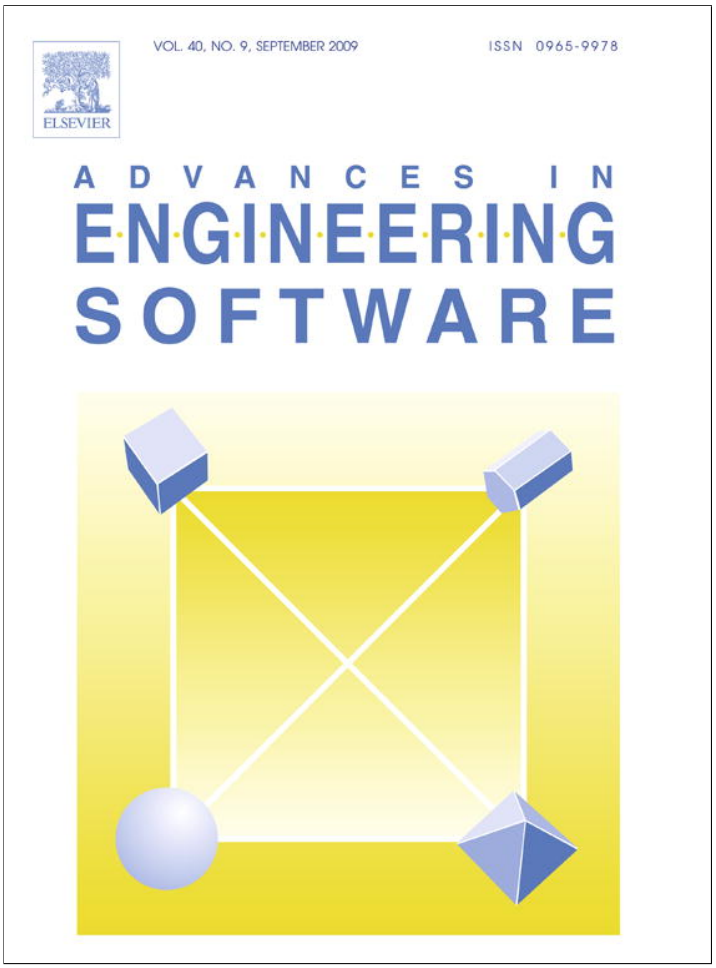

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Automating the manufacturing process under a web based framework

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ABSTRACT

The rapid evolution of the web has affected the way under which the manufacturing process is practised. In this paper, a web based framework – independent from any specific CAD/CAM software – is proposed, for employing electronic interaction between designers and manufacturers. In this context, designers and manufacturers communicate for the manufacturing of a workpiece, under a platform-independent, easier, faster and more economical way. The proposed framework is implemented as a web service, where the Simple Object Access Protocol (SOAP) is used for the exchange of the necessary machined parts data and the methodologies of UDDI (Universal Description Discovery and Integration) and WSDL (Web Services Description Language) are introduced for providing directories and descriptions information.

1. Introduction

Many efforts have been made in the last decades in the manufacturing field for the creation of an appropriate, safer, faster and more qualitative process planning, meaning the procedure of deciding which manufacturing operations and machines to be used in order to produce a workpiece or generally a component, from its original designing features. From the generic Petri Net Model [1], to the ESTRAR, FCAPP/SM and IKOOPP systems [2], a great effort and plenty of time have been spent in building these environments and therefore upgrading the level of global manufacturing planning.

For this whole procedure to take place two endpoints the designers and the manufacturers have to communicate with each other in order for the designing features, necessary for the process planning, to be transferred. As a result, this communication should not only be safe and fast but it should also provide an easy and of high quality way for a better and more efficient cooperation and transaction. Since digital data can be used at any time and place and with great reliability throughout the life cycle of a product, specific software based on web services is being created.

This software provides the opportunity to designers to draw a workpiece with the use of any CAD system and then through this website, to submit it to the Systems' software where the registered manufacturers will obtain the data and decide whether they are interested in manufacturing that part and therefore submitting an offer, or not. By this way different designers can have access to manufacturing companies and their offers for construction, without a time-consuming process and without the need for direct access to any of these companies.

Through this application the designing process becomes completely independent of the manufacturing process of the part. Plus the digital product data, the sole design authority for any product, can be accessible to a great number of computer systems and therefore different manufacturers, according to the designer's requirements.

For the achievement of this objective, this environment is based on web services for the cooperation of the two correlated parts where the essential information is transferred from the designers to the manufacturers with the use of the Simple Object Access Protocol (SOAP). Based on this protocol, the WSDL services and the UDDI registries can supply the designers with extra information about the web-based services the manufacturers offer and with their companies' integration profiles.

Thus, in Section 2 the operational specifications of the proposed environment are being presented whereas in Section 3 the web services' technologies the SOAP, the WSDL and the UDDI registries are being briefly analysed. The technical necessities of each sides' software, the designer's and the manufacturer's, are stated in Section 4 which precedes Section 5 which includes a case study of the proposed framework. Certain future enhancements to this wed based project are being proposed in Section 6 and the conclusions

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that sum this effort up follow in Section 7. The bibliography that has been used is being numbered at Section 8 and the captions that explain and supplement the particular environment are gathered in Section 9.

