Website development and web standards in the ubiquitous world: Where are we going?

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Abstract: - A website is actually the first indispensable tool for information dissemination, but its development embraces various aspects: the choice of Content Management System (CMS) to implement production and the publishing process, the provision of relationships and interconnections with social networks and public web services, and the reuse of information from other sources. Meanwhile, the context where web content is displayed has dramatically changed with the advent of mobile devices that are very different in terms of size and features, which have led to a ubiquitous world made of mobile Internet-connected devices. Users' behavior on mobile web devices means that developers need new strategies for web design. The paper analyzes technologies, methods, and solutions that should be adopted to provide a good user experience regardless of the devices used to visualize the content in its various forms (i.e., web pages, web applications, widgets, social applications, and so on), assuring that open standards are adhered to, and thus providing wider accessibility to users. The strategies for website development cover responsive technology vs. mobile apps, the interconnection with social networks and web services in the Google world, the adoption of embedded data techniques based on specifications (i.e., RDFa, microformats and, microdata), and specific vocabularies (i.e., schema.org).

Key-Words: - CMS, responsive design, mobile apps, social network, Google world, RDFa, microdata, microformats, schema.org, Facebook OG

1 Introduction

Websites as key tools for communication and dissemination have undergone radical change in terms of design, development, and implementation. From the initial purpose of providing content as documents served by a web server and rendered through a visual interface, now website design involves various aspects that need to be considered:

- Structuring information of different types by means of general markup languages and web languages to be processed, rendered, and reused and enriched;
- Implementing an easy workflow for content production and publishing;
- Aggregating information from other sources;
- Embedding web applications, widgets, and connections to social applications;
- Integrating several web services, available as public interfaces, and provided by different enterprises (i.e., Google and its applications [1] such as Google Maps, Google Calendar and so on).

Actual web content management systems (WCMs) [2] that are available as different solutions such as open source and commercial ones, provide some of these features as core components or add-ons that need to be customized for the specific context (institutional or project websites, blog systems, news systems, and so on). Meanwhile, the context where the information is rendered is dramatically changed, and with it, users' behavior. There are actually different strategies for website development to provide information to users considering open standards, and the constraints and the needs brought about through working in a ubiquitous world. The focus is on content that should be structured, processed, and rendered on different kinds of devices, but that should remain the same, regardless of the environment. The shift of users toward mobile devices has changed their behavior in using the web and its applications, and, thus, in their use of generic websites. Most people use search engines to find information, or specific applications, or applets shown as icons on tablets

and smartphone devices instead of typing website' address (the URL – Uniform Resource Locator) [3] in a web browser.

Due to the widespread diffusion of such devices (mostly smartphones and tablets), in some cases it would be better to design for mobiles rather than for desktops. Based on these assumptions, the paper describes methodologies and solutions to adopt in such cases. Starting from the basis of web technologies founded on HTML, Cascading StyleSheet (CSS) language and Javascript [3], we consider approaches in publishing information processed via several web frameworks by adding several channels, and by working with a focus on a web marketing strategy that is going to be mobile [4]. This paper describes how to approach mobile access, and the connection to external sources (web services and social applications), and contributes to the inclusion of semantic information with HTML markup. Embedded mtadata both enriches the content with semantic information and helps to integrate the information into the Search Engine Optimization (SEO)[5] methodologies. There are different technologies that are used in such a context, varying from using RDFa [6], microformats [7], and HTML5 microdata [8], combined with other vocabularies (i.e., schema.org [9]) or protocols (i.e., Facebook OG graph [10]) that contribute to the realization of the so-called rich snippet. These methods implement an inclusion of semantic technologies [6] in combination with web design technologies. The aim is that a modern CMS could integrate both the capabilities to render the content on mobile devices, and add semantic technologies to promote reuse and linked data. The final goal is to provide the same information to all users regardless of the device used.

2 How to develop a website for the ubiquitous world

Website implementation actually employs a CMS or WCM, which are developed to simplify content production and publishing for developers and authors. However, when considering the statistics regarding user' behavior change in terms of browsing the web and the prediction that "mobile overtake fixed Internet access by 2014" [11], developers' issues are related to the fact that content should remain the same, while presentation should change depending on the context.

Moreover, the mobile world has led to the development of interconnected devices with small dimensions (the so-called things) that could contribute to producing data on the web (Fig.1). Behaviors to consider are:

- Accessing the web carried out more and more through mobile devices such as tablets or smartphones, and, thus, the content is visualized on specific web browsers;
- Users are suited to finding different facilities on a website that are needed for e-collaboration (i.e., mailing lists, calendar systems, etc.) and interconnection to their favorite social applications;
- Users navigate through search engines that have become the access points for website.

