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**ENGINEERING WEBTOP INTERNET SERVICE – BUILDING FRAMEWORK FOR
RAPID MECHANICAL DESIGN BY USING INTERNET SERVICES**

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ABSTRACT

This paper presents concepts, business models, content management issues and technology framework for design of Internet community portal for engineers, designers and decision makers involved in mechanical industry.

KEYWORDS

Internet, mechanical design, mock-up, parts repositories.

INTRODUCTION

Web-centric environments can provide various open and secured features for round-trip engineering through internet application services model. All these features, including client webtops are integrated into virtual engineering community which is new workplace for most of the engineering tasks in ones product design phases.

In order to demonstrate a value that could be added to a product in design stage, at the Faculty of Mechanical Engineering, University of Nis, Part*3D application service has been developed with general idea to support product design by enabling engineers to reuse design ideas by browsing through and searching of internet library of product models.

First part of this paper investigate diferent possibilities of Internet and Internet tehnologies in order to acomplish rapid product design. Last part describes Part*3D as an example of Internet service providing.

**VIRTUAL COMMUNITY FOR ENGINEERING
WEBTOPS**

Engineering webtop ressembles all client applications and protocols needed to support participation from one workplace, in all collaborative product development activities inside virtual engineering workspace.

Virtual Engineering Community is strongly integrated network environment which ressembles webtops, application services, groupware facilities and network infrastructure, designed to support all engineering activity through internet protocols (TCP/IP, IIOP).

Basic goal of virtual engineering community infrastructure is to enable rapid product development in collaborative manner.

In order to support all development activity, virtual engineering community must contain *Groupware Support Facilities*. Groupware support facilities are means for enabling groupware in engineering environment. Necessary elements are *storage, logging, workflow, messaging* and *authorization*. Groupware support facilities are integrated into enterprise portal core as web beans – functions that shall be used by proprietary application services, as will be described later.

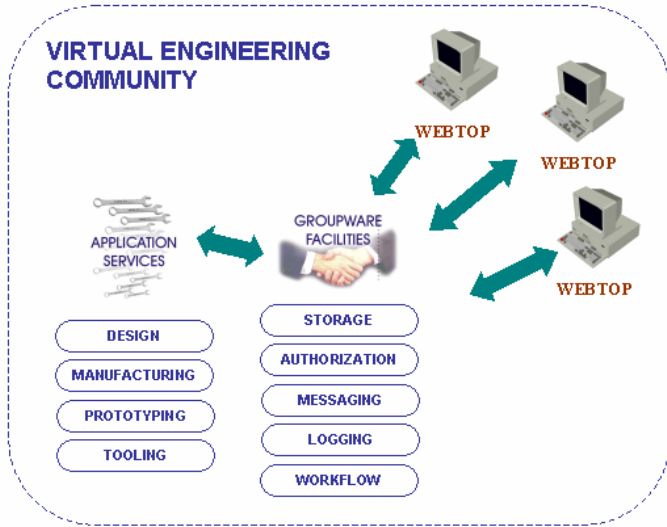


Figure 1. Virtual Engineering Community environment

By many expert and corporate opinions, *Internet application services model* appears to be a ground base for future development of e-mentality. Development of new communication technologies and rapid increasing of bandwidth will force users to move from stand-alone applications environment to web-based application services.

INTERNET APPLICATION SERVICES MODEL

By that way, users will benefit with reducing costs for application ownership and maintenance and establishing environment for strong collaboration.

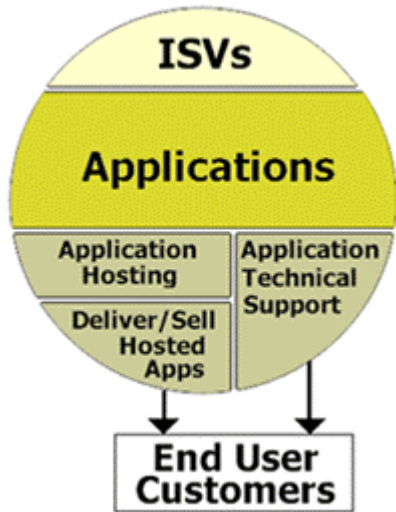


Figure 2. Application services environment

The term ASP (Application Service Provider) is a generic term currently used to describe a company that hosts applications on centralized servers. Customers pay a hosting fee or monthly rental fee to access these applications either via the Internet or a private network.

