These four stages of interaction help companies establish internal and external experience expectations that are easy to communicate, to understand, to measure and have a direct impact on the financial performance of the enterprise. Additionally, this type of interaction provides a framework that enables the development and implementation customer processes and solutions, each stage resulting in a specific customer experience designed to lead to the next stage and achieve value for both parties: emotional (what the customer should be feeling), intellectual (what they should be thinking), behavioral (what the customer should be doing and which behavior the vendor wishes to change), respectively culminating status (the state of the customer at the end of a specific stage that enables the transition to the next stage).

The **customer-to-customer interaction** can be represented using one major component of consumer advocacy and advertising – word of mouth. As consumers find emotional and practical benefits of participating in online discussions, these conversations have profound implication on the business of an enterprise. Word of Mouth (WOM) is the process of conveying information from person to person and plays a major role in customer decisions (Richins & Root-Shaffer, 1988) as consumers are attitudes, opinions and reactions about business, products of services with other people. Moreover, research indicates that people trust seemingly disinterested opinions from people outside their immediate social network more than reviews done by professionals or information posted by the enterprise (Duana, Gub, & Whinston, 2008).

3.3.3 Cooperation and Value generation

Changes in the business environment caused by the proliferation of the Web 2.0 have resulted in consumer demand for increased product-service innovation, product variety and high quality, support service and satisfaction. Therefore, simply being customer oriented is insufficient – enterprises must learn from and collaborate with customers to create values that meet their individual and dynamic needs (Pralhad & Venkatram, 2000). Value generation is central and customer participation should deliver value to both customers and enterprises (Auh, Bell, McLeod, & Shih, 2007).

Moreover, studies show that customers who perceive more value from their service encounters tend to be more satisfied (Ouschan, Sweeney, & Johnson, 2006).

Another step in ensuring value generation is managing a brand's reputation. According to [(Li & Bernhoff, 2008)], we can identify five levels of reputation management: listening, talking, energizing, supporting and embracing. *Listening* implies that a company willing to engage with its customers must first learn about WHAT the customers are discussing (the conversation topic) and WHO is talking (the community or individual). On the other hand, *talking* suggests that enterprises must participate in the discussions in order to initiate and ensure customer engagement. Similarly, *energizing* implies that the enterprise lets other key players talk for it, while *supporting* means that the enterprise must reinforce the community through initiatives and platforms. Final, *embracing* refers to allowing and enabling the online community to participate in further developing the company value in a crowd sourcing approach.⁷⁴

Regardless of the effort made in the field of Human Computation (which is an interdisciplinary research field that aims to integrate human intelligence and human cognition into the computer-managed, automated execution of tasks that are beyond the power of the state of the art of pure algorithmic approaches), online communication will continue to require and involve human labor. Understanding text, generating useful output and interacting properly cannot be achieved without having a human in the loop. On the other hand, engagement will not scale well if too many tasks are left to the human. Therefore, the need for an architecture that maximizes the amount of mechanized tasks arises. Additionally, the architecture should permit the smooth integration of humans for tasks that cannot be fully atomized (e.g. actual interaction with the customers). The architecture should have the potential to be applied in other domains that present similar characteristics, such as crowd-sourcing initiatives where methods to define incentives for large user communities are developed.

Crowd sourcing is an online approach for outsourcing tasks that cannot be solved by computers, to humans. Different incentives are applied to convince people to work on these types of problems. One example of such incentive is receiving small amounts of money, such as the strategies applied by Amazon Mechanical Turk⁷⁵, Clickworker⁷⁶ or Zhubajie⁷⁷. Another common example for human motivation is creating competition amongst participants, such as the initiative of TopCoder⁷⁸, or provide opportunities for language learning, such as DuoLingo⁷⁹. Used in an intelligent manner, crowd sourcing can enhance sentiment analysis, language

⁷⁴ See also [(Helbing & Konitzer, 2010)] for a similar and refined model.