2. Frameworks operational specifications

This environment is based on web services providing thus the designing and manufacturing community with a system that is common for both designers and manufacturers, abolishing the need for the installation of an expensive, specialised or difficult to use software on each side. By this way the problem of incompatibility of data, data that are designed in different CAD/CAM systems, which modern manufacturing and designing companies are confronting, is exceeded releasing the communication and the manufacturing procedure from the constraints of time, security and reliability.

This system is designed to provide the designers with the possibility of receiving economical offers for the manufacture of their workpieces from different manufacturers while the interested manufacturers will get the chance to expand their public relations and raise their profits with credibility and security.

This system also, will be comprised of two kinds of users: the registered users, meaning the designers and the manufacturers, and the visitors:

- Each designer and manufacturer, or manufacturing company, is obliged to fill in, only for the first time, a specific form of personal and private data so as to create a personal account in the Systems Data Base. With this account each registered user will have a username and a password with which he will be able to submit his designs to the System and receive the offers in the case of the designers or to be provided with the requests for an economical manufacture of a specific designing part in the case of the manufacturers.
- Visitors to this web based environment will be given a chance to browse into the site and get informed about the benefits of this web-based communication, the safety regulations and the necessary operations they will have to make in order for them to take part in this communication process either as designers or as manufacturers.

Therefore, this system will have to fill up the following specifications:

1. Allow users to login.
2. Give the opportunity to visitors to register to the site by filling out, as mentioned above, a specific form of personal data.
3. Data from step 1 and 2 must be properly administrated by the System for these specific requests to be activated.
4. Provide the possibility of uploading the designing files in .xml format to the Systems Data Base.
5. All the data provided in the System must be stored in the Data Base.
6. The designing files must be obtained from the Data Base and then be forwarded by the System to the registered manufacturers.
7. The offers from the interested manufacturers will have to be routed from the Data Base to the designer who raised the specific demand.
8. Provide the designers with the appropriate environment for the management of the received offers.

These are the specifications in order for a simple transaction to take place in this web based environment. In step 4, the files for upload must be in the .xml format. This format has been selected after research [3], due to the fact that XML (eXtensible Mark-up Language) exceeds the problem of incompatibility of data and with the combination of the SOAP protocol, used in web services [4,5], it can offer a secure and simple transfer of any digital data across the web.

In step 5, the Data Base must be organised in a dynamic way, using dynamic data structures, so that any extra additions to be managed easily and all the necessary information to be obtained quickly and clearly. Both sides can request from the System the retrieval of their password or username or of any other personal data, along with information regarding the ID of the workpiece, the final cost, etc. [4]. All these messages are embodied in SOAP messages and as a result quick, safe and easy retrieval is being accomplished.

In step 6, when the designing files are sent to the manufacturers, each of them is being given a predefined time to estimate the cost and the duration of the manufacturing procedure. When an economical offer is being raised, step 7, the manufacturer sends his offer to the designer, through the System.

From that point and on, the two endpoints can exchange a number of messages, step 8, which are all embodied in SOAP messages and that concern more clarifications for the manufacturing of the part and the final entrusting of the deal.

This procedure is being presented in the diagram, Fig. 1. The entities that exist in this system are the designers, manufacturers and the System-Data Base. The steps that have been analysed above are presented in order for this communication to be established.

3. Methodologies applied in distributed systems for the collaboration of different endpoints in the communication process

For the transport and transformation of any kind of digital data into and out of any programs of any computational systems, web

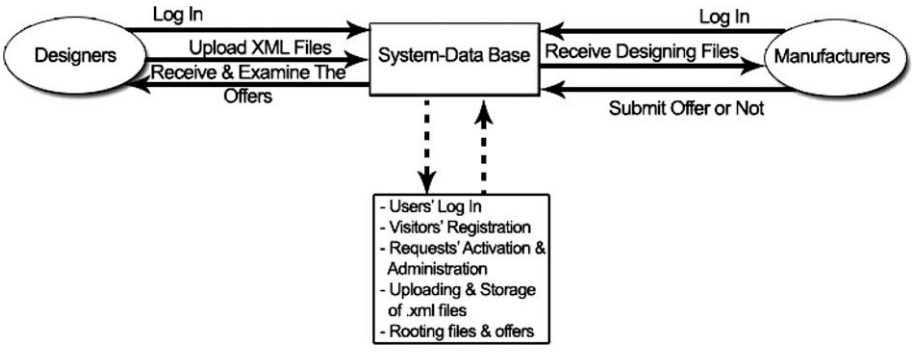

Fig. 1. Main parts and operations of the web Based environment.

```
<?xml version="1.0"?>
<soap: Envelope
 xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
 soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">

   <soap: Header>
     <!- Content of header goes here->
   </soap: Header>

   <soap: Body>
     <!- Content of body goes here->
   </soap: Body>

</soap: Envelope>
```

Fig. 2. A typical SOAP-Envelope.

services are used along with technology based on XML. The web services framework is composed of three important factors:

1. Some communication protocols such as the Simple Object Access Protocol (SOAP).
2. Certain service descriptions like the Web Services Description Language (WSDL) and
3. Particular service discovery like the Universal Description Discovery and Integration (UDDI).

