

Building Modern Network Infrastructure for Tencel Europe Enterprise

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ABSTRACT

The study contained design of Tencel Europe Network. We implemented an Ethernet technology in five building. The network design connected to a one central point called backbone by suitable cables that has been designed with Gigabit Ethernet. Each building in the network connected with Local Area Network (LAN). The study led us to get high speed, enough bandwidth, greater capacity, in addition, to reduce cost and connection between network segments. Also we got to mind the budget allocated for this project before we did it on the real world. Tencel Europe Network were built and simulated in IT Guru software.

KEYWORDS: *Tencel Europe Network, Ethernet Technology, Local Area Network, OpenNet IT Guru software.*

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I. INTRODUCTION

A computer network is a group of computers connected together for many purposes. This way allows computers to share resources and information. Recently, the rapid development in the computer technologies has made enterprises to look for better networks in a way that able to support future development in additional to their existed applications [1]. Tencel Europe is a medium enterprise which specializes in research, design and production of fabrics for haute-couture markets. Tencel Europe buildings are distributed in two locations. One of them is called Beckett Part Campus which contains five building called: Sales and Marketing, Manufacturing, Distribution, Accounting and Finance, and Design and Creativity as well as small building for managing director's office. And the other location (far building) called Research and Development Campus, which is located in Leeds centre with a distance about 10 kilometers from the first campus. Each building has different applications and a number of employees [1] [2] [3]. The proposed design will explain how to implement modern network infrastructure for Tencel Europe Enterprise and replace the old one, which was built by X.25 links as well as they used to support small transaction by using central databases between building. The planned design will show how to choose the technologies at each location. It will include the strategies that could be use to support the network with modern standers between client/server systems. Also it will replace the old technology with modern one to enhance network performance. Furthermore, there will explanation about how I have built robust Gigabit Ethernet backbone that could be support the network with high bandwidth as well as high speed to increase network performance and achieve user requirement [4] [5] [6] [7].

1.1 AIMS OF DESIGN

The aim of this design is to plan a design for development in the network infrastructure of Tencel Europe buildings. Also, to invest in high reliability networking components, from the end machines to backbone connections. The new design will enable each part to provide the required services with high speed, enough bandwidth, as well as computer supported cooperative work within the organization.

1.2 OBJECTIVES

The objectives of this assignment are:

1. Design a suitable network technology for each building.
2. How to build a LAN networks with necessary devices and connections.
3. How to connect two distance LAN networks.
4. Understanding what an Ethernet, Gigabit Ethernet and ATM networks.
5. Increase network performance with a robust backbone.
6. Build a good network with high speed and high bandwidth as well as a suitable cost.
7. Creating a network which will be able to fulfill the application required in each building.

1.3 PLAN OVERVIEW

In our design, we have two main locations. After consideration of the geographic area covered by two sites of Tencel Europe with user requirements in each building, we put two locations nearer just for explanation as illustrated in the figure (1) [3].

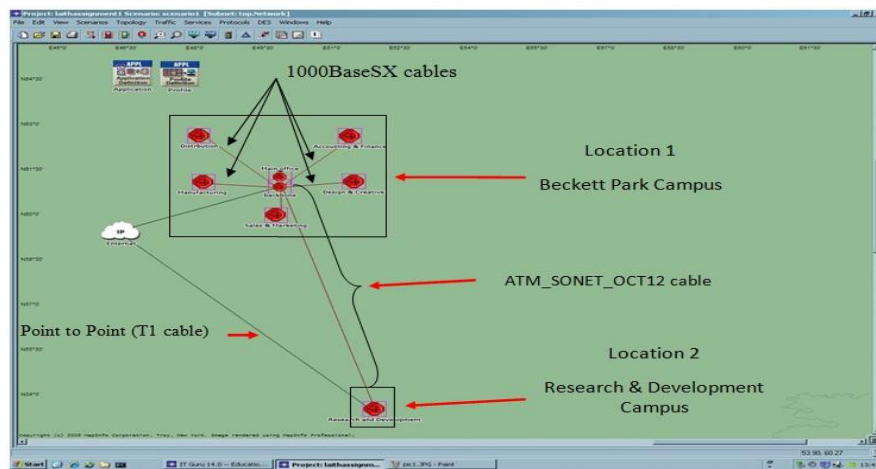


Fig. 1. Tencel Europe Network

1.4 DESCRIPTION OF DESIGN

Tencel Europe has two locations. Each location contains a number of clients. As shown in the figure 2.