⁷⁵<https://www.mturk.com/mturk/welcome>

⁷⁶<http://clickworker.com/>

⁷⁷<http://www.crowdsourcing.org/site/zhubajie/wwwzhubajiecom/2118>

⁷⁸<http://www.topcoder.com/>

⁷⁹<http://duolingo.com/>

processing, and help improve translating algorithms with human intelligence, until artificial intelligence reaches a satisfactory level. A successful example of an application that combines the two computation paradigms is CrowdDB [(Franklin et al., 2011)].

3.3.4 Tools

Regardless of the name it goes by, measuring engagement is a complex process as it attempts to qualify the qualitative. For all tasks and goals required in the successful implementation of customer engagement (communication, cooperation, transactions), providing a numerical measure of success is not only extremely important, but also very difficult to obtain. One approach of measuring the impact of the enterprise's strategies for engagement is by (1) quantifying the social values presented in user generated content, and (2) quantifying the brand and reputation of the enterprise. Research has shown that a number of factors affect engagement, including factors related to the customers' messages, the media environment (the attributes of the medium that affect advertising receptivity), and the consumer mindset and physical situations that have an effect on receptivity.

The qualitative dimensions are an important part of engagement research. In this respect, researchers have examined factors such as the role of emotions, consumers' media experiences and the relationship between the consumer and the media channel used to communicate in order to identify the elements which can increase the customer's positive response in regards to the enterprise brand. Although difficult to quantify, emotions play a key part in consumer engagement and are more important and influential than initially believed (Gordon, 2006). (Zajonc, 1980) states that there are three main reasons why feelings must be precognitive: (1) they are unavoidable, (2) they operate without the need of words and are very hard to verbalize; and (3) they are hard to measure. When rational decision-making capability is impaired, emotions and feelings act as a gatekeeper to decisions (Damasio, 1994), and when time is limited, customer choices are likely to be driven by feelings rather than logic or rationality.

Another important qualitative measure is the level of attention, defined as the amount of "conscious thinking" [(Heath, 2007)] going on, and is classified in two categories: (1) active attention, when its application is willful, deliberate, and aimed at achieving the person's goals; and (2) passive attention, when the application of attention is inadvertent and controlled by external stimuli. Much of human decision making happens at a subconscious level and is reported to our conscious brain post-hoc [(Heath, 2007)]. However, attention operates only in the conscious brain, and not in our subconscious. If attitudes can be changed without active conscious processing, then the level of engagement a consumer has with a brand is going to be entirely dictated by the amount of "feeling" that goes on at the start of the process [(Heath, 2007)].

Quantification of social values. The success of online social networks leads to an enormous amount of data that may be analyzed in order to find out about social struc-

tures and relationships. A mature way of quantifying values like popularity, authority, influence or reach has yet to be found. Various tools such as PeerIndex⁸⁰ or Klout⁸¹ already attempt to measure it, but consider only very small parts of the whole social media landscape. Also, there are other attempts to measure various factors in social media using different techniques or different forms of proximity to forecast activity (cf. [(Lermann et al., 2011)]).

Quantification of brand and reputation. Similar to the quantification of social values, brand and reputation have to get a countable unit as well. Likewise, it will be very challenging to find fitting metrics, since already existing measures such as brand equity are considered meaningful by a small share of marketing professionals (cf. [(Farris et al., 2010)]). The combination with social media and the possibilities of sentiment analysis allows more suitable metrics to be introduced next to the existing ones.

With impressive amounts of user generated data being created each and every minute on the internet, it is no wonder that the task cannot be achieved by a single human (but requires an entire army of specialized and trained human beings). In order to deal with such a scalability issue, tools have been created in order to aid the process of understanding what the customer is saying and what is the sentiment of their statements in regard to the enterprise's brand, product or service.