By defining a standardised mechanism for description, location and communication web services simplify the procedure of the exchange of data between different and incompatible systems.

In the following paragraphs the most important features of SOAP, WSDL and UDDI will be cited.

3.1. Simple object access protocol (SOAP)

SOAP is a simple and extensible protocol that provides a way to communicate between applications running on different operating systems, with different technologies and programming languages. It uses HTTP and XML in order to define an Extensible Messaging Framework [4].

A typical SOAP-Envelope consists of the Section Header and the Section Body and has the form as appears in Fig. 2.

This figure contains the following elements:

- The *envelope* is the top element of the XML document representing the message and containing namespace declarations.
- The *header* element contains application specific information about the SOAP message.
- The *body* element describes the information exchanged with the message recipient.

SOAP enables communication among web services through messages that consist of all the data needed to be exchanged, header information, call, response and information about errors that might occur while processing the message. In the Case Study that is presented at the end of this paper, a SOAP message of the above form is being presented containing information of this Wed based environment.

3.2. Web services description language (WSDL)

WSDL is used in combination with SOAP and XML-Schema to provide certain services over the Internet. It is a document written in XML and describes the way to communicate using a web service by specifying the location of the service and the operations that it exposes.

The elements of which it is comprised are used to specify the following purposes:

1. the data that are exchanged between the endpoints,
2. the operations that are performed so as the receiver to know how to process the message and,
3. a binding to a protocol allowing the sender to know how to send the data.

Therefore when using a web service for establishing a communication between two endpoints, both parts designers and manufacturers, have to comprehend the same WSDL file and the same XML-Schema. This is essential because it's the only way for the receivers to understand how to interpret the input message correctly and the sender how to format the output message [6].

With the WSDL descriptions users and developers, designers and manufacturers, which participate in this interaction, are released of the need to remember or understand all the details of service access.

3.3. The universal description discovery and integration (UDDI)

The Universal Description Discovery and Integration (UDDI) offers a different approach in the way that companies and businesses can be found on the Internet for the services that they offer.

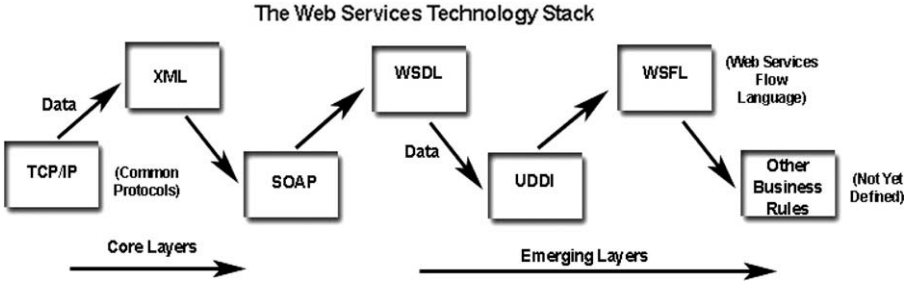

Fig. 3. The Data Flow Through the Web Services Technology Stack (source: The Stencil Group, June 2001).

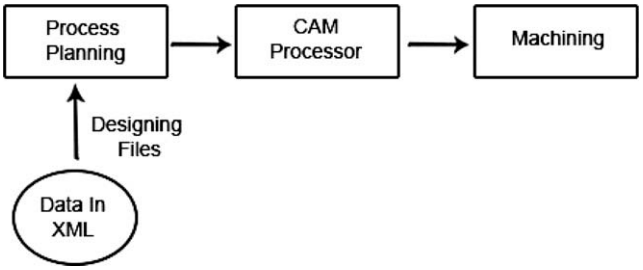

Fig. 4. ManufactorSite Software structure.

Beyond the common way of local databases and storage of personal information UDDI supports the description and discovery of

1. businesses, organizations, and other web services providers,
2. the web services they make available and
3. the technical interfaces which may be used to access those services.

UDDI is based on XML, runs on HTTP, has adopted SOAP messaging guidelines for cross-platform programming and uses WSDL for describing web services.

Generally through a UDDI registry companies are allowed to find one another. They are able to find specific information about a company, the products it sells, the way that one can access these products and of course find all the necessary information about the essential business processes and the relevant document exchanges in order to establish a communication. The information that businesses can register are divided into three categories: the White, the Yellow and the Green Pages [7].

- White Pages provide information about a company's business name, address and contact information.
- Yellow Pages categorize companies according to industry taxonomies, and geographical location. This information allows others to discover business services based upon its categorization (such as being in the manufacturing or software development business).
- Green Pages provide references to technical specifications, information on what types of documents a company can receive as well as the technologies the company interacts with and supports.