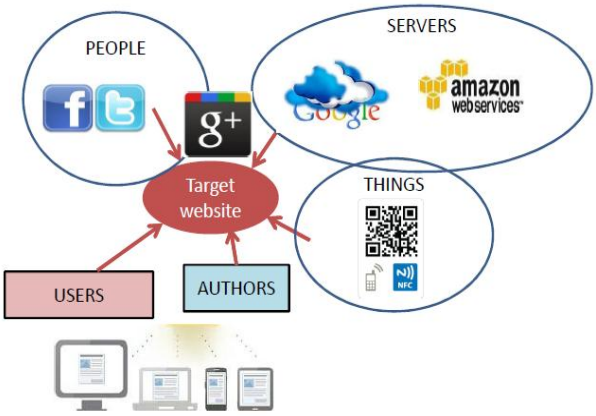

Fig.1 The context in which a website is located

There are a plethora of CMS solutions (Fig. 2) that are built to the open standard solutions (i.e., HTML/CSS/Javascript languages) and that adopt the HTML5 version [8] and the CSS3 [12] version of markup and presentation language, respectively.

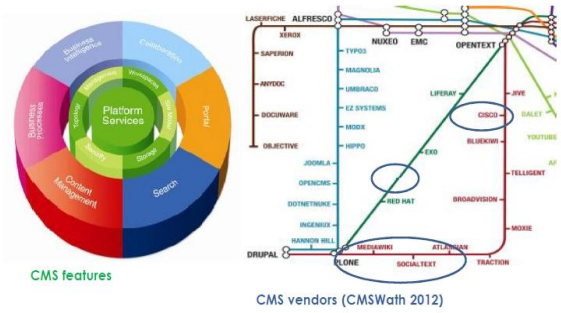

Fig. 2 CMS solutions (source CMSWatch)

These solutions allow the new features of such languages to be used which help to structure data embedded in the language (i.e., the introduction of HTML5 audio, video, and the canvas element), to develop web applications with enhanced features, (i.e., offline apps, data storage, geolocation, etc.)

and to present it according to the "device-recognition" scenario (i.e., the CSS properties media queries or the viewport meta tag of the HTML5 specification). Our experience with generic CMSs such as Plone [13] and news-based CMSs such as Joomla have verified that the choice of a CMS is not a subjective decision, but involves specific design criteria about the scope of a website being taken into account. Such criteria take into account the categorization of a CMS (i.e., portal, blog, news-based, etc.) and the context, but not the functionality, or the extension features, which are very similar. In most cases, open source solutions are chosen, since they provide for the possibility of changing the tool without a lock-in into proprietary solutions. The commercial solutions are also oversized so that they can be applied in context of complex and large organizations. Among the open source tools there are CMSs designed with a small or medium-size usage in mind (i.e., Joomla, Drupal, etc.), and others with a larger enterprise view (i.e., Plone). If we consider the behavior of such systems in terms of different kinds of content presentation for mobile devices, we find the same approach. Layout rendering is based on templates that collect style sheets able to be applied according to the device that is going to request the content. This is a web design technique known as responsive design [14]; that is, the CMS recognizes the kind of device and applies a specific template. Moreover, considering the user's behavior, in some cases it could be better to adopt the approach of a mobile app, which means the development of a website as a specific application designed for a category of mobile device (i.e., iOs-based, Android-based, Windows-like based, Nokia-system-based, and so on). The other aspects that need to be taken into consideration are the integration into a website of specific applications or web services such as those related to social networks, Google world, or the cloud world [15] (i.e., Amazon web services, Dropbox, etc.).

A final consideration concerns the "web of things" [16], a concept that refers to a connection of networked Internet-connected devices known as objects providing URL access to the data. In some cases there is a need to process or aggregate this information from the website.

2.1 Responsive design vs. mobile applications

The mobile ecosystem is developing for Internet users thanks to the diffusion of newer categories of mobile devices (i.e., smartphones and tablet devices). Mobile browsing is enriched by the presence of different kinds of web browser. Next to the mobile versions of the desktop browsers (Firefox, Opera, Safari, etc.), there are a plethora of web browsers (Fig. 3) customized by the device vendors. Web browsers have an engine that is able to process different standards, and most of them are based on the Webkit engine [17]: open source software that implements HTML5 and CSS3 specifications allowing for the implementation of the specific features introduced by these languages. The new tags introduced contribute to enriching the multimedia content that is natively rendered on the web browser without the need for an external plug-in or proprietary software.

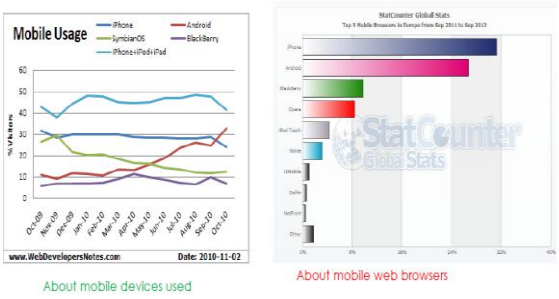

Fig. 3 Mobile browsers and mobile devices used

The features that allow for executing web applications in an offline context, contribute to providing the web experience that is the same as a desktop experience, in terms of executing applications. As regard user interfaces, using a local application is the same as using a remote web application.