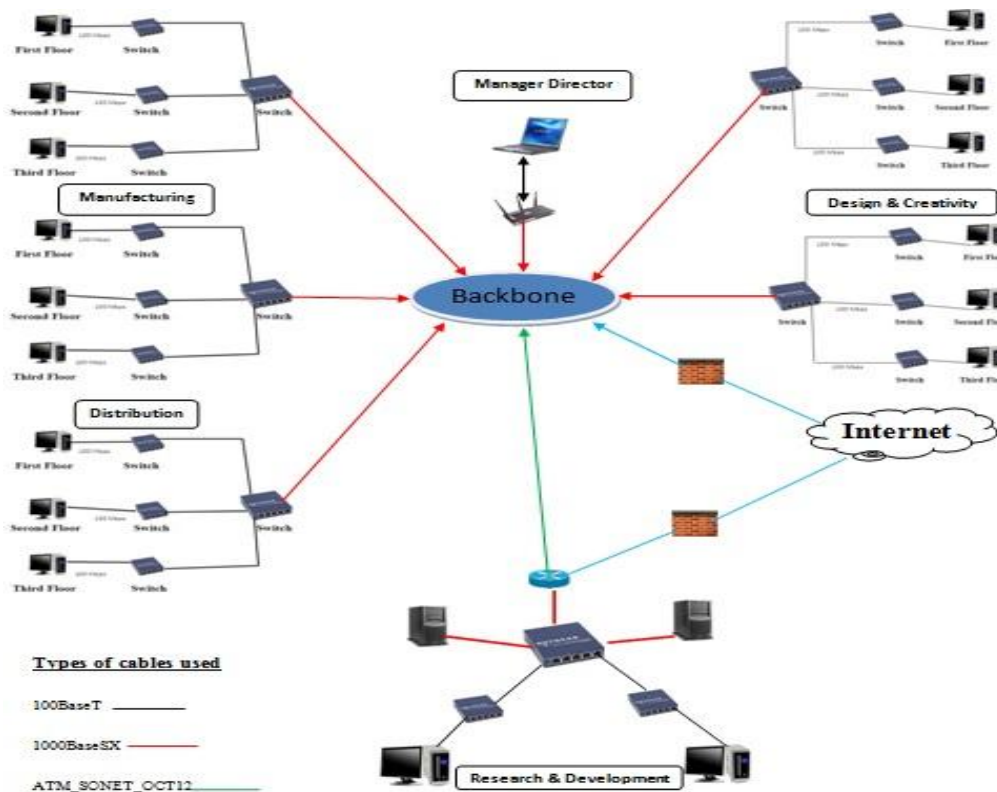


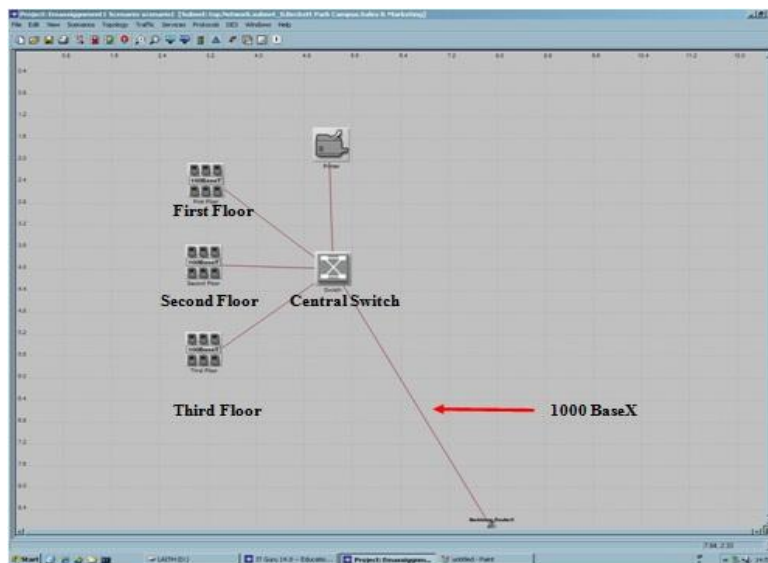
Fig. 2. LAN in Each Building.