An example of category of tools which enable such analysis is provided by social media monitoring tools. Tool suites such as *eCairn*⁸² and *Radian6*⁸³ enable the enterprise to seek out all conversations generated around a topic on the social web, to measure and summarize them, and to react and publish the feedback on appropriate social media channels.

Another example of tool capable of aiding with the scalability issue of online engagement is *ifttt*⁸⁴ which provides a multi-channel trigger and action engine that allows automatic reaction to events in the information space by observing a multitude of channels and executing guarded transaction rules acting on these channels.

Additionally, the *Social Media Dashboard*⁸⁵ manages multiple social profiles, allows scheduling messages and tweets, can track brand mentions, and analyzes social media traffic.

Furthermore, multi-channel integration can be achieved through the use of applications such as *TweetDeck*⁸⁶ which provides multi-channel integration for reading and writing for Twitter, Facebook, MySpace, LinkedIn, Foursquare and Google Buzz. Measuring the impact of user generated conversations is not an easy task.

⁸⁰<http://www.peerindex.com/>

⁸¹<http://klout.com/home>

⁸² <http://ecairn.com/>

⁸³ <http://www.radian6.com/>

⁸⁴ <http://ifttt.com/>

⁸⁵ <http://hootsuite.com/>

⁸⁶ <http://www.tweetdeck.com/>

4 Case Study EDF 2012

We developed and applied our approach in three major case studies: the European Semantic Web Conference Series (ESWC)⁸⁷, the PlanetData project⁸⁸ and the Semantic Technology Institute (STI) International research association⁸⁹.

- The mission of the *Extended Semantic Web Conference (ESWC) series* is to bring together researchers and practitioners dealing with different aspects of semantics on the web. Founded in 2004, the ESWC builds on the success of the former European Semantic Web Conference series, but seeks to extend its focus by engaging with other communities within and outside ICT, in which semantics can play an important role.
- *PlanetData* is a semantic technology project funded by the European Commission. It aims to create a durable community made up of academic and industrial partners working on large-scale data management.
- *STI International* is a global network engaging in research, education, innovation and commercialization activities on semantic technologies working to facilitate their use and applicability within industries and society as a whole. STI International is organized as a collaborative association of interested scientific, commercial and governmental parties that share a common vision.

Around 80% of the information items of ESWC, PlanetData, and STI International are interchangeable due to some simple renaming (e.g., core and associate partner versus partner and member). This is excellent news and a hint for scalability especially given the fact that we talk about a research *project* and a research *association*. This could imply that an even higher degree of reuse could be achieved when applying our information model to tens of thousands of European research projects (and hundreds of thousands of research projects or millions of projects) on the one hand, and millions of associations on the other. This is actually the second major assumption of our approach.⁹⁰ Reuse of the information model in a certain vertical area. The costs to build an information models are quickly paid back when applicable to several entities in a domain. In the end, this is the SAP business model applied to online communication. These models empower simple non-IT users to communicate at the level of their domain knowledge rather than at the symbol level of various channels and these models can be reused between different players in the same vertical.

Based on our approach ESWC, PlanetData, and STI International are now managing their online appearance. In total, we have identified around *five hundred* different semantic and non-semantic channels in these case studies that are used to

⁸⁷ <http://eswc-conferences.org/>

⁸⁸ <http://www.planet-data.eu/>

⁸⁹ <http://www.sti2.org/>

⁹⁰ The first one is that is that it will pay back to model the information independent from the multitude of dissemination channels, ensuring reuse over them.

disseminate elements of the information model. Obviously, such a bandwidth requires a structured and mechanized approach. Based on our approach, around 300 concepts and properties, 500 channels, i.e., more than 100,000 potential content-to-channel mappings are run efficiently by a very small dissemination team.

