# Knowledge Modeling of On-line Value Management

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**Abstract.** We discuss the challenge of scalable dissemination and communication approaches in a world where the number of channels is growing exponentially. The web, Web 2.0, and semantic channels have provided a multitude of interaction possibilities providing significant potential for yield, brand, and general reputation management. Our goal is to enable smaller organizations to fully exploit this potential. To achieve this, we have developed a new methodology based on distinguishing and explicitly interweaving content and communication as a central means for achieving content reusability, and thereby scalability over various heterogeneous channels.

## 1 Introduction and Motivation

In current times, it is (in principle) possible to instantly communicate with a large portion of the entire human population. Nevertheless, new means also generate new challenges. Take the world of the TV consumer as an example. Twenty-five years ago, there were around three channels. Therefore, selecting your program was a rather trivial task which required no more than a few seconds. Whilst hundreds of channels have been added, thousands of channels have been connected via the Internet, where extremely large libraries of videos (which go beyond the metaphor of a 'channel'), currently define the content. The consumer could now spend a lifetime in search of a program he or she wishes to watch. 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 on-line (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 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 on-line 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


E. Simperl et al. (Ed.): ESWC 2012 Satellite Events, LNCS 7540, pp. 245–258, 2015.
DOI: 10.1007/978-3-662-46641-4_18

know when someone talks about the hotel, and how much the costumer liked it. As much as this is needed, this obviously does not scale and [15] calls it "*the growth of the multichannel monster*". 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 remainder of this paper is structured as follows: Sect. 2 analyses the major goals that may underlie communicative interaction of an organization with a larger audience. Section 3 sketches the major technical elements that we developed to implement a common value management framework. Section 4 discusses some of the related work. Finally, conclusions are provided in Sect. 5.

## 2 The Aspects of Value Management

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. 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" [8].[1] Short-term increase of income is a valid target for a business entity;

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

however, it is quite tricky to realize in a multichannel world. 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. 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.

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*.[2] Observing in real time the reaction of customers and competitors will be a key to achieving successful on-line marketing. Adapting an offer dynamically in response to the behavior of the (on-line visible) environment will become critical for 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, 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 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*.[3] "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."[4] 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.

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[2] http://en.wikipedia.org/wiki/Swarm_intelligence.

[3] E.g. http://www.readwriteweb.com/archives/how_to_manage_your_online_reputation.php.

[4] http://en.wikipedia.org/wiki/Reputation.

### 2.4 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 disseminating, communicating, and interacting with large, on-line 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. Reference [10] identifies the following activities as part of an on-line 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 A Methodological Approach Towards Common Value Management

We start this section by introducing the underlying idea and major structure of our approach. We then discuss our information model, channel model, the weaver, and we sketch some applications of our approach.

### 3.1 Separating Content and Channel to Enable Various Dimensions of Reuse in Transactional Communication

The core idea of our approach is to introduce a layer on top of the various Internet based communication channels that is domain specific and ***not*** channel specific.[5] 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.[6] Our approach requires the creation of a communication model (i.e., an increasingly complete model of channels), and knowledge models for each vertical (such as research projects, research institutes, associations, hotels, restaurants, tourist events, medical doctors, etc.), and finally linking the

[5] See also as an excellent presentation on this idea: http://www.slideshare.net/reduxd/beyond-the-polar-bear.

[6] In analogy to style sheets that separate the contents from its presentation.

knowledge model with the communication model through a weaver that weaves concepts with channels. Data and information can be expressed at the conceptual level, which the domain expert understands. Mapping of the different communication means (where he is not at all an expert) is done automatically after the first implementation. The difficult dissemination through channels is done automatically through proper channels that are attached to these concepts.

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

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

### 3.2 Information Model

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. 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 can focus on the major and typical information items that are used in the on-line dissemination and communication processes. Therefore, the size of these ontologies in our case studies (see Sect. 3.4.), were moderate (around 100 concepts and properties), and many of these concepts and properties could be reused between different use cases. As a result, there was a reduced effort in building informal domain models (less than one person month). After defining an informal model, we formalized this ontology (see [2] for more details) in a simple sublanguage of OWL-2, since we foresee little need for reasoning about it. We model structured information items as concepts and non-structured ones as properties, i.e., we assume simple non-structured values for properties.

In an intermediate phase of our journey, we also tried to directly use some LOD vocabularies to model these ontologies.[7] The conclusion from this experience is shared by [17]: "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". We draw an important conclusion from this: *For us, LOD vocabularies are not means to describe our content models, i.e. they were not really useful for deriving domain models.* That is,

[7] We had used a mélange of Dublin Core, FOAF, schema.org, and GoodRelations.

we model our information items in a Domain Ontology that is understandable by the domain experts. Interaction with them is essential to our approach and therefore understandability of our means towards these domain and communication experts. *For us, 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 [6]." We achieve this by weaving our models with LOD vocabularies when we see a gain in broadening our range of communication through them.

### 3.3 Channel Model

"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."[8] In on-line communication, we take a broad definition of a channel. A channel is a means of exchanging information in the on-line 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 through Facebook are not 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. As described previously, 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 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

[8] http://en.wikipedia.org/wiki/Communication_channel.

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, which provides means for adding *machine-processable semantics* to information.

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

**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. Such news can be further spread through a news ticker such as *RSS feeds* and *Twitter*. *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.

**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* access[9]. 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.[10] *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.

[9] Write access cannot be provided due to spamming.

[10] http://www.nytimes.com/.

