

# WEB MAPPING OF REAL-WORLD THINGS AND ITS APPLICATIONS

## *Product WebID as a driving force for new supply chains*

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Abstract: This paper discusses the use of web sites as individual IDs for things and processes of the real world. We regard a web site as an information entity that perfectly fits the purpose of identifying a real-life object or process. We examine a scenario of tagging manufactured products with information tags called WebIDs and describe their possible information makeup. Individual WebIDs that are automatically created for each item during production and accompany the item throughout its entire lifecycle, have far-reaching implications for many areas of human activity. The availability of pertinent information contained in the product ID promotes awareness of the product origin, quality, location and history. Access to information about the product protects consumer rights and contributes to the efficiency of commerce. Elimination of manufacturer and owner anonymity helps to combat produce counterfeits, smuggling, and illegal movement of commodities.

## 1 INTRODUCTION

None of the technological breakthroughs of the mankind has been developing as quickly as the Internet. The sweeping growth rate of net hosts and bandwidth capacity has long surpassed the pace inferred for microelectronics in the well-known Moore's law. The speed at which new web sites proliferate can only be compared to that of nuclear fission. By the end of the year 2003 the amount of web sites reached several hundred millions and may well exceed the global population in a half decade.

Each site on the Internet is some sort of an information entity, and the multitude of individual sites, taken as one aggregate, constitutes a huge distributed data base. The content of the database is extremely variegated, nevertheless the overwhelming majority of web visits are made with the sole end of finding information about the objects and processes of the material world. It follows herefrom that most of the information entities in the

worldwide web are reflections of the real world in this way or another. Yet, at present such reflection of things and phenomena in the Internet is not adequate, as information about one and the same real object can be scattered among numerous entities and often is controversial. Some information entities reflect already non-existent objects and processes, while many other objects have no corresponding reflection in the web at all.

In this paper we suggest that all things manufactured by the man globally and all objects of the real world be provided with an individual web site and a designated URL. We call these information entities WebIDs. The WebID of an inanimate object is a counterpart of the ID used for identification of humans. The EPC, Electronic Product Code suggested by the researchers of Massachusetts Institute of Technology, can be used as its serial number. Deployment of a network of WebIDs will lead to emergence of an entirely new global structure of trade allowing full control