5 Related Work

5.1 Ontology-based content management systems (CMSs) for websites

The field of *semantics-based or enhanced CMSs* has already been quite thoroughly explored. One of the earlier approaches to ontology-based website management is the OntoWebber system described in [(Jin et al., 2001)]. The proposed three-way approach of “explicit modeling of different aspects of websites”, “the use of ontologies as foundation for Web portal design”, and “semi-structured data technology for data integration and website modeling” presents an early but comprehensive approach to semantifying CMSs. OntoWebber introduces an integration layer which adapts to different data sources. This is related to our weaver concept introduced in Section 4, but, in contrast, the weaver adapts to different channels rather than to different information sources. A year later, in [(Sheth et al., 2002)], Sheth et al. introduce the SCORE system, which defines four key features: semantic organization and use of metadata, semantic normalization, semantic search, and semantic association. Although written in the early days of the Semantic Web, the paper covers topics such as metadata extraction from unstructured text and automatic classification that may also become relevant to our approach. [(Garcia et al. 2008)] introduce “The Rhizomer Semantic Content Management System” which integrates services with metadata browsing, editing, and uploading, continuing their earlier work on the Knowledge Web portal. [(Corlosquet et al, 2009)] proposes a Linked Data extension for Drupal that enables content annotation with RDFa and provides a SPARQL endpoint. The British national broadcaster BBC started to integrate semantic technologies (i.e. Linked Data) in 2009 in order to integrate various data and content sources distributed throughout the enterprise [(Kobilarov et al., 2009)]. As a result, as reported in [(Bishop et al., 2010)], BBC's World Cup 2010 site⁹¹ is based on semantic repositories that enable the publishing of metadata about content rather than publishing the content itself. While the data input is fixed, different schemas for the output are defined. However, as only one channel for output is considered, the mapping performed is quite straight-forward. In contrast, our system accounts for different information needs of various and heterogeneous channels and therefore enables the distribution of content through different portals. Finally, the European

⁹¹ <http://www.bbc.co.uk/worldcup>

project Interactive Knowledge Stack (IKS)⁹² focuses on porting semantic technologies to CMS software solutions.

In a nutshell, all these approaches aim either to help the user publish semantic data or to use semantic methods to support the content management process for maintaining websites. We are taking these approaches and generalizing them to support the overall management of content dissemination in a multi-channel and bi-directional communication setting. Further, we augment the technical approach with a methodology and the approach of using vertical domain models, which are shared and reused in a vertical area instead of being used for a single application only.

5.2 Semantic matchmaking of senders and receivers of content

Semi-automatic matchmaking is a well-studied field in Artificial Intelligence and related areas. Obviously we can only select a small sample of approaches in this area, which focus on matchmaking in regard to content. [(Katzagiannaki & Plexousakis, 2003)] present a selective information dissemination system that is based on semantic relations. In their paper, the terms in user profiles and terms in documents are matched through semantic relations that are defined using a thesaurus. Similarly, the approach taken by [(Morales-del-Castillo et al., 2009)] introduces selective dissemination of information for digital libraries based on matching information items to user profiles. Obviously, user profiles correspond to our channels, however, we instead manually model their relationship with contents. The system introduced in [(Ma et al., 2006)] uses RDF, OWL, and RSS to introduce an efficient publish/subscribe mechanism that includes an event matching algorithm based on graph matching. Our approach, in contrast, matches information items to channels rather than events to users. Also, instead of graph matching, we use predefined weavers for channel selection. While [(Morales-del-Castillo et al., 2009)] uses fuzzy linguistic modeling and NLP techniques for semiautomatic thesaurus generation and performs a matching based on statistical analysis, we use semantics to manually define the connections between information items and the channels.