The old network technology was built through X.25 links. The general concept of X.25 was to create universal and global packet switch network. It was only interface between subscriber data terminal equipment (DTE) and X.25 network data communication equipment (DCE). It was supported small transactions. In the

present day, Tencel Europe networks becomes not good enough to achieve all clients' requirements because they need new applications to apply in this network such as Video, Voice, CCTV, Real time control, Multimedia mail, and interactive computer aided design, in addition the increase in the number of users. These reasons led to change Tencel Europe to modern network [9]. The characteristics of desktop computers and other network equipment should be able to handle the services required for each building. Moreover, the designed network should support as computer supported cooperative work and group multicast. It is suitable to achieve a LAN for each part and then they could be connected together with a suitable media connection. As shown in figure 2 [2].

1.4.1 BECKETT PART CAMPUS NETWORK

This campus contains five buildings; Sales and Marketing, Accounting and Finance, Design and Creativity, Distributed, and Manufacturing. Each building contains three floors. There are four buildings have the same size and distance between them, and another building is located in the middle between them. As well as there is a small and old building called managing directors office. The geographic area of this campus is suitable for LAN network. So we can create by preparing a subnet for each building and connecting all of them, after that we put a suitable Local Area Network (LAN) inside each subnet for this campus. As illustrated in the figure 1 and figure 2. We can do LAN interconnected in several ways. In this design I have built LAN network for five buildings by using Ethernet technology with star topology which will provide high speed data through 100 baseband UTP cable. Also it supports applications HTTP, Email, FTP, Database, Video, Remote Login, etc. It will cover all user required in these building. As shown in the figure 3 [3]. Each building contains three floors, all computers in each floor connected with switch and each switch connected with central switch. I chose central switch because when there is a need to extend this network in the future it will be easy to add or change more devices. It is possible to put Hubs instead of switches, however, switches provide more scalability than hubs, and allow all operations to work at the same time. Also it supports 16 Ethernet interface and can connect only LAN of the same types for instance, Ethernet to Ethernet, FDDI to FDDI, Token Ring to Token Ring, etc. it supports the network with (10 Mbps, 100 Mbps, 100 Mbps) speeds. As shown in the figure 3 [4].



The choice connected from central Switch to backbone for each building 1000BaseX cables also known Gigabit Ethernet. It is an extension of the IEEE 802.3 standard. It supports with high speed Ethernet. It is ten times speed than fast Ethernet. Thus reducing queuing delay generated by their applications. There are a lot of cables types of Gigabit Ethernet, as shown in the table 1 [13].

Number	Name	Type	Distance
1	1000 Base-CX	STP Copper cable	25 meters
2	1000 Base-SX	Short Wavelength	220 - 550 meters
3	1000 Base-LX	Long Wavelength	Up to 5 kilometers
4	1000 Base-T	Four pair of CAT 5 UTP	100 meters
5	1000 Base-ZX	Non-Standard	70 kilometers

Table 1. Types of Gigabit Ethernet.

There is another building called manager director office. This building provided with computer desktop (fix) with adapter card wireless which is enable to share data, internet and applications as well as to control on all buildings. As shown in the figure 4. And it connected to backbone with router wireless.



Fig. 4. Manager Director Office.

1.4.2 RESEARCH AND DEVELOPMENT CAMPUS

The Research and Development building has 30 employees. This division is currently employed 20 highly qualified textile engineers and scientists and 10 normal. As mentioned above the distance between two campuses is 10 kilometers. That is led to connect between two campuses Wide Area Network (WAN). I provided two servers for this building because it is far building, if I connect with the same servers in the backbone it will be a weak network, very slow and a lot of packages will drop and they do more and complex applications such as Multi site interactive computer aided design and Manufacturing, Professional Image Communications, Multimedia mail, Videotext including moving pictures, Mixed document retrieval as well as Building Security. The way of connecting this campus is that all computers connected to a switch and after that switch to router at the same campus and then it is connected to the router inside backbone with ATM_SONET_OCT12 cables as shown in the figure 5 and figure 1 [3].