The way that these registries can be used in this web based environment is actually twofold. The web services provided by this site can be registered in the UDDI's directories so as to be found by clients looking for services that provide communication between designers and manufacturers. On the other hand, besides this wide area-based registry, UDDI can be used locally. Instead of inserting manufacturers in the local Data Base of the System that has been presented, the necessary information for them can be pulled out from the UDDI registries. In any case though, through these UDDI specifications, users will be offered a unified and systematic way to find appropriate service providers.

The Data Flow of the above mentioned technologies is presented in Fig. 3.

id	designers_id	xml_file	date
14	1	Circle.xml	23/1/2007

Fig. 7. "Part" table, with all the information that characterizes a workpiece.

4. Framework's modules

In order for this web based environment to be completed, every part that wants to participate in this communication should follow certain specifications. Those specifications are divided to the following three categories, according to the participating part.

4.1. Designing necessities

Every designer who wants to gather economical offers for the manufacture of his design must be able to communicate properly with the System server. This means that the software on the designers' side must be compliant to the client–server architecture of the System so as to be able to act as a client with the necessary network connection established. Moreover the client must have certain specific descriptive SOAP files which he will be able to obtain through the Systems' software and which will give him the ability to connect to the system and use the SOAP protocol for the transfer of the data. From that point and on the successful cooperation depends on the designing file. Since the only way to send the information regarding the workpiece, is by uploading the file to the system, then this file should be in .xml format which every CAD system produces at the end of the designing procedure.

4.2. Manufacturing necessities

The manufacturer, just like the designer, must have embedded software in which the components of the used web service must be set up. Again the architecture is the same, the client–server model on which the web service of the system is based and developed, the network protocols that depends as well on the OSI model (Open System Interconnection model) and the descriptive SOAP files that enable the manufacturers to understand and use the services of the proposed system. Since the successful communication is given, then the manufacturer's side with a simple parsing can immediately have access to the designing file that the System

id	username	password	Firstname	Lastname	Compname	address	mail	phone
1	gdarras	30672	George	Darras	ArtCraft	Dafnhs 12	gdarras@gmail.com	6939475684

Fig. 5. "Designers_data" table, with the designer's personal information.

id	username	password	Firstname	Lastname	Compname	address	mail	phone
4	iliappis	271145	Ion	Liappis	Kleemann	Bosporou 2	iliap@tellas.gr	69772675194

Fig. 6. "Manufacturers_data" table, with the manufacturer's personal information.

id	manufacturers_id	id_part	part_changes	price	entrusting_date	delivery_date
3	4	14	Circle14_Changes.xml	35,5	5/2/2007	1/6/2007

Fig. 8. "Offer" table, with all the information of an offer about a particular workpiece.

has forwarded. From that point and on the exchanged data can follow the route towards the process planning of the particular part, in case a deal has been arranged, which means entering the CAM Importer and then the CAM constructors.

The procedure that has to be followed by the manufacturers' side in order for the xml file to be properly interpreted and therefore constructed is presented in Fig. 4.

More specifically: an xml file, which contains – both geometrical and topological – information for all the features of the designed workpiece, with the application of a previous established software, leads to the creation of the appropriate process plan, which in turn inserts its data to a CAM (Computer Aided Manufacture) system. From this system, the requisite program for the tool machine is created, which finally will lead to the machining of the particular part. This process is prone to errors and quite time-consuming. This is the reason, as it is shown in Section 6, that the MP-ML must be introduced in the manufacturing field for a more accurate and independent manufacturing procedure [3].

4.3. Software at the System server side

The software in the System server is the basis of this whole web based environment. In this Data Base all the information about the designers' and the manufacturers' personal and business data are stored as well as the data concerning the specifications of a workpiece and the offers for its construction. Therefore, the dynamic and organized structure of this Data Base is essential. What is needed in the System is the set up of the essential components and libraries for the web service to function, the creation of the server side files needed for the incorporation of the SOAP as a communication protocol, the proper network protocols (such as the OSI model mentioned above), the administration and secure transport of the .xml files, as well as the secure registration and login procedure for the users. The most important factor is reliability and security in order for this environment to provide a platform where both sides companies can communicate easy and fast for the arrangement of deals.

5. A case study

In the following paragraphs a case study is examined. For this purpose, at the beginning the database's structure is analytically defined. After that a very simple workpiece is given, and all the necessary steps of the applicable procedure are described. Finally the application's environment is displayed with the use of two screen shots, showing both the designer's and the manufacture's interface.

