VIRTUAL ENTERPRISE NETWORKS SOLUTIONS TO SUPPORT THE VIRTUAL TEAMS WORK

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Abstract: In the 21st century, the enterprises continuous implement ICT strategies & architectures to improve manufacture, research, products quality, sales, services and to costs control. All enterprises have a local area network, a virtual private network, an Intranet and Internet, servers and workstations for operations, administration and management working together for the same objective: profits. The virtual team's concepts are discussed in this article. This work analyzes the network architecture for a geographically dispersed enterprise (seen as a virtual enterprise) as support for virtual teams work.

Key words: enterprise, enterprise network, virtual enterprise, virtual network, virtual team.

1. INTRODUCTION

The global market today increase the need for common and collaborative processes and sharing information seamlessly between companies involved in extended enterprise. All forecasts predict very rapid growth in e-commerce as part of e-business and e-services that attract increasing attention because of the impact of new information and communication technologies on firms, markets, employment, and development. There are fundamental effects on the organization of business flows and processes, transaction costs, the creation of new business models, and changes in the boundaries of firms across sectors [1]. All this effects are defining the new digital economy perspectives on business, products, individuals and technology.

The digital economy encompasses e-business, e-commerce, and e-services as services or resources that can be accessed through people or businesses, using network technologies. New enterprise model architecture uses the Intranet/Internet/Extranet infrastructure and technologies (see Fig. 1). The Internet is a worldwide conglomerate of different networks that communicate among each other via a common protocol, independently of the hardware type used. 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 automation of information processing on the supply and/or the demand side; improved coordination and cooperation with exter-
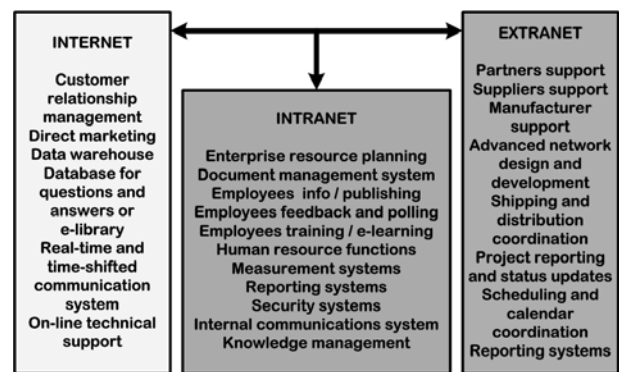

Fig. 1. New enterprise model architecture in e-economy.

nal partners using an integrated information and communication platform (e.g. platform independence, information exchange without media ruptures). Various network services can be used by everyone, either supplying or demanding them. Informational society construction cannot be realized without research and investment project in ICT. In this new era of information, the fundamental sources of wealth are knowledge and communication, and not natural resources or labor work [3, 4]. In the 21st century, all organizations use Internet or Internet technologies to attract, retain and cultivate relationships with customers, streamline supply-chain, manufacturing, procurement systems and automate corporate processes to deliver the right products and services to customers quickly and cost-effectively, also to capture, explore, analyze, and automate corporate processes information on customers and company operations in order to provide better business decision [5, 6]. For the future, e-services and e-business, as were defined, require the enterprise re-thinking and re-modeling, with the system and applications design for an efficient use of new network technologies [7, 8].

As a general requirement for an infrastructure support is than the enterprises must be able to inter-operate and exchange information's and knowledge in real time so that they can work as a single integrated unit, although keeping their independence/autonomy.

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2. THE ENTERPRISE VIRTUAL TEAMS

The term *virtual team* is used to cover a wide range of activities and forms of technology-supported working [9]. Virtual team is a group of people and sub-teams who interact through interdependent tasks guided by common purpose and work across links strengthened by information, communication and transport technologies [10]. With rare exceptions [11] all organizational teams are virtually to some extent. This era is growing popularity for virtual team structures in organizations [12]. The virtual teams are the teams whose members use technology to varying degrees in working across location, temporal, and relational boundaries to accomplish an interdependent task [11].