In such a context, when designing a website, the two main categories should be considered: desktop-based and mobile based. Mobile browser behavior is different to viewing a webpage designed for desktop-based. Some browsers display content as it is (i.e., requiring scrolling via a horizontal side), while others carry out an automatic resizing (i.e., requiring the zoom features), even if device recognition techniques do not apply to the website. The mobile market is complicated by the fact that there are more vendors, each one with specific software solutions that are, in most cases, proprietary software. Usually there is a distinction between iOs-based and Android-based devices (i.e., when considering statistics about mobile usage, as shown in Fig. 3), Windows-based devices, and the others, but these considerations exclude users, and this is not a good approach in web design.

However, the strategy to "mobify" a website has two key aspects (Fig. 4): applying the responsive design technique on a single website (i.e., implemented with a CMS and by means of

templates), or developing specific mobile applications, also called native applications [18], customized for a specific category of devices (i.e., which implies a double effort, since it is necessary to design two websites).

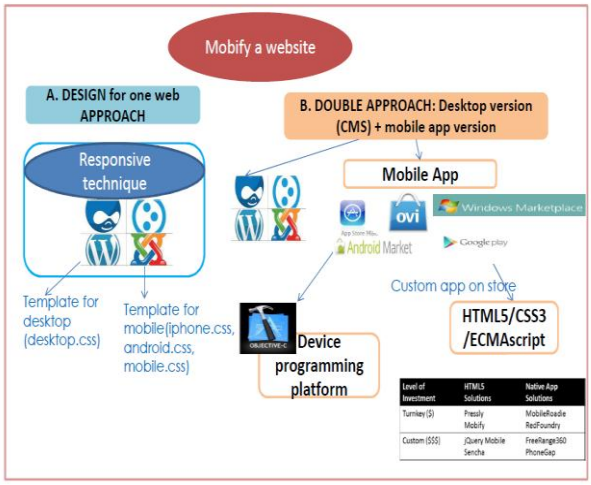

Fig. 4. Mobifying a website

Responsive design is based on specific features of CSS language and of HTML5 language: media queries and viewport. Such techniques act on target device classes and inspect the physical features of devices. By using the media attribute of the HTML link tag, a developer can set the media types (screen, all, print, etc.) defining the screen dimension limits (es. max-device-width), or orientation (portrait/landscape). Such settings are then applied according to the devices recognized by the browsers and are then associated with one or more style sheets. An example of the settings is reported in Fig. 5.

```
<link rel='stylesheet''
      media='' screen and (min-width:900px)''
      type=''text/css'' href=''desktop.css''/>

<link rel='stylesheet''
      media='' screen and (max-device-width:480px)''
      type=''text/css'' href=''phone.css''/>

<link rel='stylesheet''
      media=''only screen and (-webkit-min-device-pixel-ratio:2)''
      type=''text/css'' href=''iphone4.css''/>
<link rel='stylesheet''
      media=''all and (orientation:portrait)''  type=''text/css''
      href=''portrait.css''/>

<link rel='stylesheet''
      media=''all and (orientation:landscape)''
      type=''text/css''  href=''landscape.css''/>
<meta name='viewport''
      content=''width=''device-width, initial-scale=1, maximum-scale=1>
```

Fig. 5 Examples of media query settings and the viewport meta tag.

The second approach implies a decision (Fig. 4); that is, to use either an HTML5-based approach or a general purpose programming language (i.e., Objective-C in the Apple environment, .NET in a Windows environment). Both the solutions, however, could take advantage of the availability of frameworks that almost automatically transform websites in mobile apps by following the two approaches (i.e., PhoneGap or Apache Cordova [19], Sencha or jQuery [20], etc.).

2.2.1 Native apps: custom or HTML5-based

Mobile applications developed with the aim of producing custom solutions for mobile devices present with specific characteristics. They have reduced, even if in expansion mode, hardware capabilities in respect to desktops and other devices used in computing, and provide specific add-on features through their sensors (i.e., accelerometers, Wi-Fi, short range connectivity, GPS sensors, cameras, etc.). The usual way to access these features is by means of a specific code to enable direct communication with the hardware. Business rules dictated by mobile device vendors mean that companies must provide various software items, customize for each type of mobile devices through a storefront (i.e., the Apple Store, Nokia OVI Store, Android Store, Google Play, etc.). Through these channels, users download and install their favorite applications. The issue on the developer side is that, since there is such a huge variety of devices and, thus, stores, in choosing a mobile app solution to work on, a set of mobile applications needs developed - each one specific for each platform- with much greater effort in terms of work, time, and cost. Otherwise, the developer will exclude a portion of users who cannot view that content. Secondly, in choosing this solution, the developer has to decide between two routes: using the device's platform programming languages to design the mobile app, or following the HTML5-based solution. With the first solution, the tradeoff concerns the code that uses all the hardware functionalities with good performance, but with a cost in terms of development time, maintenance, and upgrades. The second solution has reduced cost in terms of the development life cycle as a web application [21], could provide strong adherence to web standards, but with limited access to hardware. The HTML5 suite attempts to include specific APIs that may access the main hardware features of devices, even if such development actually does not give the same user experience as a native approach.
The other aspect to consider is that modern websites use CMSs to manage their own content, but the information that is hosted could come from other sources in an aggregated manner such as through syndication [22], by means of web services APIs

available from various sites (i.e., Google, Amazon, etc.) or via interconnection to social networks.