Since we aim for high precision and professionalism in online communication, we see little use for statistical based semantic methods (natural language understanding, information extraction, etc.). We want to allow the user to abstract from the channel level to the content level, but we see the need for human involvement in defining the content-channel mapping and at the content level. However, as we expand towards a full-fledged value management approach that monitors the entire web space for important statements, such methods will be needed. Fortunately, a large number of such web analytical toolkits already exist, [(Kasper et al., 2010)] and [(Stavrakantonakis et al., submitted)]⁹³ lists a large number of them that cover parts

⁹² <http://iks-project.eu/>

⁹³ See also [(Solis, 2012)] and <http://www.somemo.at/?p=474>.

of these tasks. However, there is an important need for methods and integrated tools that cover the multi-channel bi-directional aspects of value management and provide highly scalable and effective solutions. Obviously, the goal to develop a Common Value Management Framework (CVMF) based on combining these different areas of technology provides a long term roadmap for research, engineering, and commercial exploitation.

6 Future Work and Conclusions

The next steps of our research and investigation regarding the engagement of an enterprise with the customers could be realized from two different, yet interconnected perspectives. The first one refers to the integration of the customers response in the main dissemination channels of an enterprise in a prosperous way that would return added value to the enterprise even if the feedback from the customers is sometimes negative, whilst the second one refers to the internal treatment and distribution of the problem aligned with the social media monitoring activities of the enterprise. The former, could be called as *uncensored engagement* and the later as *controlled engagement*, respectively.

Uncensored engagement. Based on the explanation given in the beginning of this sub-section, the uncensored engagement is the direct publication of the customers' feedback in the dissemination channels of the enterprise. For demonstration purposes, we consider two examples from the tourism domain, which is easy to understand and sensitive to the opinion of the customers. The opinion of the customers in the tourism domain is one of the determinant factors regarding the number of bookings for a hotel, transport service or restaurant.

The opinion of the customers in the tourism domain is reflected to their reviews that are available online integrated with booking portals (e.g. expedia⁹⁴, booking.com⁹⁵, etc.) or in the various review sites that are not offering booking services but possibly refer to booking portals (e.g. tripadvisor⁹⁶). Having all these real reviews online, there is a great opportunity for the hoteliers to gather these reviews and incorporate the feedback in the way they run their businesses. However, it is not practical to browse through all the websites and posts of the travelers in the various review websites in order to extract valuable information. That process would no scale

⁹⁴ <http://www.expedia.com/>

⁹⁵ <http://www.booking.com/>

⁹⁶ <http://www.tripadvisor.com/>

and would be impractical in the long-term. The solution to this scalability and efficiency problem would be a tool that is responsible to gather all the reviews, capture the valuable feedback of the travelers and deliver it to the hoteliers via useful and actionable insights. *TrustYou*⁹⁷ and *HotelNavigator*⁹⁸ are two well-known tools that facilitate the management of the reviews and implement the previously described idea. These tools aggregate the reviews from the various reviews sources and from social media channels; analyze the content to classify the comments in different categories according to the sentiment analysis (e.g. positive or negative for each service that is offered by the hotel); and then summarize the results into a meaningful way for the hotelier and provide him with a detailed report via a user-friendly interface and dashboard. Furthermore, these reports could be integrated with transparency on the individual hotel web sites as an interactive badge or widget. These widgets cannot be controlled by the hotelier in order to provide the needed trust to the website visitor. The website visitor is able to see more information and navigate through the various reviews that resulted in the score displayed by the widget. These interaction and transparency helps the hotel to increase the bookings as well as to increase the direct bookings via the booking engine of the hotel that is integrated in the hotel's website. The potential customer does not need to check in the review sites and other platforms the information that he needs and consequently he is not moving away the website of the hotel. Obviously, this booking process empowers the hotelier in terms of profit, as he avoids the transaction fees and the commission of the booking portals.