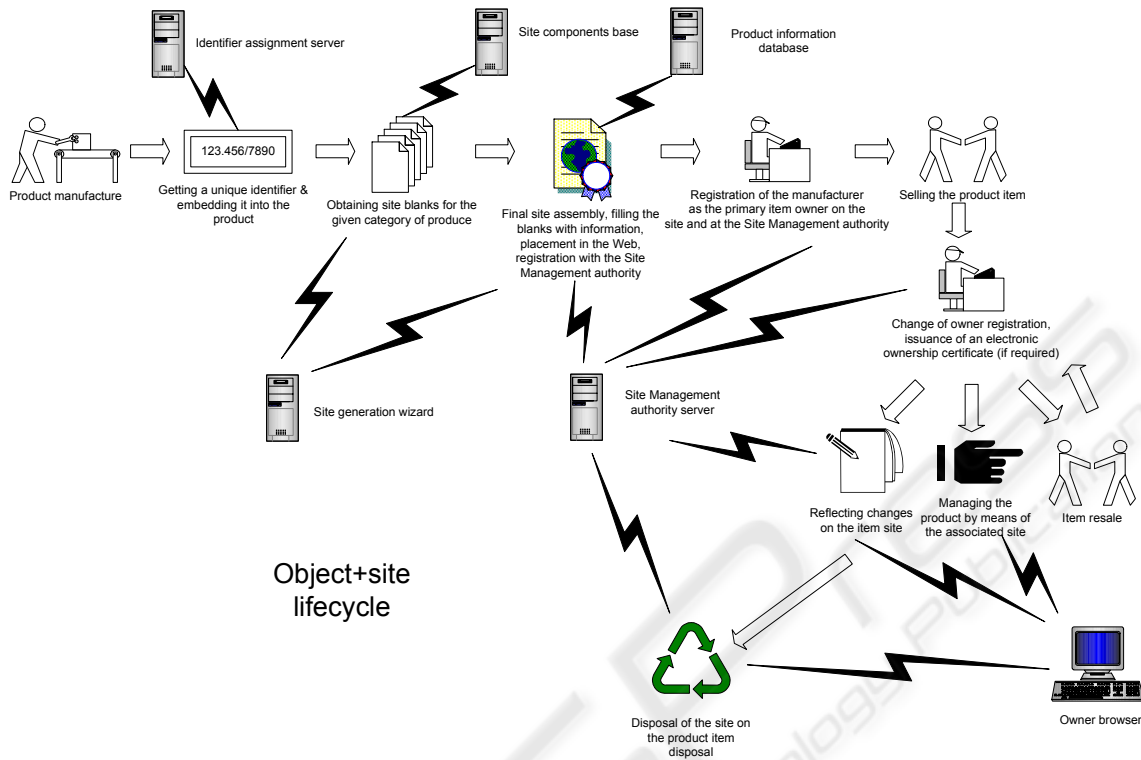


Figure 1: Lifecycle of a Product and its Information Self – WebID

over the lawfulness of goods turnover, permitting a multistage product life cycle and giving the ability and means of remote object management.

## 2 LIFECYCLE OF A PRODUCT AND ITS INFORMATION SELF – WEBID

The following essential lifecycle stages of an object and its site become apparent (see Fig. 1):

1. Creation of an Object and its Site.
2. Changes happening to the Object. The changes are reflected either by manual site editing done by the owner, or by automatic site updating.
3. Change of the Object owner accompanied by corresponding site changes and vesting the new owner with the site editing rights.
4. Disposal (elimination) of the Object.

As indicated above, the object site goes along with an object from the moment of the object creation, which means that site generation and product creation must coincide in time, and ideally

both events must occur within the same production process.

Upon output the manufactured product is assigned a digital identifier. Then, the identifier is passed on to the so-called site generation wizard. The wizard is designed for automatic site generation based on templates and components (stored in the templates-and-components data base) and application of object-specific or object-class specific information. Information specific to a certain class of objects comes from the corporate product database, which is prepared before the manufacture process begins. Information specific to a particular object is generated during production process. The digital identifier is the minimum of object-specific information.

Having received a unique digital identifier for an object the site generation wizard analyzes it and determines the object class (by belonging to a set of objects with similar attributes). The sites of objects belonging to one class have an identical structure and differ in the information content only. After that the site wizard selects the templates and components necessary for making the site for an object of the given class, fills the templates with the class-specific information obtained from the corporate database

and adds the data specific to this particular object. Adding object-specific information is the final stage in site generation.

Placement of the site on the Internet is the next step. Internet siting is accomplished by a siting wizard. The siting wizard places the site on the server whose owner has a siting agreement with the object manufacturer. In some cases the site can be placed inside the object itself.

As a rule, objects of the material world belong to owners who possess an exclusive right to change the state of the object, that is to perform operations that cause the object to change. As discussed before, the object's site must reflect such changes. In addition to automatic means of site updating (that is reflecting changes occurring in the object) the owner must have tools for manual site editing. For the sake of editing convenience the site information content must be segregated from the methods of its visualization. This separation will allow storage of the site information in a readily editable form (this, for example, may help avoid information redundancy manifested as identical information stored in different locations, a situation that may lead to problems in editing) and subsequent use of unified representation means. This demand can be met by using XML for description of the site information content and the XSLT technology for its visualization

An important event in the life cycle of an object and the related site is change of the owner. Change of the owner can result from a certain legal act – sale, grant and so on. Change of owner registration at the site is initiated by an authority registering the conveyance of property. In fact, change of owner registration is the responsibility of a special automated service – Site Access Control. On receipt of a change-of-owner request from the registering authority this service alters the site status so that the old owner loses exclusive access rights while the new possessor is registered as the site new owner lodged with privileged access to the site.

Disposal (elimination) is the final stage in the lifecycle of an object. To preserve topicality (as the material object does not exist any longer) the site is withdrawn at this stage from the Internet and is archived. Archiving is preferable to annihilation, as the site of a non-existent object may be of interest afterwards, for instance, to investigators or historians.

### 3 WEBID: INFORMATION STRUCTURE AND ESSENTIAL WAYS OF IMPLEMENTATION

The information essence of each object, viewed as a merchandisable product, comprises the following constituents:

**Product description.** It includes information about the product appearance and characteristics (verbal description, product photos, a video clip, etc.). This allows a user employing search engines to explore the Internet in search of specific product items that best meet user's demands.

**Current location of the product.** This information enables the customer to find products located conveniently. It can materially increase search efficiency due to reduction of search time (through automation of search by geographic location), as well as due to reduction of shipment expenses (as the buyer will be able to find the product in closest vicinity to his place).

**Manufacture and expiration dates.** This information prevents the consumer from buying substandard products; it can also serve as a search criterion in finding the freshest products.