2.2 Integration with web services APIs and interconnections with social networks

A website is actually a container of information from various sources. The original idea to link hypertext has been developed and now the concept is that of linked data [23]. With the development of technologies such as web services [24], web applications are deployed as services, which, through specific interfaces can be used by a developer on their own applications. The idea of data and software reuse and sharing, is a current reality. Google and the other enterprises working on the web on computing, to commercial, to social projects, provide web services by means of available APIs.

2.2.1 The role of APIs

Modern web applications make use of APIs in development and they include different services. Web services [24] were initially developed based on XML technologies by using SOAP (Simple Object Application Protocol), WSDL (Web Services Description Language) and UDDI (Universal Description, Discovery and Integration) as primary protocols able to transport, describe, and search for a service. The second generation of web services, also known as WS-* web services, was based on a set of XML specifications, which defines and specifies different features that are useful for security, and services that focus on interoperability of the software. These so-called SOAP-based web services, on which the Service Oriented Architectures (or SOA [25]) were built, were joined by the so-called REST (Representational State Transfer)-based web services [26], which make use of the classic Internet transport mechanism (HTTP). SOA and REST are two different concepts; one is an architecture, and the second is an architectural style. The use of RESTful web services was due to the complexity of the structures of the first type of services (often called big services), which relies on a stack of protocols implemented across several layers. Such web services, whose data could be described by XML, but that normally use the lightweight JSON (Javascript Object Notation) data format [26], rely on HTTP methods to transmit information. Usually, web services available on the web are developed as REST-based, and they develop APIs in order to include such services in their applications.

2.2.1 Integration with Google and the social network world

Google [1], in addition to being the most famous and most used search engine, provides a plethora of services that could be easily integrated in websites. Google Maps is a useful localization service that all websites use to help users in locating their positions, and other tools such as Google Calendar are used to include e-collaboration utilities in an easy way, avoiding, for example, the installation of custom software in a CMS. A CMS usually has add-ons to include such services inside the chosen CMS. Google Docs, now included in Google Drive, represents a full working environment for users together with an online web storage. The Google world is very pervasive, but since it is used by the majority of users, it cannot be neglected, and gives, however, a good user experience to users who are suited to using these tools in their life. Developers can find all the information in the Google Developers area inside the Google Apps Platform. The APIs allow developers to write applications that access several applications. Most of them are RESTful applications based on the JSON data format, even if many others are based on the Atom and RSS syndication formats and the Atom publishing protocol [22].

Even if considering social applications, social networks inside organizations, both institutional and commercial, are used as communication channels to promote information [27].

Most organizations make Facebook pages, or Google+ pages, or organize tweets in Twitter, and then make the interconnections within the site. Most of these social apps provide the APIs needed to include a connection with them. Facebook, for example, offers the possibility of including social plugins (i.e., the Like button) on a website, of creating mobile web apps, and of building an app on Facebook. This is an approach followed by web marketing initiatives [27], but also these strategies need to be taken into consideration by every website developers regardless the organization context.

2.3 Introducing the web of things

Future Internet technologies [28] are moving toward the realization of an interconnected network of objects. Such objects, usually equipped with a form of wireless Internet-connectivity, will form a network infrastructure that, if analyzed from the network layer, is known as the Internet of Things (IOT) [28], while from the application layer, it is known as the Web of Things (WOT) [16]. The objects present a communication link (i.e., usually

with wireless technologies) and transmit data that could be collected by a website to be aggregated.

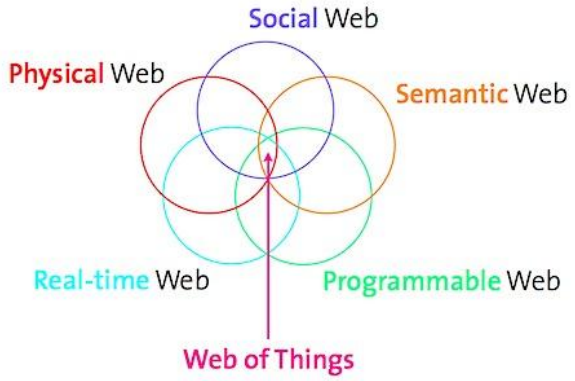

Fig. 6: The Web of Things (source webofthings.org)