5.1. Database structure

The basic and most significant part of the presented framework is the System's database. This means that the way of the organization and therefore the construction of the tables on which the whole project will be based on, is of utmost importance. More specifically the database of the System is organized in five tables as appears in Figs. 5–9 :

(1) The "designers_data" and "manufacturers_data" tables gather the data that characterize each user, the full name, the address, the telephone number etc. In both tables though, the first three fields are the fields "id", "username" and "password". The last 2 fields are meant to save the username and password of each user with which he will be able to login to the system and be treated as a unique user with his own personal record. The "id" field holds an increasing number (automatically incremented) that specifies each user in the table.
(2) The table "part" gathers all the information that concerns the designing files that are uploaded to the System by the designers. It carries the "id" of the part, the number from which the file is being identified by the user, the "designers_id" that specifies who the designer of the particular part is, the "xml_file" which is the actual file that the designer has uploaded to the system and that contains the features of the prismatic part and last the "date" that the file upload has been made to the system.
(3) In the table "offer" all the offers that have been proposed by the manufacturers are contained. There is also here a field with the "id" of the offer, one with the "manufacturers_id" and another one with the "id_part", the id of the designing file on which the particular offer has been raised. The next field "part_changes" contains an .xml file with which the manufacturer states that for the particular offer to be valid certain changes to the prismatic part must be made. He therefore names a price for the construction, that is saved in the field "price" and the timetable-dates, "entrusting_date" and "delivery_date", that he is committed to follow for the manufacture of the part.
(4) Finally, the table that bears the most important factor in this project, which literally depicts the arrangements and the final entrusting of the manufacture is the "final_entrusting" in which the ids of the part, of the offer, of the designer and of the manufacturer are saved. By this way a specific part is bound up with a particular offer of some designer and manufacturer. In this table, it is shown that different manufacturers and designers can be bound up with an entrusting deal (the same values of the "manufacturer_ id" and the "designer_ id" variables can appear more than once in these fields), but the values of the "part_ id" and "offer_ id" variables appear only once in the table proving the uniqueness of their connection and of the final entrusting of the deal.

The organization of these tables inside the database offers to the System the necessary transparency and expandability in order for new data and records to be added in the database without confronting any problems of data conflict.

part_id	offer_id	designer_id	manufacturer_id
14	3	1	4

Fig. 9. "Final_entrusting" table, with the id of the part, of the offer and of the designer and manufacturer.

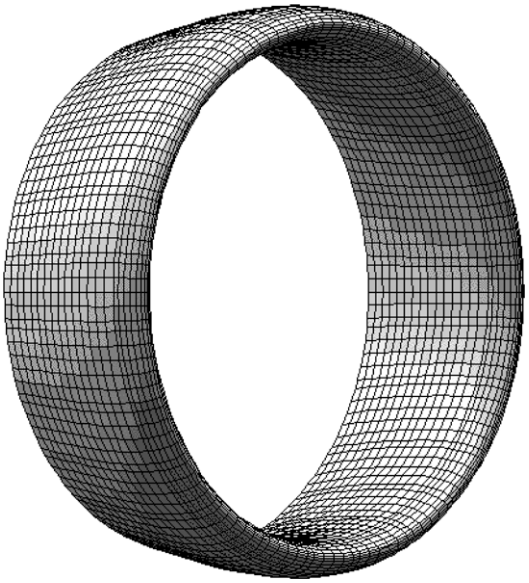

Fig. 10. An application example.

5.2. An application example

An application example is shown in Fig. 10. This particular design depicts a very simple workpiece that a designer wants to manufacture and that is contained in the Circle.xml file. in order for this part to be uploaded to the system, the designer has to log-in and choose from the menu the upload button. From that point the system communicates with the user with the SOAP protocol. In order for the SOAP to be used, the file shown in Fig. 11 must be executed on the side of the server. In this file the library of "NuSOAP" is included so as to define the namespace of the service (line 2). In lines 5, 6 and 7 the SOAP server is instantiated and the settings for the WSDL file that will be created, such as the service name and the namespace, is defined. By registering (line 9) the function "Upload_Design" the server is aware of the existence of this method, as well as of the values that will pass to, and from the method which will be the file that is assigned as a "longtext" value. The "Upload_Design" method is defined below and through this function are conducting: the opening of the database (lines 12 and 13) that the System uses and the storage of the file that has been uploaded by the user in the appropriate field of the table "part".

With a similar procedure as the one described above, the registered to the System manufacturers receive the designs from the database and reply with their offers (which can be more than one). The manufacturer has the ability to propose any changes he believes that are necessary for him in order to manufacture the specific part. Therefore he can upload an .xml file with the changes he wants and raise his offer based on the specific changes' file. For example, a possible change to the design shown in Fig. 10 could be the perimeter of the circle and/or the material that it is made up of. It is up to the designer to examine the offers and decide whether or not he wants to assign the construction to the particular manufacturer.

A typical example of a SOAP message Fig. 12 as it transfers the data from the client–user to the server-System for the upload of a designing file has the elements presented in Section 3.1 whereas it shows the tags where the function "Upload_Design" (line 1) is called in order to upload the design "Circle.xml" (line 2). The file will be assigned to the "$xml_file" value of Fig. 10 (line 15) and will be inserted to the database.

Through this generalized example the proposed system and the way that it functions is being presented, portraying the basic elements and properties of the database that stores and administrates all the necessary data for an easy, safe and fast collaboration. The flowchart of the system's operations is presented in Fig. 13, in which the SOAP message contains all the information and data in xml and the WSDL file of the system so as to specify the operations of the services used in this environment.