Enterprise virtual team's members are located in more than one physical location. Enterprise virtual teams work across boundaries of time and space by utilizing modern computer-driven technologies. Although virtual teamwork is a current topic in the literature on global organizations, it has been problematic to define what virtual means across multiple institutional contexts [13].

Virtual teams are groups of individuals collaborating in the execution of a specific project (Fig. 2) while geographically and often temporally distributed, possibly anywhere within (and beyond) their parent organization [14]. The organizational context of a virtual team is a conglomeration of pieces related to the life worlds, organizational structures and work practices of the local organizational contexts (local sites), the distributed organizational context (global company) and the professional context (software process improvement) [15]. Virtual teams can be defined as groups of workers geographically, organizationally and/or time dispersed brought together by information technologies to accomplish one or more organization tasks [16]. The degree of geographic dispersion within a virtual team can vary widely from having one member located in a different location than the rest of the team to having each member located in a different country [17]. Virtual teams do not operate like traditional physical teams, as their requirements reflect a whole new way of communicating, working collaboratively, sharing information and mutually supporting other team members.

Cooperative processes are not the automatic results of implementing collaborative, real-time communication technologies, but the result of a carefully designed and systematically maintained virtual team development plan. Product development is the process that covers the following: product design, production system design and product introduction processes and start of production. Product development is widely recognized as a key to corporate prosperity and is vital and needs to be developed both innovatively and steadily [17, 18].

3. THE ENTERPRISE VIRTUAL NETWORK

Traditional infrastructures (Internet/Intranet/Extranet) have now a fast dynamic, marking the transition to new generation networks to provide higher speeds to the user (end to end), for different types of transactions and a reduction in the number of servers by passing information between two nodes. A hierarchical network design model (figure 2) breaks the complex problem of network design into smaller, more manageable problems.

A network is a chain where each link must be strong for the network to be resilient. In this network computers are called host. The hosts are connected through communication subnets, called the short subnet. The main task of the subnet is to send messages from one host to another host. 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. Large area networks (WAN – Wide Area Network, specific large enterprise) were designed to solve connection problems between workstations and local networks, or only the local network where the distances are too large to be able to use a simple cable connection. Large area networks are generally required for the transfer of large volumes of data over long distances.

A reliable and available network provides users with 24-hours-a-day access. In a highly reliable and available network, fault tolerance and redundancy make outages and failures invisible to the end user. We purpose in Fig. 3 a general network for a large enterprise (with headquarters and branches), geographically dispersed.

Appearance of virtual networks is related to the evolution switches. A *virtual network* is to combine a group of users regardless of their geographical position but such a manner that it flows together and to provide the best performance. The second advantage of a virtual network consists of administrative solutions which accompany the products, allowing users moving from one group to another through a simple reconfiguration of the equipment. Extension for virtual networks, more than Ethernet switches or token ring, the ATM network federating other techniques are required to convert cells in the frame for local network emulation on switched virtual circuits.