Objects can vary in dimension and scope, and each one is a building block for the web platform. Each object exports a Uniform Resource Identificator (URI) or IRI (internationalized Resource identifier) that identifies a web resource [3] through which it is accessible through such a platform. A web server could be installed on the object itself allowing it to serve information. The realization of such software infrastructure is based on standards in languages and protocols defined by various working groups of specific consortia according to the different application fields. Members of the Open Geospatial Consortium (OGC) [29] are building a framework of open standards for exploiting Web-connected sensors and sensor systems of all types. Other groups and standard bodies (i.e., the World Wide Web Consortium–W3C [30], Advancing Open Standards for the Information Society–OASIS [31], Web Hypertext Application Technology Working Group – WHATWG [32], the Web Standards Project – WaSP [33], etc.) are working to establish technologies, the "web standards", for creating and interpreting web-based content regardless of the kinds of devices that have produced them or that should be able to access them. The idea is that data should be shared, and should be open to reuse, since web publishing could follow a different framework that involves the different actors: search engines, web applications, web services, etc. From this perspective, it could be useful to adopt various languages to describe data from the basis of reuse, sharing, and the aggregation of that data.

Within this context, the strategy that a developer could use in developing a website links with the choice of a specific CMS to follow the best practices of web marketing in general, and, specifically of mobile marketing [4] in order to have a website that could be really useful for its users. A possible strategy is having a website that integrates other data, web services, and social networks, and that uses a specific tool in enriching the information that the site gives. One example is the implementation of rich snippets, which are a way to enrich the information in order to give more information to the search engine and users during their searches.

3 Strategies for website development

Website development strategies include the reuse and sharing of data, and, thus, avoiding duplication via the integration with other data, services, or tools. From the viewpoint of mobile access, integration with services should incorporate social networks developed for mobile platforms (i.e., Foursquare) and techniques from mobile marketing to promote the site. The mobility is related both to the types of devices (i.e., mobile phones vs. tablets vs. smartphones), communication protocols (i.e. wireless-based) and users' behavior on the web platforms.

A way of developing the enhanced integration of data is if the data are enriched with embedded information; that is, metadata useful to search engines and other applications able to link the data and reuse them in other services. This means adopting data formats related to the use of semantics as a way to facilitate machines to understand the informational meanings on the web. In this way there is an extension of the network of hyperlinked human-readable web pages through inserting machine-readable metadata.

The metadata approach starts from information in an HTML format, and then new elements belonging to a specific schema of language are embedded to add information that is invisible to users, but can be processed by machines. However, as the data are included in the markup language, they are also readable by humans. These techniques, used within SEO methodologies, are based on different languages structuring the information: RDFa, microformats, and the microdata specification of the HTML 5 language, and they also involve vocabulary such as schema.org [9] or protocols such as Facebook's Open Graph Protocol [10].

Most specifications are based on the Resource Description Framework (RDF) [6], which is a real data model for data interchange on which the semantic web is based . RDF data are represented as triples and adding new information is solved by

adding a specific triple. It uses URIs to address the information and to retrieve information about an object (by means of the ex:object1 URI as shown in Fig. 7). It has a graph data model and the URIs bring this to the linked data. RDF refers to a suite of W3C recommendations and provides a different syntax for RDF serialized representations (i.e., Turtle, Terse RDF Triple Language, N3–Notation 3, RDF/XML [6], etc.). These methods are used to compact the data when the RDF graph is saved to a file or sent over the network. RDF also has a schema called RDFS – RDF Schema [6] or OWL [6], an ontological representation which adds semantics to the data and allows for the inference of new information from the current data. RDF in attributes (RDFa) is one of the serialization formats that can be embedded in other serialization formats such as HTML. However, it is a way of annotating HTML web pages with RDF data.

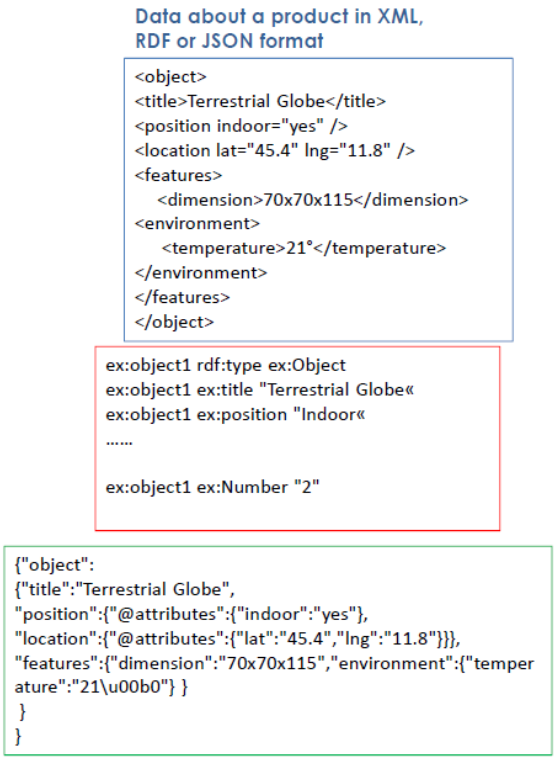

Fig. 7: A product described by different formats (XML, RDF and JSON)

Embedded metadata specifications allow us to annotate content with specific machine-readable labels to be processed by software. Web pages enriched with such content could be easily machine-readable as well as human-readable. There are different application methods inside an HTML page, however, they are related to HTML elements or attributes that are also used in style sheet languages. Semantic markup is known as POSH (Plain Old Semantic HTML): a semantic markup that means giving a meaning to a tag (i.e., ul for lists or p for a paragraph), meanwhile the presentation is controlled via CSS semantics. Semantics are, however, related to CSSs by means of class and id naming.

