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Naloga navideznih omrežij v navideznem podjetju

The Role of Virtual Networks in a Virtual Enterprise

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Napredki pri razvoju izdelkov so pokazali usmeritev k integraciji različnih razvojnih faz skozi integracijski podatkovni model in sodelovalne tehnologije. Razvojna faza prihodnosti bo vsebovala vse faze izdelovalnega kroga izdelka. Obenem pa bodo interakcijske in komunikacijske tehnologije omogočile ljudem z različnim znanjem sodelovanje in s tem doseganje najboljše oblike izdelka. Ta prispevek orisuje futuristično različico proizvodnega kroga s poudarkom ustvarjalne oblike. Mi ga imenujemo neposredna digitalna oblika. Prav tako ta prispevek predstavlja vizijo podjetja naslednje generacije in opisuje jedro informacijske tehnologije, na katerem bi lahko bil zgrajen sistem prihodnosti. Predstavljene so tudi zamisli navideznih podjetij in navideznih oseb, opremljenih z novimi spletnimi tehnologijami, to so: internet, intranet in extranet. Le tako bodo lahko podjetja ostala konkurenčna in rasla na današnjih turbulentnih trgih.

(Ključne besede: podjetja navidezna, skupine navidezne, mreže navidezne, tehnologije spletne)

Advances in product development concepts have demonstrated the trend for integrating different development phases through the integrated product data model and collaboration technologies. Future product-development processes will take all aspects of the whole product lifecycle into account. At the same time, interaction and communication technologies will allow people with different knowledge backgrounds and dealing with different aspects of a product work together to achieve the best product design. This paper sketches a future vision of product development with an emphasis on the support of creative design. We call it direct digital design. This paper presents a vision of next-generation enterprise working environments and describes a core information technology that future systems can be built on. The concepts of a virtual enterprise (VE) and of virtual teams, enabled by a new generation of internet/intranet/extranet-based services are discussed here, as a means to stay competitive and to thrive in a turbulent market.

(Keywords: virtual enterprises, virtual teams, virtual networks, internet technologies)

0 INTRODUCTION

The internet is a world-wide conglomerate of different networks that communicate with each other via a common protocol, independent of the type of hardware used. Various network services can be used by everyone, either supplying or demanding them. The large range of distribution, the platform independence, the large number of user-friendly services that are easily accessible through the world wide web as well as the open standards used and the free or budget-priced products (such as browsers, html editors, software updates) have led to a widespread and continuously growing proliferation of the internet [1].

The advantages offered by the internet for covering the information needs are held to be the following [2]:

- Reduction of local barriers by means of world-wide information offers;
- Reduction of time barriers by means of permanently available information;
- Reduction of (transaction) costs by way of the automation of information processing on the supply and/or the demand side;
- Improved coordination and cooperation with

external partners using an integrated information and communication platform (e.g., platform independence, information exchange without media ruptures).

However, the application-to-application communication problem still exists. Businesses need a standardized way for applications to communicate with one another over networks, no matter how those applications were originally implemented [3]. Web Services, the latest evolutionary step in distributed computing, represent exactly this solution, by providing a standardized method of communication by means of which different applications can be integrated together in ways not possible before. Different applications can be made to call on each other's resources easily and reliably, and the different resources that applications already provide can be linked together to provide new sorts of resources and functionality [4]. Moreover, the application integration becomes much more flexible because web services provide a form of communication that is not tied to any particular platform or programming language [5]. At the core, web services represent a unit of business, application, or system functionality that can be accessed over the internet. Web services are applicable to any type of web environment, internet, intranet, or extranet, and be focused on business-to-consumer, business-to-business, department-to-department, or peer-to-peer communication (see Figure 1).

We present in figure 1 a general architecture for the virtual enterprise environment implemented in the CESICED platform.

A web service consumer could be a human user accessing the service through a desktop or a wireless browser; it could also be an application program or even another web service [6].

1 COLLABORATION AND COMMUNICATION IN THE CESICED PLATFORM

A central point of future product development is therefore collaboration and communication. This is based on consistent, integrated data sets and on tools that support the collaboration (see figure 2).

Traditionally, only data about the designed product are stored, and made available for the product development team and archived for later product-development projects [7]. With product lifecycle management, information coming from all product lifecycle phases is to be integrated, including sales, operation and service data about sold/installed products. Product-data management technologies are extended to manage more complex and more dimensional data. With this data management, tools used by different people throughout the product lifecycle are integrated, including requirement analysis, reverse engineering, production planning, resource planning, logistics and traditional design and simulation systems [8].