**Semantic-based Dissemination.** 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 and retrieving this information. 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 3, 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 [21]." Already more than 60 million web domains are using machine-processable meta data.[11]

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.[12] 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.[13]

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 and technical means, we need to reuse predefined *LOD vocabularies* to describe our data to enable semantic-based retrieval of information.[14] Currently, we use Dublin Core, FOAF, GoodRelations, and schema.org.

Notice that we use each term of a vocabulary as a potential dissemination channel. For example, for the PlanetData fact sheet we publish pieces of the information using the following vocabulary terms: schema:url, foaf:topic, dc:creator, dc:date, dc:subject, and dc:title.

### 3.4 Weaver

The central element of our approach is the separation of content and communication channels. This allows reuse of the same content for various dissemination means. Through this reuse, we want to achieve scalability of multi-channel communication. The explicit modeling of content independent from specific channels also adds a second element of reuse: Similar agents (i.e., organizations active in the same domain) can reuse significant parts of such an information model.

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[11] Compare http://webdatacommons.org/.

[12] See [21] for more details.

[13] Compare http://webdatacommons.org/.

[14] More than a hundred of them are listed at http://labs.mondeca.com/dataset/lov/index.html.

Separating content from channels also requires the explicit alignment of both. This is achieved through a weaver. Formally, a weaver is a set of tuples of nine elements:

1. An *information item:* As discussed in Sect. 2, it defines an information category that should be disseminated through various channels.
2. An *editor:* The editor defines the agent that is responsible for providing the content of an information item.
3. An *editor interaction protocol:* This defines the interaction protocol governing how an editor collects the content.
   Elements 1 to 3 are about the content. They define the actual categories, the agent responsible for them, and the process of interacting with this agent. Elements 4 to 9 are about the dissemination of these items.
4. An *information type:* We make a distinction between three types of content: an instance of a concept, a set of instances of a concept (i.e., an extensional definition of the concept), and a concept description (i.e., an intensional definition of a concept).
5. A *processing rule:* These rules govern how the content is processed to fit a channel. Often only a subset of the overall information item fits a certain channel.[15]
6. A *channel:* The media that is used to disseminate the information.
7. *Scheduling information:* Information on how often and in which intervals the dissemination will be performed which includes temporal constrains over multi-channel disseminations.
8. An *executor:* It determines which agent or process is performing the update of a channel. Such an agent can be a human or a software solution.
9. An *executor interaction protocol:* It governs the interaction protocol defining how an executer receives its content.

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 at 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

[15] In case of LOD this can be an R2R mapping rule [4].

published on the website. Then, an excerpt of the news together with its URI will be published as a tweet.

A weaver is basically a large collection of tables specifying what is disseminated by whom to where. Interaction protocols, rules, and constraints further guide this process. Such a manual is of extreme importance to manage the on-line communication process.

### 3.5 Use Cases

We developed and applied our approach in three major case studies: the European Semantic Web Conference Series (ESWC)[16], the PlanetData project[17] and the Semantic Technology Institute (STI) International research association[18].

- 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.[19] 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. 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.

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[16] http://eswc-conferences.org/.

[17] http://www.planet-data.eu/.

[18] http://www.sti2.org/.

[19] 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.

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

## 4 Related Work

Many aspects of our work clearly relate to different fields that have been explored before. Generally, we see two specifically related areas: *Ontology-based content management systems (CMSs) for websites* and *Semantic matchmaking of senders and receivers of content*. Both areas will be briefly described and compared.

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 [9]. 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 Sect. 4, but, in contrast, the weaver adapts to different channels rather than to different information sources. A year later, in [18], 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. Reference [7] 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. Reference [5] 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 [12]. As a result, as reported in [3], BBC's World Cup 2010 site[20] 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 project Interactive Knowledge Stack (IKS)[21] focuses on porting semantic technologies to CMS software solutions.

[20] http://www.bbc.co.uk/worldcup.

[21] http://iks-project.eu/.

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.

*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. Reference [11] presents 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 [14] 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 [13] 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 [14] 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 on-line 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, [10, 20][22] lists a large number of them that cover parts 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.

## 5 Conclusions

The following core features characterize our approach:

- We use ontologies to model content in order to have a representation layer independent from the communication channel. We want to achieve reuse of content over channels allowing small organizations to deal with an increasing number of

[22] See also [19] and http://www.somemo.at/?p=474.

communication channels and exploit their potential. The alignment of content and channel is achieved through a weaver that aligns ontological items with channels.
- These ontologies are not case-specific, but model a certain vertical domain such as research projects, associations, accommodations, restaurants, bars, touristic events and services, etc. Therefore, these ontologies and their channel alignments can be reused on a larger scale, providing a quick return of the investment necessary to build and maintain them.
- Our approach is bi-directional, i.e., in the same way that we disseminate through concepts we use these concept to aggregate feedback and impact found in various channels.
- We support in an integrated fashion, the dissemination via traditional web channels, Web 2.0, and semantic based channels, using various formats and vocabularies.

Based on our approach, ESWC, PlanetData, and STI International are now managing their on-line appearance. Currently, we are performing additional case studies. First, we use our approach in the dissemination of other research projects and associations. Second, we are entering more commercial areas such as eTourim, where millions of hotels are desperately waiting for a scalable dissemination strategy, given the fact that soon, around 50 % of all room bookings will be done on-line.

**Acknowledgements.** We would like to thank Anja Bunnefeld, Johannes Breitfuss, Carmen Brenner, Alice Carpenter, Michael Fried, Mark Greaves, Marko Grobelnik, Martin Hepp, Lyndon Nixon, Ina O' Murchu, Alexander Oberhauser, Simeona Pellkvist, Elena Simperl, Corneliu Valentin Stanciu, and Alexander Wahler for contributions to early drafts of this paper.

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