⁹⁷ <http://www.trustyou.com/>

⁹⁸ <http://www.hotelnavigator.eu/>

Controlled engagement. The controlled engagement is related with the social media monitoring activities of an enterprise. The main idea behind this concept is that every single one publication of a customer in the social media sphere is characterized by three parameters that comprise a three-dimensional space. These parameters are: a) *when*, b) *where* and c) *who*. The “When” dimension specifies the response time from the moment of the customer’s publication in the social media sphere (e.g. in 4 hours from that moment, in 8 hours, tomorrow, etc.). The “Where” dimension refers to the communication channel that should be used in order to respond to the publication of the customer (e.g. facebook, twitter, etc.). Moreover, in some cases the response should be communicated through an offline action. Finally, the “Who” parameter refers to the physical person or department of the enterprise that should react and respond to the customer. In Figure 4, we try to visualize the aforementioned approach with an example from the tourism domain.

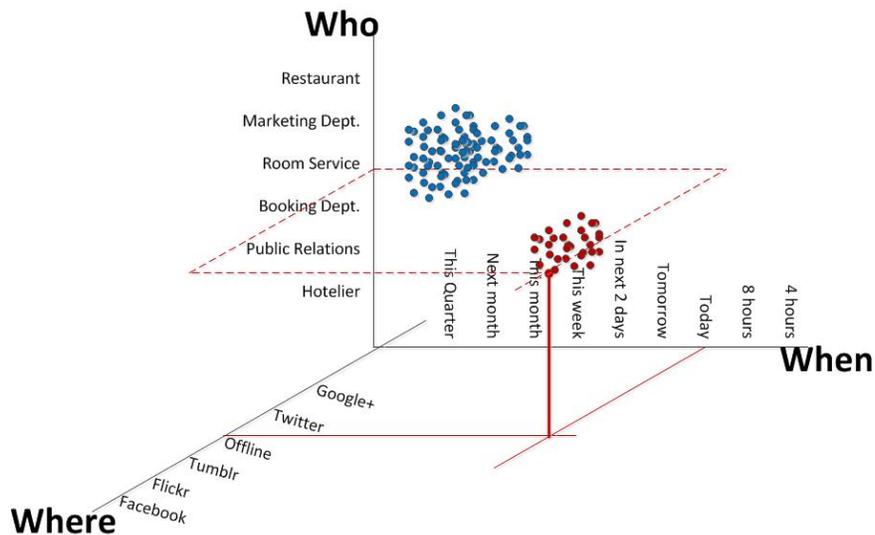


Figure 4. The 3W Engagement approach

The diagram of Figure 4 reflects the described example in the sub-section 3.3 in the scope of the fourth major requirement for the customer engagement in the social media era. The customer faces a problem with the hygiene of his room and tweets about that. The social media monitoring tool of the hotel captures that tweet. The integrated engagement tool should be able to automatically analyze the semantics in the content of the tweet and classify it. Consequently, the social media monitoring administrator would be able to easily check the most urgent issues and assign them to the responsible person with the right deadline and, also, suggest him which channel to use for the response. Particularly, in this example the response should be a visit of the

room service to the room of the customer in order to ask if any problem does exist and in such case, to solve it within the day. Furthermore, the classification of the captured data and the arrangement in this 3D graph would enable the enterprise to distinguish the weakest points of the business workflow internally and recalibrate the resources to be aligned with the needs of the customers and the weaknesses of the provided solutions.

The engagement concept should be treated by the enterprises as an opportunity to build strong ties with their customers and turn them into advocates that will add positive value to the brand reputation via the online word of mouth. The customers need answers to their questions and should give them whatever they ask for. By being authentic, transparent, and operating with integrity, you will successfully engage your market and a build community of advocates who will spread your message virally in your market. The challenges for bringing the engagement to the full potential are definitely the scalability of the possible solutions and the effectiveness of the approaches. In this paper, we tried to cover the current status in the online communication ecosystem and the available dissemination and communication channels, including the use of semantics as a channel. Afterwards, we outlined the importance of the social media monitoring tools and the achieved level of empowerment for an enterprise that follows and engages with the customers. Finally, we discussed in brief our preliminary ideas regarding the future steps and the facilitation of the engagement in a highly-scalable way.

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