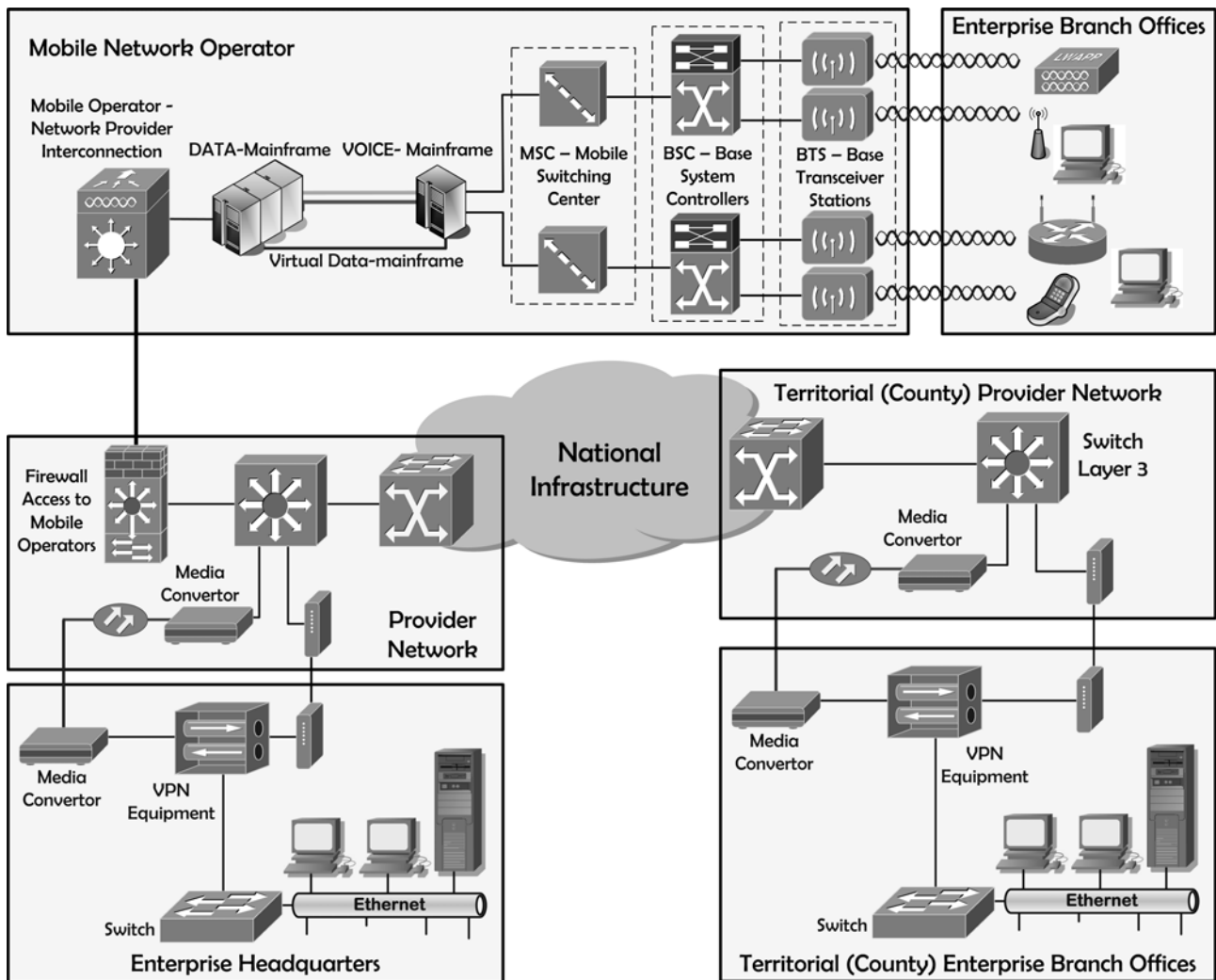**Fig. 2.** The enterprise virtual team for project development.

Fig. 3. A geographically dispersed enterprise network with mobile access – an overview.

Common commands to create VLANs (for Cisco equipments) are the following:

```
vlan 105
    name PREMINV_Provider1
vlan 106
    name PREMINV_Provider2
interface FastEthernet1/0/1
    description PREMINV_Provider1
    switchport access vlan 105
    switchport mode access
interface FastEthernet1/0/2
    description PREMINV_Provider2
    switchport trunk encapsulation dot1q
    switchport trunk allowed vlan 106
    switchport mode trunk
interface Vlan105
    description PREMINV_Provider1
    ip address 9.10.22.1 255.255.255.252
interface Vlan106
    description PREMINV_Provider2
    ip address 9.10.24.1 255.255.255.252
```

The *virtual private network* (VPN) is a network emulated (the *virtual*) built on public infrastructure (*shared*), dedicated to a client (the *private*) to connect users in locations and to ensure similar conditions of integrity, confidentiality and quality similar with those of a private network. VPNs allows the provisioning of private network services for an organization or organizations over a public or shared infrastructure such as the Internet or service provider backbone network. The shared service provider backbone network is known as the VPN backbone and is used to transport traffic for multiple VPNs, as well as possibly non-VPN traffic.