3.1 RDFa-based vocabularies: Facebook Open Graph Protocol and schema.org

RDFa is now also an extension to HTML 5 that adds a set of attribute-level extensions to XML-based documents. Its application is in HTML5, but it is a variety of HTML-like languages (i.e., XML documents, SVG documents, etc.) This means that the attributes are used to carry metadata in an XML language. RDFa becomes a way of annotating web pages with RDF data. Yet it is a way of publishing linked data in HTML5 documents. A similar idea is that data should be published once. RDFa uses a small set of XML attributes to specify the semantics behind the information and it allows for the inclusion of different schemas or vocabularies. The benefit of such integration into websites is that it goes through the expression of Google Rich snippets or schema.org to allow web pages to be displayed in an enhanced format in search engines or through the Facebook OG protocol to express concepts that are contained in a web page relating to people, places, events, products, and so on. The Facebook OG protocol is derived from RDFa.
RDFa-based syntax can be added inside a web page by means of different attributes for labeling information for machines. It needs a proper name space (a specific xml schema), the inclusion of such a schema, together with the declaration of the information type.

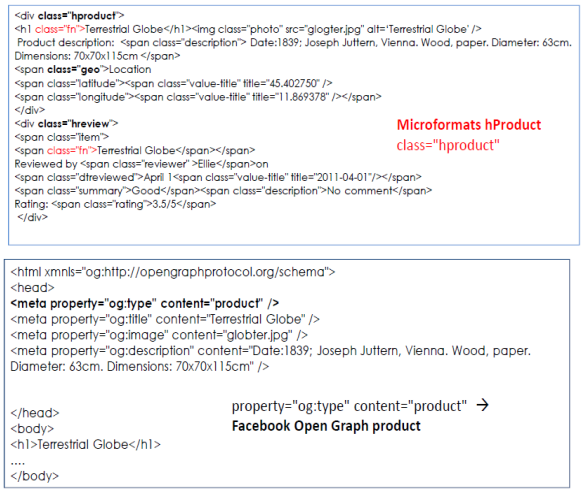

Fig. 8 Representing a product by means of microformats or Facebook OG

Schema.org, an initiative launched in 2011 by some search engine operators, provides a vocabulary that adds information to the HTML content. It provides a common set of schemas for structured markup on web pages. It works with other XML-based languages, since it offers types and properties that could enrich the information. It defines types such as person, thing, place, and business, each one with specific properties. Actually, it works with the attributes introduced by the microdata specification of the HTML5 (i.e., itemscope, itemtype, and itemprop).

Facebook's OG protocol enables the integration of webpages into the social graph. It defines open graph tags (that are metadata based on RDFa) that are included into a web page to express concepts about people, products, and also the other items described in the schema.org (Fig. 8). The Open Graph (OG) tags belonging to a specific namespace that have the og prefix (xmlns:og=http://ogp.me/ns#) work as attributes of the meta tag HTML element (using the attribute property="og:type" content="typeofcontent"). The types of objects described in this enhanced way belong to several categories: business, organizations, people, products, and so on. The protocol defines four properties that are og:title, og:type, og:image, and og:url to describe the object, but these are in addition to other meta tags such as those related to location (i.e., og:latitude, of:region, etc.) or contact information (og:email, og:phone, etc.) of the meta HTML element.

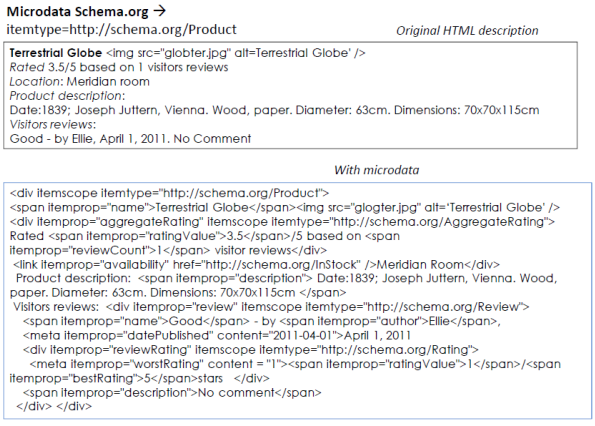

Fig. 9 Microdata a and schema.org

3.2 Rich snippets: RDFa, microformats, and microdata

Rich snippets or Google Rich Snippets are the lines appearing under every search result. They give more information about the information in the result, and may be implemented with the three languages used for embedding such human-invisible data, which are microformats, microdata and RDFa. Fig. 10 shows the three representation for describing a person.