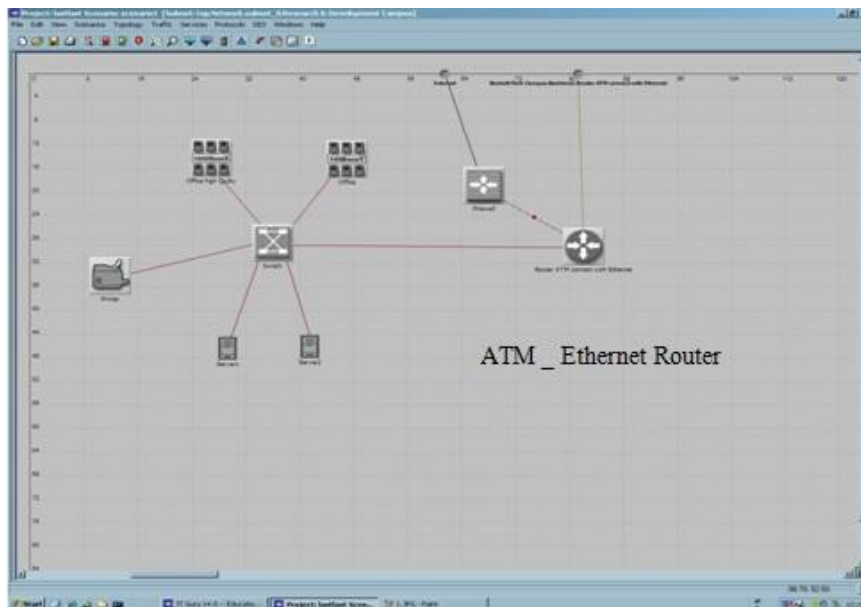


Fig. 5. Research and Development Campus

The most important point in this router is supporting Ethernet and ATM connection, high speed, as well as deal with IP gateway. However, it is very expensive. Asynchronous Transfer Mode ATM technology is implemented as a network protocol and the first developed was in the middle 1980s. The aim was to design signal networking strategy that could transport real time video conference and audio as well as email and text. ATM uses small cells to transfer and each cell about 53 bit and speed transfer data from 25 Mbps to 1.2 Gbps [7] [10].

ATM Features are [11]:

- Flexible channel bandwidth allocation.
- Scalable over physical size, speed, and node count.
- One Single Network.
- Enables New Applications.
- Long Architectural Lifetime.

ATM_SONET_OCT12 cable transfers data with high speed about 594,432,000 bps and use to connect between wide area such as city to city, country to country [10].

1.4.3 BACKBONE NETWORK

Backbone is a part of computer network infrastructure that interconnects many devices of networks which is provides a path for transfer data between different LANs or Subnet. All Tencel enterprise divisions connected to one point backbone. This network was built to achieve many tasks. There are some abbreviations from backbone advantages.

- To provide the network with high bandwidth.
- The backbone capacity is greater than the networks connected to it.
- Network congestion is often taken by designing backbone.
- No confuse between backbone network and backbone internet.
- To reduce cost and connection between network segments.

To build a backbone network that is able to support buildings with features as mentioned above, the design requires two central switches, and a numbers of routers, in additional four big and high quality servers. The links between devices are made by 1000 Mbps cables as shown in the figure 6. The choice of using Gigabit Ethernet technology to build backbone because it provides high speed, low cost, flexibility to handle new applications and data types, as well as scalability to higher performance levels [8].Furthermore, in this design backbone provides network with capability to keep linking if any routers fault, thus enhancing the overall network availability, but this will increase the cost of network by adding more routers.