The communication with the UDDI Registries can be implemented with the SOAP protocol either the Registries are used locally, in the Data Base where the manufacturers' information are pulled out by the Server System, or over the Internet in which case this web based environment is registered in the UDDI specifications.

```
1  <?php
2  require_once("nusoap.php");
3  $ns="http://www.co-create.com/...";
4
5  $server = new soap_server();
6  $server->configureWSDL('Upload_Design',$ns);
7  $server->wsdl->schemaTargetNamespace=$ns;
8      ...
9  $server->register('Upload_Design',array('file' => 'xsd:longtext'),$ns);
10
11 function Upload_Design($xml_file){
12     $my_db = new database;
13     $my_db->connect($database_name,$database_host,$database_user,$database_password);
14     ...
15     $successfull_upload=$my_db->add_new("part",$xml_file);
16     return new soapval('return','int',$successfull_upload);
17     $my_db->close;
18 }
19     ....
20 $server->service($HTTP_RAW_POST_DATA);
21 ?>
```

Fig. 11. A part of the descriptive SOAP file from the side of the server, which handles the requests from both designers and manufacturers.

```
POST/ Upload_Design HTTP/1.1
Host: www.co-create.com
Content-Type: text/xml charset="utrf-8"
Content-Length: nnn
...
<SOAP-ENV : Envelope
        xmlns: SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope"
        SOAP-ENV: encodingStyle="http://schemas.xmlsoap.org/soap/encoding"/>
      <SOAP-ENV: Body>

          <m= Upload_Design xmlns: m= "www.co-create.com/../Upload_Design">  1
             <xml_file> Circle.xml </xml_file >                              2
          </m= Upload_Design >

      </SOAP-ENV: Body>
</SOAP-ENV: Envelope>
```

Fig. 12. The SOAP message, with which the designer uploads his design to the system.

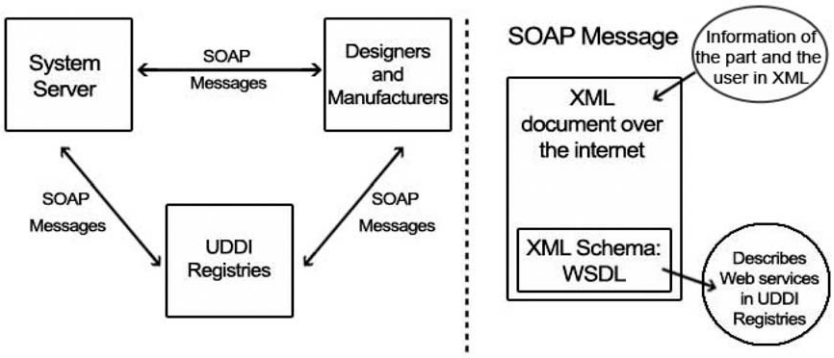

Fig. 13. The process of communication comprised of SOAP, XML and WSDL.