An environment supporting collaborative design would comprise the following components:

- Integrated data sets, including a description of the product and all the related processes, and

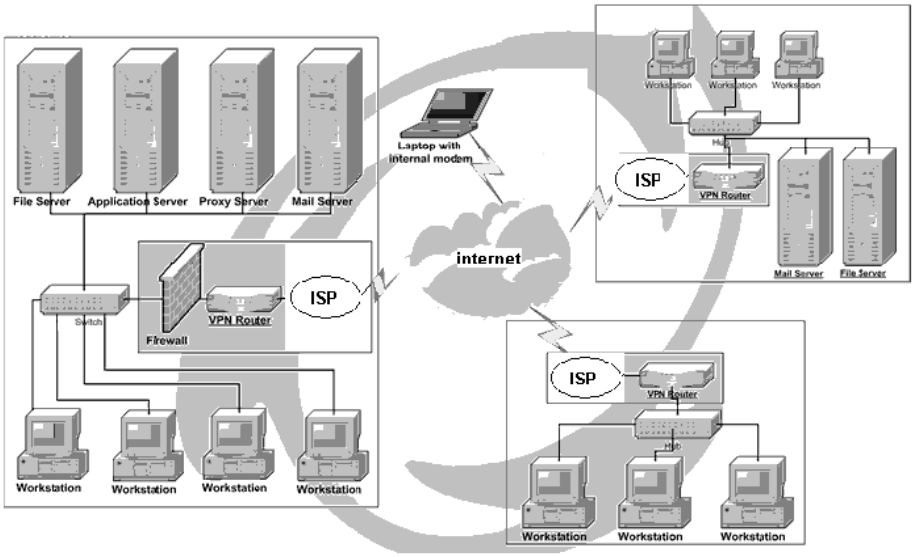

Fig. 1. *Internet/intranet/extranet-based tools in the CESICED platform*

including data collected from the lifecycle of this and other related products;
- Interface to detailed planning, analysis and simulation systems, as some of the product and process features need to be derived from the collected data;
- Simulation and visualization engines, to obtain an virtual environment containing easy and understandable representations of product features and scenarios;
- Multi-modal, intuitive user interfaces, which allow people to easily view and manipulate the product features.

The collaborative design is based on the simulation of scenarios [9].

The key elements of a scenario are the desired product, the targeted environment, the lifecycle processes and the people involved in the processes ([10] and [11]).

2 THE NETWORK SUPPORT FOR VE

A hierarchical network design model breaks the complex problem of network design into smaller, more manageable problems. Each level, or tier, in the hierarchy addresses a different set of problems, so that network hardware and software can be optimized to perform specific roles. Devices at the lowest tier of the hierarchy are designed to accept traffic into a network and then pass traffic up to the higher layers [2].

The core of the network has one purpose: to provide an optimized and reliable transport structure by forwarding traffic at very high speeds. In other words, the core layer should switch packets as fast as possible. Devices at this layer should not be burdened with access-list checking, data encryption, address translation, or any other process that stands in the way of switching packets at maximum speed [12].

The distribution layer sits between the access and core layers and helps differentiate the core from the rest of the network. The purpose of this layer is to provide boundary definition by using access lists and other filters to limit what gets into the core. Therefore, this layer defines the policy for the network. A policy is an approach to handling certain kinds of traffic, including routing updates, route summaries, virtual local area network (VLAN) traffic, and address aggregation. You can use policies to secure networks.

The access layer feeds traffic into the network and performs network entry control. End users access the network via the access layer. As a network's "front door," the access layer employs access lists designed to prevent unauthorized users from gaining entry. The access layer can also give remote sites access to the network via a wide-area technology, such as Frame Relay, ISDN, or leased lines.

A reliable and available network provides users with 24-hours-a-day access.