Complete application service consists of three unique service components: *application hosting*, *application delivery* and *application technical support*.

Application Hosting - Physical hosting of applications on centralized servers

Deliver/Sell Hosted Applications - Selling and delivery of the hosted applications to end users will often be performed by a company other than the company that is physically hosting the application.

Application Technical Support - While the company that hosts and/or delivers the hosted application to the end user will typically provide end-to-end connectivity support, often times that will not offer application technical support for the specific application.

ENGINEERING PORTALS

This proposal for new framework for engineering activity within one enterprise assumes that almost all actions and procedures are taken in web space, behind corporate firewalls. But, in order to add real value to enterprise product, a very special guests of virtual engineering community must be customers, supplier representatives, outsourced field experts, teleworking researchers, academic researchers, equipment manufacturers, contract manufacturers, etc.

In order to integrate all services and facilities into virtual engineering community, a *web shell* must be provided, with support for open and secured features and links to enterprise internet and intranet web sites. Web shell which resembles all features of presented virtual engineering community is *Engineering Portal*.

Engineering portals are database-driven web sites – on-line communities, that represents gateway to all web-tools needed in one engineering environment. Besides links to application services, they must provide means for synchronous and asynchronous communication of engineers, searchable enterprise knowledge base and on-line view in enterprise resources database. Based on authorization result, visitor can be constrained only to some domains of presented data or functionality.

It is very important for engineering portal to enable simple tools for easy communication to enterprise suppliers and customers. It is not intended only for internal engineering purposes, but also to welcome company customers and suppliers into its workspace, for the purpose of better communication, advertizing new products and technical support.

As for almost all on-line communities, basic features of open engineering portals are:

Content – Searchable and browseable knowledge-base, structured into articles separated into categories. Articles and categorized can be administered through Content management system.

Message Board – Enable asynchronous communication of engineers, not only on-site enterprise employees, but also teleworking researchers, suppliers and customers. Some area of message board must be protected for internal communication purposes.

Yellow Pages (suppliers and collaborators) – Searchable and browseable database of companies that has their own place in enterprise product value chain.

Chat – Enable synchronous communication of engineers, outsourced field experts, teleworking researchers, suppliers and customers.

Personalization – Based on authorization result, portal must be able to adapt to visitor profile (on-site employee, teleworking researcher, outsourced field expert, supplier representative, customer) and therefore adjust content display based on its anticipated needs.

Also, within personalization method, a list of portal area with authorized access must be assembled in order to prevent misuse of services and data from enterprise database.

Technical support – Although technical support for enterprise products can be done through already depicted tools, it is necessary to emphasize a value that this feature can add to a enterprise product lifetime, by assigning special portal area and tools for this purpose.

DESIGN PRODUCTIVITY SERVICES FOR VIRTUAL ENGINEERING COMMUNITY

Application services for Virtual Engineering community can be separated into three different categories – design productivity services, conferencing and collaboration services and project and product data management services.

However, since this paper focuses on web-enabled mechanical engineering environment, special attention will be given to design productivity services. Collaboration and workflow management services belongs to groupware and management facilities, described in a next chapter.

The most common design productivity services, with already established customers and vendors market are offering translation and healing of CAD models, RFQ services, browsable part libraries (e-catalogues), simulation and analysis services, detailing services and 3D model generation services.

Depending on actual service, practiced business models are pay-per-service, pay-per-model and rent-a-application.

Translation and healing of CAD models- Solving the problem of interoperability among CAD/CAM/CAE applications by automatically translating and healing 3D models. Service provides a solution for enhancing translated models and making them compatible in multiple engineering processes.

RFQ (Request For Quote) services and cost estimators – e-manufacturing service that automatically provides fast and accurate process planning and costing information for machining parts.

After uploading CAD model, server application must do some common tasks in order to enable user to download reports (feature report, operation report, tool report and final quote). Those tasks are automatic machining feature recognition, automatic operation and cutting tool selection, detailed time and cost estimations and process plan and quotation report generation.

Benefits of using third party RFQ services cover wide range of improving quality and reducing costs factors, from improving process planning productivity and quality and chance to win orders by quickly providing professional detailed quotes, to reducing risk of overly aggressive quotes and cost of software ownership.