VPNs may be service provider or customer provisioned and fall into one of two broad categories: site-to-site VPNs connect the geographically dispersed sites of an organization or organizations (figure 4, 5 and 6) and remote access VPNs connect mobile or home-based users to an organization's [19].
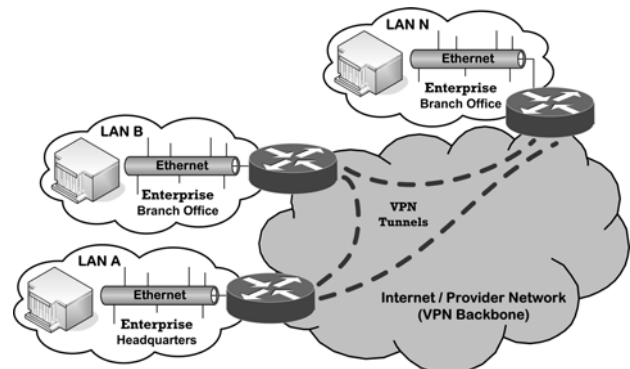

Fig. 4. Typical Site-to-Site VPN general architecture – allow connectivity between enterprises geographically dispersed sites.
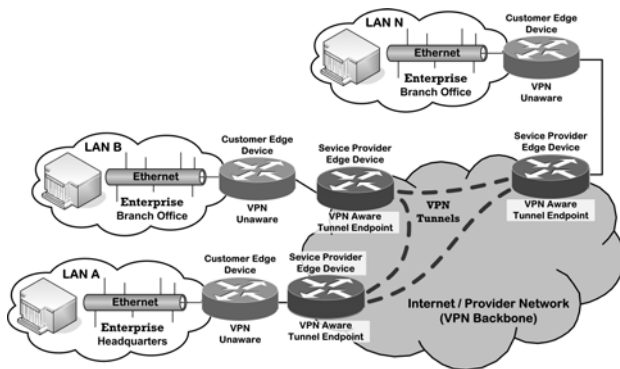
Fig. 5. Typical Provider-Edge based Site-to-Site VPN general architecture - provider edge devices (are aware) participate in customer network routing and forward traffic based on customer network addressing.
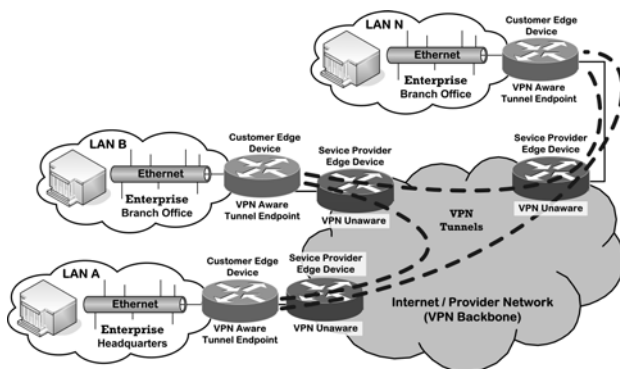

Fig. 6. Typical Customer-Edge based Site-to-Site VPN general architecture – provider edge devices (are unaware) do not participate in customer network routing and forward customer traffic based on globally unique addressing.

VPNs can be used in different ways to support business processes, is the ideal solution if it is not efficient in terms of construction costs of a particular network for a firm with a workforce highly mobile, or for small firms that can not justify the cost of their telecommunications network.

4. CONCLUSIONS

In this paper was analyzed the network architecture for geographically dispersed enterprises (seen as virtual enterprises) as support for virtual project development by virtual teams work. In this paper was present a team's work (collaborative work) at the enterprise level through virtual teams for project development. A central point of future product development is therefore collaboration and communication.

This work was realized at the UPB-PREMINV Research Centre. The validation of this solution by a case study in the PROGPROC research project (CNMP 11014/2007, 2007-2010) is to determine the new organization type for integrating the virtual enterprise medium and to outsource shared resources from UPB-PREMINV research centre to industrial partners.

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