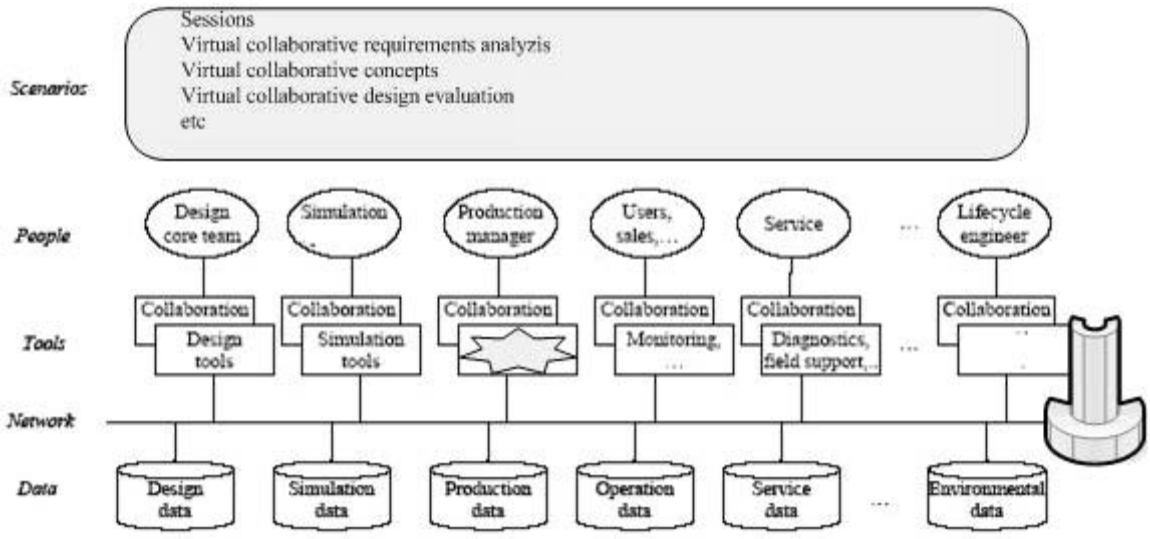

Fig. 2. *The key elements of collaboration and communication in the CESICED platform*

In a highly reliable and available network, fault tolerance and redundancy make outages and failures invisible to the end user. However, the high-end devices and telecommunications links that ensure this kind of performance come with a large price tag. Network designers constantly have to balance the needs of users with the resources at hand.

Multicast traffic can also consume a large amount of bandwidth. Multicast traffic is propagated to a specific group of users. Depending on the number of users in a multicast group or the type of application data contained in the multicast packet, this type of broadcast can consume most, if not all, of the network resources. As networks grow, so does the amount of broadcast traffic on the network. Excessive broadcasts reduce the bandwidth available to the end users and force end-user nodes to waste CPU cycles on unnecessary processes. In a worst-case scenario, broadcast storms can effectively shut down the network by monopolizing the available bandwidth.

Two methods can address the broadcast issue for large switched LAN sites.

The first option is to use routers to create many subnets and logically segment the traffic. However, this scenario can create a bottleneck in the network.

A second option would be to implement virtual local area networks (VLANs) within the switched network. A VLAN is a group of end devices that populate multiple physical LAN segments and switch ports; they communicate as if they were on a single LAN segment.

One of the primary benefits of VLANs is that LAN switches (by creating VLANs) can be used to effectively contain broadcast traffic and manage traffic flows.

The VLAN is the best support for the virtual design offices or the virtual teams [3]. The interconnection of VLANs is realized on level two (ELAN – Emulation Local Area Network), and on level three (MultiProtocol Over AT – MPOA).

MPOA Client (MPC) and MPOA Server (MPS) are given their configuration by LECS (LAN Emulation Configuration Server). The virtual networks MPOA is named IASG (Internet Address Summarization Groups).

In this case a design team is formed with members located at different geographic locations [2]. A virtual local area network is created for the project (see figure 3).

In addition to the team's full-time members, the team also includes contributing members who are recruited for specific components of the project. As such, a core group is responsible for leading the project and a sub-group is involved in specific components of the project [12].

While the full-time employees form the central core of the team, experts in the different problems of the project (control systems, mechanical systems, electronic systems, programmers etc.) are also team members.

Virtual teams for engineering design are becoming more commonly used in industry and the engineering education community must prepare graduates to be employed in such working environments. It is inevitable that multidisciplinary teams for product design, with members located in different geographic locations, will become more commonplace in the future. It is widely understood that successful design is often a highly collaborative team-based activity [3]. To be effective, a virtual team must be able to communicate, collaborate and coordinate, all at distance. Though some corporations are practicing a form of distributed design, a documented procedure for conducting distributed design and product development has yet to be created, tested and distributed. However, the same set of skills that guide design teamwork for a team where all members are in one location is different from that set of skills needed to lead a virtual team.