**Information about product manufacturer.** Being well protected from unauthorized access and tampering this piece of information prevents the consumer from buying counterfeit produce. It can also be instrumental in search of products from specific vendors.

**Information about sale terms** is posted on the website by the current owner and permits the customer to buy products on most favorable terms.

**Additional information from the current owner.** It may consist of the owner's contact information, information on availability of any after-sale services and other pertinent data of interest to the customer.

**Product history** contains information from all previous owners. The current owner can open access to this section for prospective customers who wish to know what has happened to the product since the date of manufacture.

This convenient information structure of product websites enables customers to easily and quickly find the exact item they need. The only thing customers must know is what they want. All the rest will be done for them by a search engine that will find the goods which meet the criteria specified by the customer.

Furthermore, the WebID of a produce item increases the consumer's effect of the goods due to enhanced functionality. For instance, if the item is an electronic device, it can be continuously or periodically online interacting with its website. This

enables users to remotely control the device and monitor its operating state. The consumer receives a full set of tools for would-be resale of the item, which also contributes to the product's added consumer value.

There can be different approaches to site editing. Editing can be arranged:

- On the side of the server hosting the website
- On the side of the client
- With the help of specialized Web-services

In the first case the customer sends modification requests in response to which the host server modifies the information. In the second case the client modifies the modules him/herself. In the third case the site is maintained by specialized Web services on behalf of and for the client, and the host server's role is limited to storing the information.

Each of the above arrangements has its strengths and limitations.

The advantages of accomplishing the site maintenance tasks directly on the host server include low dependence on the qualities and capabilities of the web client (user's browser) and moderate load on data links (the sever only receives requests to modify the information, whereas modification proper is performed on the server). However, this approach presupposes availability of a high capacity server with necessary software components (at least, an XML parser, an XSLT processor and environment for program execution). These requirements can make the hosting services prohibitively costly.

The strengths of managing the site on the client side include much lower demand for the server capacity and, hence, a lower cost of site hosting. But this places stringent requirements upon the client (the same as the server requirements in the first instance). Furthermore, in this case the network load is much higher due to exchange of complete information modules between the client and the host server (though this demerit can be minimized by optimized distribution of information between modules).

The third approach involves transfer of all site editing functions to an independent set of Web services. This will reduce requirements to both the server and client, though the cost of developing specialized Web services may pose a great hindrance to introduction of the entire system.

#### 4 WEBID: MOTIVE FORCE FOR GLOBAL TRADE

Support of globalization processes is another challenge coming into being with adoption of the system. The buyer and the needed product can be located in different countries, with dissimilar trade and export/import regulations. Moreover, a transaction perfectly lawful in one country can turn out illegal in another. In such cases transfer of the website ownership rights should be prevented. We wish to propose a mechanism that will effectively address this issue.

If the product is sold locally and does not cross national borders, transfer of the privileged access right to the new owner is performed by a local access control server. In case of an international transaction (when the commodities cross state borders), transfer of the privileged access implies involvement of both local and national access control servers of the buyer's and seller's countries. National servers check if the product may cross the border and control the appropriate change of local access servers associated with the product website.

Let us consider a case illustrating conveyance of the privileged access right associated with an international sale.

A company, registering a sale, sends a transaction confirmation to the appropriate local access control server, situated in the seller's country and currently involved with the product website. The local server checks whether the transaction is international. If the check is positive the server reports the transaction to the national control server of the seller's country. The national server examines the legitimacy of the product export. If it is legal the national server of the seller's country informs the national access control server of the buyer's country about the transaction. The latter examines the legitimacy of the product import. Thus, if the product transfer is legal in both countries, a change of the local access control server takes place. As a result, the product becomes associated with the local access control server in the buyer's country. Finally, the new local access control server grants the new owner the right of privileged access to the website.

If the product import is illegal, conveyance of rights will not take place and the illegitimate transaction will be reported to the relevant authorities.

We witness an onset of a new world of goods turnover, of truly free global trade. Supply links turn into supply nets. Reuse of products will open the world of technology-intensive goods to those who cannot afford buying high tech products at the manufacturer's price, it will alleviate the stress load

on the environment, broaden the geography of product distribution. All these processes will compel resellers to contribute considerable intellectual value to the existing supply chains by creating helpful user manuals, through carrying out comparative analyses for favorable positioning of the product among other products and so on.

The Internet, the Net of nets, has already made the world transparent and boundless for all the information needs of the man. And the laws of its progress allow us to foresee how this world may become equally penetrable for much needed goods as well.

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