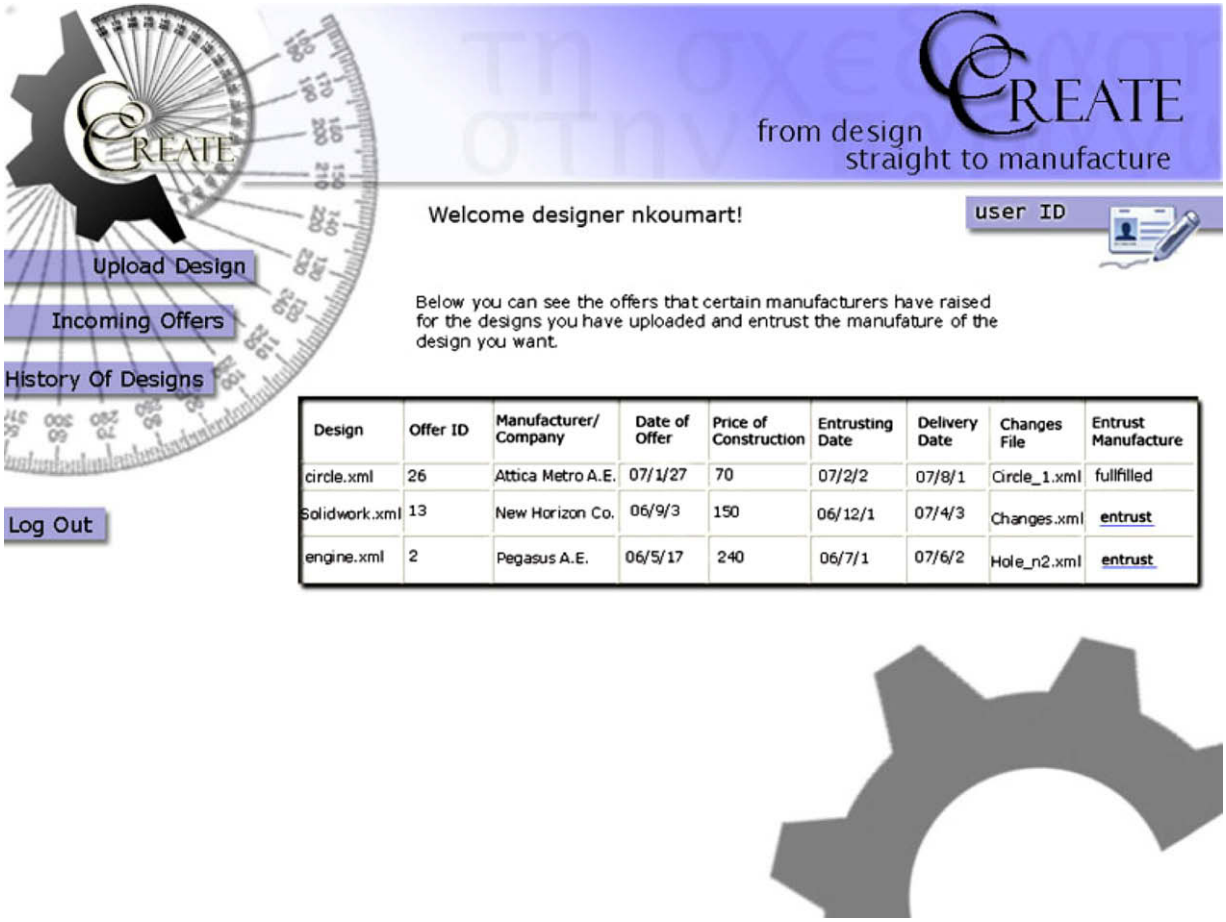

Fig. 14. Screen shot of the designers interface of the proposed system.

5.3. Application interface

Regarding the technical information given for this system and the way that it functions, the following example of the users interface will offer a more complete aspect of the proposed web environment and of the user's abilities when registered to the system.

In Fig. 14, the designer with the username: "nkoumart" is examining the offers he has received from interested manufacturers. At the displayed table, the name of the designing file, the id of the offer, the name of the manufacturer who has raised the offer and the date, are being presented, followed by the price of the construction, the dates that the manufacturers can begin and deliver the fabricated piece and the file with the possible changes for the particular part. In the last field, the designer can view the offers that have been assigned and he is given the ability to entrust an offer by clicking on the appropriate link ("entrust").

In Fig. 15, a Screen shot of the manufacturers' interface is displayed, when a manufacturer chooses the "Incoming Designs" from the left menu and observes the table with the designs he has received. In this screen shot, a manufacturer with the username: "msarigia" has signed to the system and is uploading his offer by filling a form that contains the id of the designing file, the price for the manufacturing of the workpiece and some dates. This id has provided to him when he received the designing file for examination. He can then upload or not a file with the changes he wants to make to the particular workpiece.

6. Proposed future work

This environment is at an advanced stage of development, offering at this point communication between designers and manufacturers for the construction of prismatic parts and not for the wide range of the workpieces that can be produced in a manufacturing company.

Based on this temporarily early functionality, enhancements are already under development concerning the way that the designing files are uploaded to and administered by the System. More specifically the ability of the registered designers to be able to upload their design by filling out an on-line form supplied by the System is being examined, providing at this point the necessary specifications about the geometrical and topological features of a part which will be extracted with the aid and use of the MP-ML format as has been analysed and presented in [3]. MP-ML is a language that contains not only the geometrical features of a part but also other more specific characteristics such as the holdings of the work piece, the desired, by the designer, process plan of the part as well as the cutting tools for that process planning. It is obvious that MP-ML can organise the features and specifications of a workpiece and therefore cover the whole wide range of mechanical features sorted by each kind of workpiece. Therefore, with this on-line form, there will be no constraints regarding the kind of components that can be uploaded and therefore constructed. With this option, designers will be granted with the possibility of a wider and more