The term "virtual team" is a misnomer as although it makes reference to virtual reality and the concept of creating a virtual space that can be experienced it also suggests that the virtual team is not actually a team, and as such can lead to a loss of performance. In the initial stages it became clear that whilst a distributed computer-based platform could support distributed teams it could not completely replace face-to-face contact [3]. The reasons behind this are complex but lie largely in the operational cultures of the organizations and individual apprehension about the process of decision making and conflict resolution in a distributed environment. In particular it is recognized that face-to-face contact at the beginning of a project leads to significant advantages in the areas of building trust, establishing the team working methods and communications protocols, and defining a common vision of the product. This presented an opportunity to explore how collaborative tools and technologies can be used to support the gathering of distributed teams within a co-located environment for key decision-making sessions [12]. To illustrate the infancy of distributed virtual design, the method of

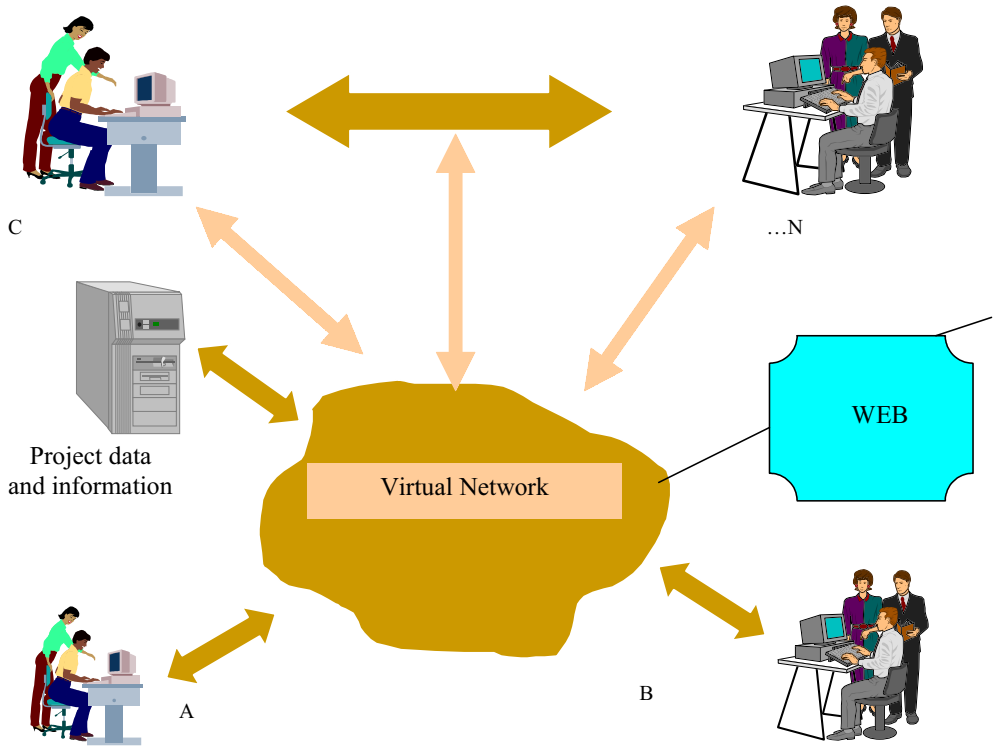

Fig. 3. *Virtual teams in collaborative processes within a virtual organization*

distributed team members working on any project currently lacks a universal name [2]. Terms such as virtual teams, collaborative learning groups, geographically and temporally dispersed teams, globally distributed teams, distributed design, e-design and e-teams, are all used to describe various internet-based design activities [12].

3 CONCLUSIONS

In this paper we discussed different related issues and proposed a concept for supporting creative design in an interdisciplinary team, considering all the phases of the product lifecycle. This is a vision for the future of product development. We know that developments in all of the sub-areas are necessary to achieve this vision. We do not expect full implementation in the short term. With this paper we want to stimulate discussions and further R&D, and to encourage colleagues both from academic institutes and from the industries to stepwise, incrementally, but continuously develop and deploy emerging technologies and concepts. In this way we will be stepwise closer to our vision.

The concept of the CESICED platform, enabled by a new generation of internet/intranet/extranet-based services is discussed here, as a means to stay competitive and to thrive in a turbulent market. The new internet technologies, the latest evolutionary step in distributed computing, has been proposed as the platform for realizing the CESICED infrastructure. This platform for research, training, consulting in the new digital economy is developed at the University "POLTEHNICA" of Bucharest in the PREMINV research laboratory.

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