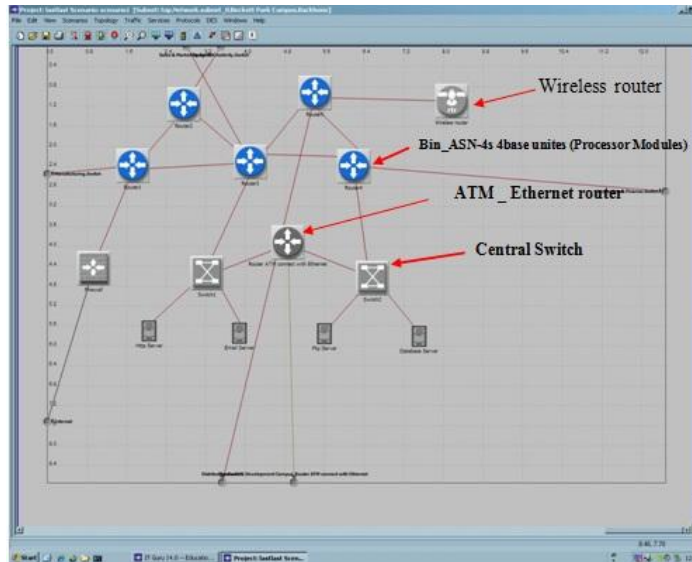


Fig. 6. Backbone Network

It is possible to achieve backbone network with ATM or FDDI technologies, that could provides all buildings with high speed, priority handling, and better performance than Gigabit Ethernet. In spite of the obvious benefits from FDDI and ATM technologies, there are some disadvantages in these technologies. One of them, adding and fixing any device will be more complex, and another point, the cost will be higher than Gigabit Ethernet [12]. The two sites of Tencel Europe provided with internet with point to point (T1) cable. This cable can carry more data than traditional telephone lines with up to 1.544 Mbps. This cable connected to firewall to protect the network from any hacker. It is required from Tencel enterprise that proposed design should support high security environment for all applications used in the network, so firewall will allow

accessing to resources on the Internet from inside the enterprise and will control access from the Internet to the internal network computers and data. Nowadays, routers and servers are manufactured with built-in firewall, so it could be used to create a robust security system in our corporate network.

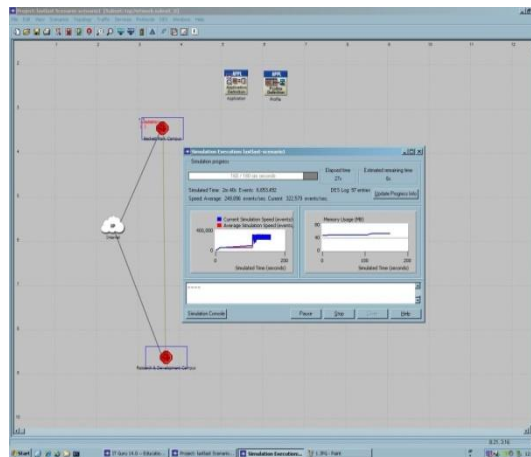
2.1 TECHNOLOGICAL ALTERNATIVE

As mentioned above, inside each Tencel Europe building an Ethernet technology was used and connected to a backbone with Gigabit Ethernet and ATM technologies. I can design all buildings using FDDI or ATM technologies that could provide all networks with high speed, better security, priority handling, and better performance, however, the design will be very expensive and more complex.

Testing

I got some snapshots as a sample of results made by OPNET IT Guru web report and it will be presented below:

Simulation for the design as shown in the figure 7.



I got some results for FTP traffic sent. According to the figure 8, the high FTP output, it was between the period (1.30 to 2.00) secs which are approximately 50,000 bytes/sec.

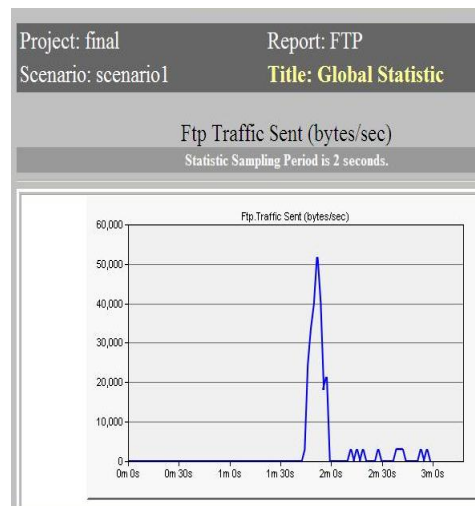


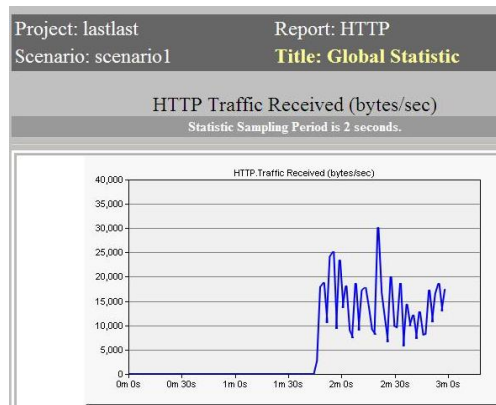
Fig. 8. FTP Traffic Sent

The snapshot for video conferencing traffic received is revealed the period between (2.00 to 3.00) secs; it was fluctuating load about 1,000,000 bytes/sec. As shown in the figure 9.