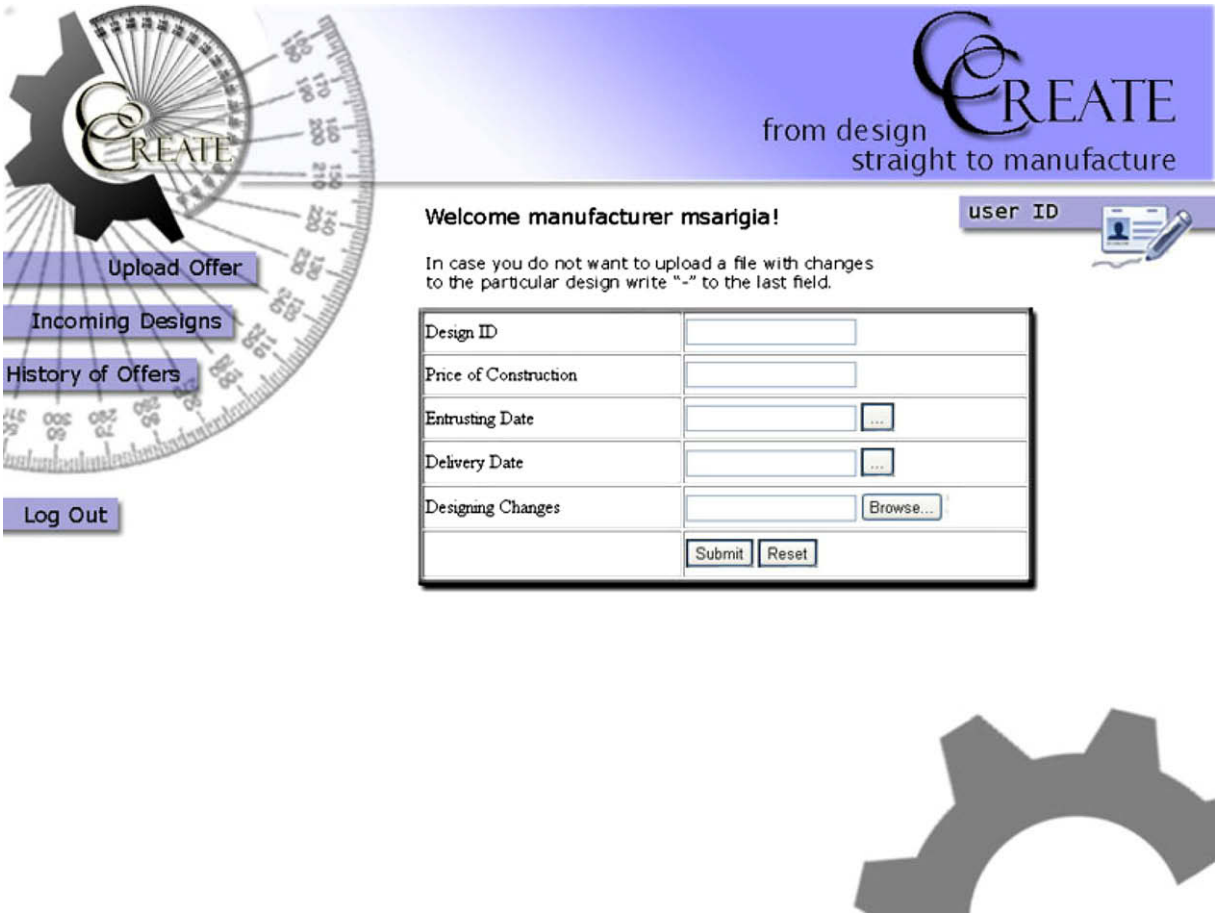

Fig. 15. Screen shot of the manufacturers' interface.

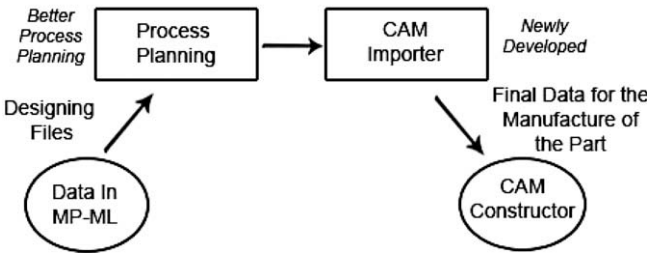

Fig. 16. The process of manufacturing a part with the use of MP-ML.

accurate communication with the registered manufacturers, for the successful construction of any workpiece.

Moreover, with the use of the MP-ML format for the representation of the data, manufacturers will be able to transform the files they receive from the System much easier and faster. This immediate transformation will lead to an easier manufacturing process, because the data will now be analysed and processed, first by entering the CAM importers, a newly developed utility. This utility recognizes the part, described in MP-ML document and from there, it will be easily imported to the CAM constructors [3]. Thus the process of manufacturing a workpiece will be less time-consuming and much easier (Fig. 16), in comparison with the process previous described in Fig. 4.

The ability to extract and visualize to this web environment a 2D or 3D model of the uploaded part will be offered given the use of the MP-ML. When the manufacturers receive the designs from the System for examination, a real-time 2D or 3D model of the particular part will be instantly developed on the browser offering them a more thorough examination of the part and its features and subsequently a more immediate and substantial cooperation between the involved parts.

In an effort to expand the range of this environment, regarding the number of the users, the way to which this platform can be accessed and the area of its response, nationally or globally, UDDI registries can be used. This will be a step forward towards the growth of the manufacturing industry and the overcome of several constraints and barriers for a reliable cooperation independent of any program or working environment.

7. Conclusions

This paper presents the development of a web based environment that aims at the facilitation of the communication between designers of prismatic parts and manufacturing companies. The use of this specialized piece of software will lead to a less consuming fabrication, regarding time and cost, independent of the designing process and from the manufacturing place.

With the use of web services, new accommodations such as flexibility and expandability are brought into the communication process. The SOAP protocol, used for the communication provides the description of the workpieces with the XML language, while the description of the web services is provided by the WSDL files. The upcoming technology of the UDDI registries grants an organized way of finding personal and technical information about companies without the need of personal intervention.

This environment is at the final steps of development providing the possibilities and facilities that have been presented to the manufacturing and designing companies that aim to cooperate through the web, thus through this easier, faster and more reliable means of modern communication.

The successful fulfillment of this platform will offer an innovation to the manufacturing process by enabling different software systems to collaborate exceeding their incompatibility problems and decreasing the total cost and time of their manufacturing process.

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