Part libraries and e-catalogues – After registering, users can view a catalog, or do a search for particular parts such as pumps. If a match comes up, the part can be examined in 3D. Parts can be downloaded in neutral formats such as IGES or STEP, or in native formats such as AutoCAD, Pro/E, or SolidWorks. Selected parts can be delivered by email or direct archive download.

Process of part purchasing can be separated into phases: authentication and setup of CAD-formats, part selection, displaying parts basket and ordering and download.

Those services could be ground base for defining enterprise procurement strategies, since they involve OEM's of mechanical parts as vendors for library data.

Simulation and analysis services – Simulation of actual manufacturing process or analysis of product exploitation conditions in most cases are time and CPU consuming tasks, not to mention the need for ownership of very expensive analysis or simulation software.

In order to drive down the costs of S/W and H/W ownership and maintenance, engineers can benefit from using the proprietary services, offered by ASP's.

One of the best examples is internet-enabled Moldflow Plastic Advisers software which enable user to check manufacturability of plastic part by using predictive tools to correlate part geometry to gate locations and polymer material selection, based on calculated values of filling time, cavity pressure and flow-front temperature. Simulation process results

with practical information to help you drive the design iterations quickly.

Detailing services – After uploading 3D model, detailing application service will create technical drafts by user uploaded or defined requirement specification and (or) standard and offer archive download or mail delivery of drafts in chosen format.

3D model generation services – Based on user submitted technical drafts in format proposed or suggested by application service vendor (necessary projections, details), application service can deliver accurate 3D model for use in assembly designs.

While those services can't remove the need for stand-alone applications, like Pro/ENGINEER or CATIA, it is expected for complete CAD web-solutions to appear on market with same and even richer functionality than stand-alone applications. Besides reducing costs for stand-alone software ownership and maintenance, CAD application service must provide also set of features for conferencing and collaboration and workflow management in product development.

Using web-enabled applications eliminates the need for software installations, upgrades, or expensive IT services and permits "anytime, anywhere" access to ongoing project activities.

GROUPWARE AND MANAGEMENT SERVICES FOR VIRTUAL ENGINEERING COMMUNITY

By using tools from groupware facilities layer, groupware and management services must provide robust and secure environment for enabling manager-to-task, task-to-engineer, engineer-to-engineer and manager-to-engineer relations.

Conferencing and collaboration services

Conferencing and collaboration services must make possible for users to conduct online conferences at which attendees can retrieve, view and annotate documents and drawings anywhere, anytime, on any computer, in a real-time online collaborative environment.

Those services offer the means to extend the efficiency of business by providing a powerful but simple way to hold on-line meetings. They must be integrated into module which is part of proprietary project and applications management system. Hosting projects in the management system gives you access to the conferencing module.

The virtual visual meeting function allows geographically dispersed team members to collaborate - whether on design decisions, engineering change orders, or any other documents, files, or issues requiring attendees to view and share ideas -

saving time, reducing costs, increasing productivity and improving efficiency throughout the project.

The meeting chairperson has authority to control member/attendees rights, including viewer privileges, markup and annotation, and control of the meeting. System must allow selective markups and redacting, permitting parts of documents to be blocked from specified attendees.

Conferencing and collaboration services are ideally suited for engineering/manufacturing companies who want to implement web-based document management and who require a collaborative environment. They are also extremely useful for helping an organization to extend its reach to its design and supply chain. No longer is it necessary for team members, suppliers, and contractors to have the applications used to create project documents. With a Web browser and application service, the entire design and supply chain can collaborate to achieve the best solutions.

Project and product data management services

Project management system must integrate proprietary document/application management services with a project workflow system. System allows users to set up and administer a project, run engineering software applications for use with project files, as well as access online e-mail, calendaring, to-do lists and a message board system. System will provide total revision control - not only of all documents, but also of the applications that create them.

Project management system must enable users with functionality to:

- [1] Effectively manage multiple projects,
- [2] Safely and securely leverage a knowledge and document management system,
- [3] Instantly communicate with others through a real-time collaboration system -both in-house and around the globe,
- [4] Jointly create, integrate and share project files,
- [5] Coordinate changes using a online workflow system,

Also, it is very usefull for workflow management system to be tightly integrated with a proprietary project ERP system capable of segregating costs at multiple levels to manage billing and invoicing for individual and corporate users.