Fig. 9. Video Conferencing Traffic Received

The snapshot for HTTP traffic received is illustrated the period between (1.7 10 3.00) sec was fluctuating load about 20, 000 bytes/sec. as shown in the figure 10.



The snapshot for Email report is explaining many tasks. Email download was between 0.012726 to 0.006056 bytes/sec and the same results for Email traffic (sent and received) were between 368 to 10,027 bytes/sec. as shown in the figure 11.

Project: final		Report: Email	
Scenario: scenario1		Title: Global Statistics Summary	
Email			
Statistic	Average	Maximum	Minimum
Email Download Response Time (sec)	0.008420	0.012726	0.006056
Email Traffic Received (bytes/sec)	368	10,027	0
Email Traffic Sent (bytes/sec)	368	10,027	0

Fig. 11. Email report

The snapshot for servers' performance is revealed task processing time in sec that is average and peak load for all network servers. As shown in the figure 12.

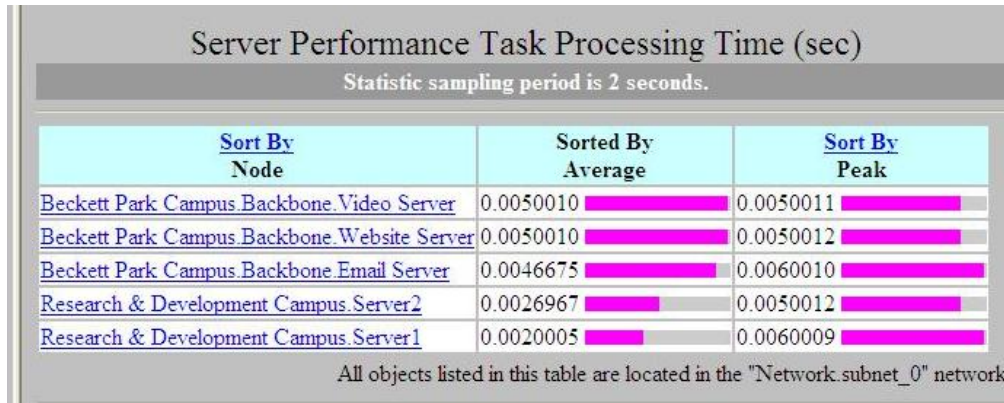


Fig. 12. Server Performance Task Processing Time (sec)

3.1 VENDOR SELECTION

It is better to buy all network equipment from one vendor and one company because some companies' products are not compatible with some of the products of other companies. Another point is that we will get discount from this vendor.

Appendix 1: contains network equipment types, and their prices and specifications.

3.2 CONCLUSION

Tencel Europe is a medium enterprise which specializes in research, design and production of fabrics for haute-couture markets. It has grown significantly in the past decade. As well as it has six building distributed in different places with a number of employees. Currently we improved Tencel Europe network by implementing Ethernet technology in each building and connecting all of them with a one central point called backbone by suitable cables that has been designed with Gigabit Ethernet. In this case they will get high speed, enough bandwidth, greater capacity, in addition, to reduce cost and connection between network segments. Also we have to mind the budget allocated for this project. The simulated design showed satisfactory results in both global and every single building applications. Thus in this approach we have achieved most of the enterprise requirements. This suggested design commensurate with the progress of civilization in our time, also this approach is planned to continue for the next decade.