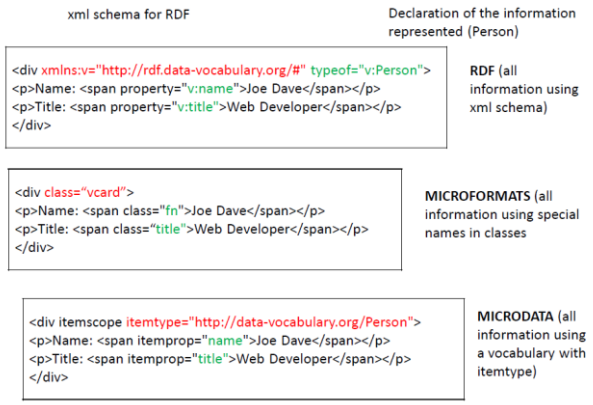

Fig 10. Representing a person with the three specifications

Microformats are the first, simple solution developed to include metadata in HTML/CSS pages. They are simple, open design patterns based on existing standards. Microformats include a set of open data formats to describe common web content (people, places, products, etc.) released as specifications and drafts, built upon existing standards. They rely on structures, but give a semantic meaning. Microformat structures are related to the HTML class attribute and the div element. Each microformat (i.e., hCard, hProduct, hPerson, etc.) has a set of properties describing the object and each object can be composed in a single page. In Fig. 8 we express an object by means of an hProduct microformat, the hRewiew, to describe the impression about the object gained by visitors, and the geo microformat, to describe the location of the object. Microformats have been established the longest as protocols used by the search engines, due to their simplicity (no need for schemas and the use of simple HTML markup language). The downside is that with this syntax, semantic information is combined with the styling and, thus, is in contrast with a good web design.

With HTML5, the WHATWG group [32] implementing such a specification decided to create its own version of embedded metadata. Microdata are thus the HTML5 specification to embed semantic information within web pages. Microdata use new tag attributes (i.e., itemscope) and allow for the addition of data vocabulary with the itemtype attribute: then itemscope is added to the wrapper element of all information. The itemprop attribute allows for assigning a value as an attribute of the span element.

In the example reported in Fig. 9, we use microdata with the schema.org vocabulary to describe a target

object. We include the Product microdata and its properties (i.e., name, description, etc.) together with the review information from a visitor.
The decision on the format to choose to enhance web pages, depends on several factors and, in some cases, on different opinions. For some, this is a question of which is better from an elegance-of-coding perspective, for yet others, the question should be focused on what is best according to the simplest solution, or a solution that is most cost-effective to apply, and least likely to cause problems. If the perspective is focused on the search engine, major search engines support the different formats, even if it is safest to use the protocol that has the most usage.
The microdata solution is included in HTML5, which is the future framework to use for web design; however, microformats are actually best processed by search engines.

4 Conclusion

Actual websites cannot leave aside using CMSs for their development, as without them they cannot consider the relationship with social networks and the world of web services provided by different organizations (i.e., Google). Finally they must approach a mobile strategy [34]. Moreover, alongside a description of web resources by means of web technologies (i.e., the HTML5 framework that includes the CSS and Javascript [35]), each resource should be enriched with metadata; that is, a machine readable information that is not seen in the browser, which could help to enhance the website features. The trend toward a mobile web has led to a change in website development approaches, necessitating the choice of an initial strategy. CMSs are actually a mature tool able to easily manage the production and publishing of web content, but thinking of mobile content brings us to a crossroads: develop a unique website and then apply the responsive technology able to determinate the device that is viewing such information and present it in a suitable way; develop, together with a website for a desktop-like experience, a set of mobile applications targeted to the various categories of devices. The choice should be evaluated in terms of costs in development effort and time when considering the stakeholder users and the users that we want to reach. Mobile app solution, however, leads us to another choice scenario: using the computing platform of the target devices for the development, or adopting an open standard approach toward a mobile web application by means of HTML5-based standards. Additionally, this choice should be carefully evaluated in terms of application performance and the use of hardware facilities versus the use in more than one category of device. Alongside the issues brought about by the mobile environment, a website should be interconnected with other web services and apps to focus on both taking advantage of these tools without implementing new ones, or loading the CMS solutions with add-ons so as to give users what they already use (i.e., Google Maps or Calendar, a connection to Facebook, and so on). Finally, an approach toward the semantic web should be adopted not only as an SEO objective, but to enable the sharing and reuse of data. Rich snippets, and Facebook OG meta tags are examples of use: microformats and microdata are specifications that allow us to include such enriched information. Finally, schema.org provides a vocabulary that helps to define the most uses content types inside an XML-like document.