PART*3D APPLICATION SERVICE

The development of complex products requires the implementation of many semiproducts or out of the house products. In order to include those products in desig, designer should collect products data (catalogue, technical

documentation), select right products and then build 3D model. All this requires a considerable amount of time. Moreover, many mistakes are possible in proces of selection and products reconstruction. So, many manufacturers made Internet product repositories whit 3D models of products. But, still there are at least two proble: how to find right product repositories, and how to find appropriate products.

One of possible solution to this problem can be Part*3D application service developed at Mechanical Engineering Faculty University of Nis [1,2]. There are three actors involved in this proces:

- [1] Vendor (compent manufacturer)
- [2] Internet Service Provider (ISP)
- [3] End-User (typically an asseby designer)

Kernel of this sistem is Part Lybrary (Fig.1). This is DB with minimum data about products, but sufficient for product serch. Vendors register their product by connecting to ISP portal and providing this data. Actually the record of an product consists of: name and synonyms for product name, values and names of product's main attributes and URL of the Electronic Catalogue. This catalog contain all data about product and program for product selection. It can be hosted on vendor's server or on ISP server.

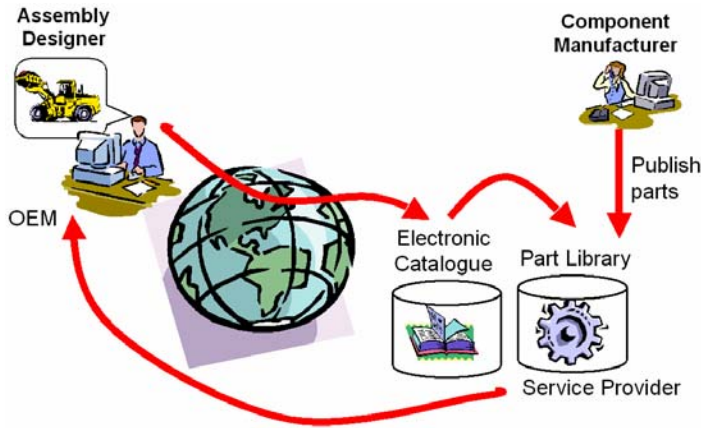


Figure 3. Scenario for product assembly design, proposed by Part*3D application service model

Typical designer's sesion (Fig. 5) has following steps:

- [1] User registration
- [2] Product search in Part Library. Based on user provided name for product, names for attributes and their values, the program queries Part Library. As result, list of all products that satisfies criteria is shown together with vendor's detail and URL of Electronic Catalogues
- [3] Product selection using Electronic Catalogue. In this step designer pass through detailed selection

procedure using dedicated vendor's program. As result, designer get product that statisfies all requirement.

- [4] Part model delivery. Afther that user can get HTML page with detailed product specification, view 3D product model (VRLM), or copy one or more of available product models (eg. 3D STEP model, FEM model, recycling model).
- [5] Product delivery. Designer can import product model in his own design. If product fits well in designer's project he can order this product using Internet.