3.3 USERS REQUIREMENTS

Number	User requirements	Configuration
1	Multimedia mail	Email, with heavy load
2	Real time control	Remote login, with high load
3	Simple multimedia	FTP, with medium load
4	User to user transfer of mixed multimedia and simple multimedia	FTP, with high load
5	CCTV	Video conferencing, with high resolution
6	Alarm	Voice , with low load
7	Videotext	Video, with medium load
8	Mixed document retrieval	Database, with medium load
9	Tele-shopping	Database and website Browser, with light load
10	Electronic Publishing	Database , with medium load
11	Professional image communication	Printing color and scanning

3.4 REQUIREMENTS AND COSTS

The price for Tencel Europe Network:

Switches per segment for each building

Switch types	Vendor	Price per one	How many	Total price
Net gear - Presage 8-Port 10/100 Desktop Switch Lifetime Warranty ,Presage 8 Port Fast Ethernet Switch 8 10/100 Ethernet ports	PC World	£24.99	17	£424.83

Central Switches

Switch type	Vendor	Price per one	How many	Total price
Net gear GS108 Presage 8 Port (10/100/1000) Ethernet Desktop Switch	PC World	£68.99	8	£551.92

* Total price for switches about **£967.75.**

Routers

Router type	Vendor	Price per one	How many	Total price
NETGEAR DG834AU ADSL2+ Router, 6 Port Switch with Modem & Firewall	PC World	£99.99	6	£599.94
Wireless Router	Vendor	Price per one	How many	Total price
Net gear WG102UK Presage 802.11g Wireless Router	PC World	£78.28	1	£78.28
ATM _ Ethernet _ Router	Vendor	Price per one	How many	Total price
CISCO 2691 Router / ATM/Ethernet/GigaEthernet support	PC World	£191	2	£382

* Total price for routers about **£1060.24.**

Computers

Computers Desktop	Vendor	Price per one	How many	Total price
Dell Inspiron 545 MT Desktop PC Intel Core 2 Quad Q8200 (2.4GHz, 4MB Cache) ,4GB memory , 500GB hard drive Intel GMA 3100 integrated graphics	PC World	£209.97	197	£41364.09
Computers Desktop high quality	Vendor	Price per one	How many	Total price
Dell Inspiron 545 / 9148 - Desktop PC with 18.5" LG monitor	PC World	£499.99	10	£54999.9
Computers Laptop	Vendor	Price per one	How many	Total price
SONY Vaio VGN-NW20EF/S Silver 15.5" widescreen	PC World	£529.99	1	£529.99

* Total price for routers about **£96893.93.**

Firewall

Firewall	Vendor	Price per one	How many	Total price
Bundle: Cisco ASA 5505 Firewall Edition (ASA5505-BUN-K9)	PC World	£246.31	2	£492.62

CCTV

CCTV	Vendor	Price per one	How many	Total price
Solidex Color Day & Night Camera	SCT	£79.95	1	£79.95
Fire alarm	Vendor	Price per one	How many	Total price
Low Voltage Wiring: Security & Fire Alarm Systems	www.nwbuildnet.com	£30	7	£210

Servers

Servers	Vendor	Price per one	How many	Total price
IBM X3400 M2 E5520 4C 2.26GHZ Server	www.ibm.com.au	£4000	2	£8000
Share Mail-email server software, unlimited user	www.lavasoftware.net	£300	2	£600
Windows Server 2003, Terminal Server External Connector License	www.microsoft.com	£6,999	2	£13998

Printer

printer	Vendor	Price per one	How many	Total price
Dell 1230c Laser Printer	PC World	£140.00	7	£980

Internet Bandwidth

Internet Bandwidth	Vendor	Price per year	How many user	Total price
Internet Bandwidth T1 Line	www.bandwidtht1.com	£1000	500	£1000

Cables

Cables	Vendor	Price per meter	How many	Total price
Ethernet, CAT5e 100-MHz Patch Cable, Use for 100BASE-TX and other 100-MHz applications. UTP cable features stranded conductors for short runs	www.thefind.com	£1.5	200 meters	£300
5M Cable 10GBASE-CU SFP+-1000BASE-X - SFP Optional	www.provantage.com	£25	300 meters	£7500
10FT ATM CABLE DS3+E3 CABL	www.thefind.com	£80	10 Km	£80000

Software

Servers	Vendor	Price per one	How many	Total price
Microsoft Windows Server 2003	www.ecostsoftware.com	£108.00	1	£108.00
Microsoft Windows XP Professional W/SP2	PC World	£84	1	£85
Anti Virus: Symantec Norton Anti Virus 2010	PC World	£30	1	£30
Network Management	PC World	£70	1	£70

*** The overall price for my design is about £213,375.49, without project designer.**

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