References:

[1] G. Taylor, *The ultimate Guide to building and marketing your business with Google*, CreateSpace Indep. Publishing Platform, 2012.
[2] N. Metha, *Choosing an open source CSM: Beginner's Guide*, 2009.
[3] L. Shklar and R. Rosen, *Web Application architecture: principles, protocols and practices*. 2ed. Wiley. 2010
[4] H.J. Sillah, *Mobile Fusion: discover how the fatest adopted technology is changing everything*. Kindle edition Amazon Digital services, 2012.
[5] E. Enge, S. Spenser, J. Stricchiola, R. Fiskin, *The art of SEO*, O'Reilly Media, 2012
[6] T. Segaran, C. Evans, J. Taylor, *Programming the semantic web*, O'Reilly, 2009.
[7] E. P. Lewis, T. Celik, *Microformats made simple*. New Riders, 2009
[8] M. Pilgrim, *HTML5: Up and Running*, O'Reilly Media, 2010.
[9] J. Ronallo, HTML5 Microdata and Schema.org, Code4Lib Journal, Issue 16, 03.12.2012
[10] Facebook Open Graph Protocols. At url: developers.facebook.com/docs/opengraph.
[11] M.Murphy, M. Meeker, Top mobile internet trends, *KPCS relationship capital*. 2011.
[12] P. Gasston, *The Book of CSS3: A developer's guide to the future of web design*, No Starch Press, 2011.
[13] S. Pastore, C. Boccato "A web multi-tiered framework for the Italian National Institute for Astrophysics: expanding functionality by incorporating collaborate tools to promote the

institute". *WSEAS Transactions on Information Science and Applications*. Issue 11, Volume 3, November 2006, pp. 2207-2214. ISSN: 17900832
[14] B. Frain, *Responsive web design with HTMl5 and CSS3*, Packt Publishing, 2012
[15] S. Pastore Serena, Distributed computing platforms like clouds and web standards: what could be the solution in an open environment?, Proc. Of the *WSEAS International Conference on Recent Research in Applied Computer and Applied Computational Science* (ACACOS 2011), 2011, pp. 195-200
[16] D. Guinard and T. Vlad , Towards the Web of Things: Web Mashups for Embedded Devices. In *Workshop on Mashups, Enterprise Mashups and Lightweight Composition on the Web* (MEM 2009), in proceedings of WWW(International World Wide Web Conferences). Madrid, Spain, 2009.
[17] The Webkit Open Source project, at url:http://www.webkit.org
[18] B. Fling, *Mobile design and development: practical concepts and techniques for creating mobile sites and web apps.* O'Reilly 2009.
[19] PhoneGap home, at url:http://phonegap.com
[20] J. Chaffer, K. Swedberg, *Learning jQuery*, Packt Publishing, 2011.
[21] Serena Pastore, "Social networks, collaboration and groupware software for the scientific research process in the web 2.0 world". Proc. of the 7th WSEAS Int. Conf. on Artificial Intellligence, Knowledge Engineering and Data Bases (AIKED'08), University of Cambridge, Cambridge, UK, February 2008, pp.403-408.
[22] Serena Pastore, "Using content syndication technologies in distributing and publishing information to reach all users". Proceedings of the 4th International Conference on Web Information Systems and Technologies - Internet Technology (WEBIST '08), 2008, pp: 228-231.
[23] C. Bizer, T. Healt, T. Berners-Lee, Linked Data – The story so far, International *Journal on Semantic Web and Information Systems*, Volume 5, Issue 3. 2009
[24] Alonso G., Casati F., Kuno H., Machiraju V., *Web services: concepts, architectures and applications (data-centric systems and applications)*, Springer, 2010
[25] T. Erl, *Service-oriented architecture: a field guide to integrating XML and web services*. Prentice-Hall, 2006.
[26] L. Richardson, S. Ruby, *RESTful web services: web services for the real world*. O'Reilly, 2007
[27] L. Coles, *Learn marketing with social media in 7 days: master Facebook, Linkedln and Twitter for business*, Wrightbooks, 2011
[28] D. Uckleman, M. Harrison, F. Michahelles, An *Architectural Approach Towards the Future Internet of Things. Architecting the Internet of Things* Book, Springer-Verlag Berlin Heidelberg, 2011. p. 1-24.
[29] Open Geospational consortium, at url:http://www.opengeospatial.org
[30] The World Wide Web Consortium, W3C,at url:http://www.w3.org
[31] OASIS – Advancing open standards for the information socienty, at url: http://www.oasis-open.org
[32] The WHATWG Community, at url: http://www.whatwg.org
[33] The Web standards project WaSP, at url: http://www.webstandards.org
[34] S. Pastore, E-business and Research Institutes: when technologies, platforms and methods converge in providing web applications and services to meet users' needs. E-Business. ISBN 979-953-307-513-5. Book edited by: Dr. Princely Ifinedo,Department of Financial and Information Management,Shannon School of Business,Cape Breton University,Canada. Feb. 2012
[35] S. Pastore, Scripting languages and technologies for mobile application development, in the *Book Recent Advances in System Science and Simulation in Engineering*, Proc. Of ICOSSE, 2008, pp. 233-238.