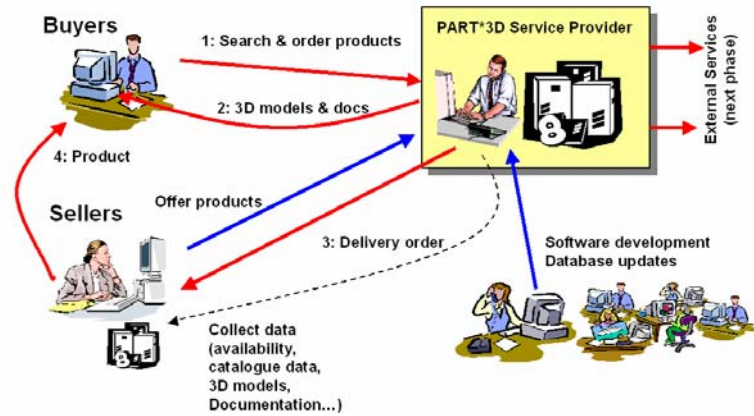


Figure 4. Possible

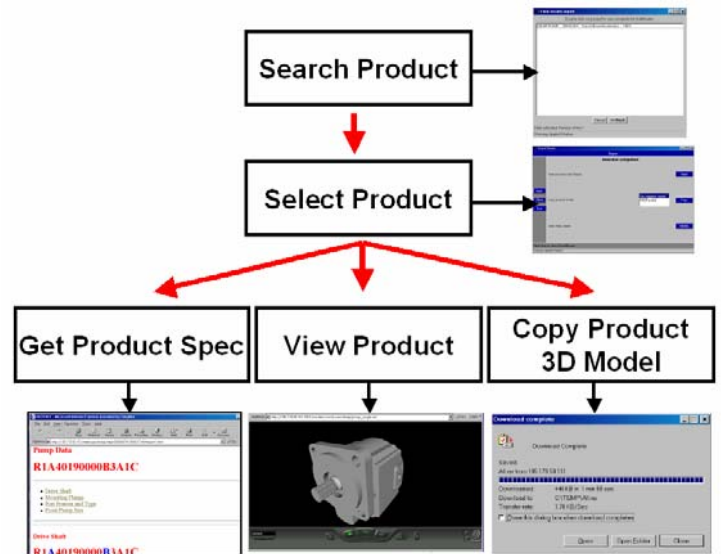


Figure 5. Product selection procedure

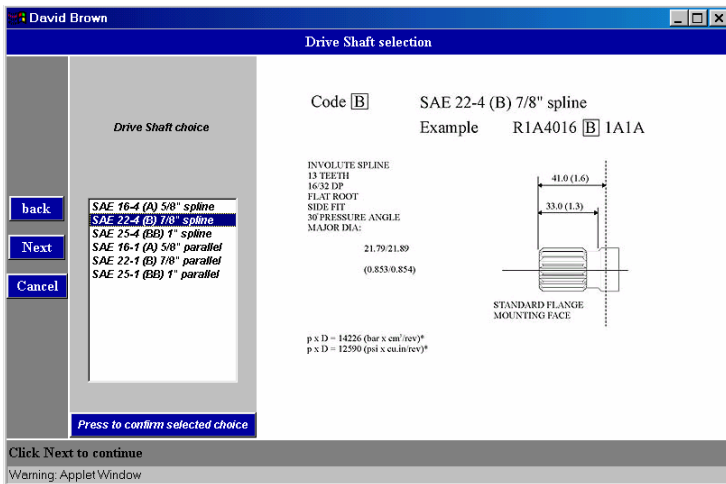


Figure 6. Example of detailed part selection using Electronic Catalogue

CONCLUSION

Internet and Internet technologies have strong impact on product development proces. Many new oportunities as engineering webtop, application service providing and Electronic Catalogue can help designer to get shorten time to market.

Part*3D is one of such possibilities. Using this service designer can easy find right product for his design. Also, designer can get diferent product models in order to investigate if this products satisfies diferent requirements.

REFERENCES

[1] Trajanovic M., Cvetanovic S., Domazet L., 2000, "An Approach to building of Internet Services for production Models", ICCIM 2000, Singapore, pp 341-350.

- [2] Trajanovic M., Manic M., Mistic D., 1997, "Rapid Product Development in Metalworking Industry by Using Web Servers", International Computer Science Conference microCAD '97, Miskolc, Section H, pp 79-83.
- [3] <http://www.planetcad.com> - ASP for mechanical design productivity services
- [4] <http://www.3dshare.com> - Translation and healing of CAD models
- [5] <http://www.bits2parts.com> - RFQ and quote management system for users of rapid prototyping (RP) and custom manufacturing
- [6] <http://www.quoteapart.com> - RFQ application service
- [7] <http://www.findapps.com> - Searchable and browsable web directory of application services
- [8] http://www.runaware.com/service=runaware/owner=sys/action=show_app?c_app_id=607 - IMSI TurboCAD 6.0
- [9] <http://www.runaware.com> - Online software testing and evaluation – running applications through direct connections.
- [10] <http://www.mdcybercad.com> - Free part libraries
- [11] <http://www.web4engineers.com> - ASP specialized in collaborative engineering solutions.
- [12] <http://www.conferos.com> - Online collaboration services for plastics community
- [13] <http://www.conferos.com/iMPA/MoldFlowIntro2.jsp> - Internet-enabled Moldflow Plastic Advisers™ software