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The Integration of Networking and Computerization towards e-Education and e-Learning at the Higher Education and Research Institutions of Pakistan

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Abstract

The Information Technology is revolutionizing the world and is essential for the growth and development of a country. It is affecting the ways we work, the way we transact, the way we meet and the way we live. No body can escape from the revolution of IT. The Islamia University, Bahawalpur (IUB) has planned to augment areas of network infrastructure and internet service setup which is to be used by the faculty members, the students and the administration in different filed such as research, planning and development. The foremost purpose to provide the facilities of internet and intranet to the various departments of the university is an aim to focus on establishing academic exchange of shared research databases, digital libraries and enhancement of academic information. The working of the university will be transformed into electronic based functioning; gaining speed, efficiency, quality, saving the time and use of paper is minimized. The successful implementation of the program with the creation and strengthening of the facilities will make the university an active associate of the government intranet at the national level. This paper envisages on the internal automation of different sections and departments and the internet facility at IUB; hence a step towards e-learning and e-education.

Keywords: HEC, Router, Switch, PBX, Optical Fiber, IUB

1. Introduction

Pakistan with a population of 160 million has one of the lowest tertiary education enrolment rates in the world, estimated at 2.6% in 2000. Even compared to other countries in the South Asia region such, as Bangladesh with 5% tertiary enrolment, Pakistan stands out as having a strikingly low level of participation. Nevertheless, in spite of the current enrolment data, the growing population and the improvement in completion rates for lower levels of education are generating high demand for tertiary education. Conventional public and private universities continue to sit at the top of the tertiary education landscape, enrolling about 140,000 students (this does not include the enrolment figures for the public enrolled in Allama Iqbal Open University). The country has 80 university-level institutions: 42 public universities, 34 private universities, and 4 government-approved foreign providers from the US, UK, Australia and Ireland. 85% of university enrolment is in public universities, with the private sector absorbing 15% at present. In addition to these universities, Pakistan has 754 degree colleges in arts and sciences (635 public and 119 private) affiliated with universities for examination and degree granting purposes. The college institutions enroll nearly 340,000 students. The vast majority of the college enrolment (88%) is in the public sector, with only 12% of enrolment in the private sector. In addition, there are also about 265 professional colleges in Pakistan [1][2][3][4]. The government has launched its IT policy to keep pace with technologically developed countries. The present policies emphasis that it is the right time for newly established facilities at the university level to penetrate into e-education and e-learning for the university faculty, research scholars, students and the administration. The university has made its contribution towards the educational development of the country by implementing the national policies of teaching, training, exchange of knowledge and research. The university is also attentive to meet the educational needs of the inhabitants of area by accepting the challenges of fast

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developments in the fields of science and technology and adopt continually changing tendencies and new problems raised by the educational development around the country. If the country wants to succeed in IT world then it has to meet the challenges of the IT race [5][6][7][8][9].

The remainder of this paper is organized as follows: Section 2 is an introduction of the Islamia University of Bahawalpur, Pakistan. Section 3 is about the methodology: a case study; the LAN/WAN connectivity between the campuses of the IUB. In section 4 we discuss the results and dicussion and finally section 5 presents the conclusion.

2. The Islamia University of Bahawalpur: An Overview

The Islamia University of Bahawalpur attained the status of the university in 1975. Presently, the University is offering teaching and research facilities in 50 academic disciplines functioning under the faculties of Science, Engineering and Agriculture, Arts, Islamic Learning, Pharmacy, Education and Commerce and Management Sciences. The university is imparting education to the population of around 6000 students. The university is located at a remote location from urbanized center and provides learning opportunities for rural society of both Punjab and Sindh Provinces. More than 4 million populations can directly benefit from these expanded facilities. No other institution is providing such educational and learning opportunities to such a huge population. The population and the income level of the population is shown in table 1.

Table 1 Population & Income of the population

Area	Population (Million)	Age Group 16-28 Years	Income Levels (RS)
Bahawalpur	2.431	0.600	2000-15000
Bahawalnagar	2.600	0.650	2000-15000
Rahim Yar Khan	3.139	0.800	2000-15000

The existing facilities are mostly confined to the department of computer science and IT with a few exceptions in functional units of the university. The latest computers, printers, scanners and Internet connections is provided to all the faculty members, the researchers, the students and the administrative staff working in different departments and sections with their integration through intranet for easy exchange of information and inter communication within the university. An infrastructure of e-offices in the university is developing. This would include local and wide area networks (LAN/WAN). The

internet and intranet e-mail is used for inter office communication. The office automation is introduced by replacing physical file system to computer based file system. A complete web site of the university has been developed which will contains commonly required information for the citizens, rules and regulations, procedures, physical facilities, academic disciplines, syllabi, fee & dues, scholarships, research in progress, infrastructure development programs, jobs and opportunities, invitation & tenders, data and information, the official news and press releases and forms required by the citizen. Intranet structure and internet facilities are provided to all the employees of the university. The hub of activity is the directorate of IT which manages the databases, operates LAN/WAN and provides support services to the whole university. The extensive training programs of varying nature are devised especially keeping in view the requirement of the university senior and middle level management. In addition, the junior staff of the university is trained in the field of computer usage, IT and operation of customized application/MIS and many more. At present the IUB has inherited following equipment and established LAN running over Windows 2000 Server, Windows XP, Windows NT 4.0, and Win Gate as Proxy at its different departments consisting of 9 computers labs. The available hardware at the university is shown in table 2.

Table 2 Network Equipment

S. #	Item	Qty
1	Pentium-IV	150
2	Pentium –III	100
3	Pentium-II	10
4	Pentium-I	10
5	Laser Printers	05
6	Dot Matrix Printers	10
7	Hub 16 Ports, LanTech	7
8	Hub 8 Ports, LanTech	5
9	Structured Cabling	5

The teacher-student ratio, lab. facilities, library books and seating capacity in the IUB are shown in table 3.

Table 3 Teacher - Student ratio

Ratio Name	Teacher - Student Ratio	National Level	Present Position
Teacher Student Ratio	1:20	1:16	Compares favorably
Laboratory Facilities	Student are distributed in Morning and Evening Sessions	--	Barely sufficient

Library Books	1 million	--	Number of books in the Central Library are inadequate.
Seating Capacity in the Library	3000	--	Sufficient seating capacity is available for the readers in the central library

The university is trying to provide the better working environment to the students, faculty members and the employees. The graduates are in great demand for the development in the country's economy, e-government, e-commerce and IT education. The graduates of the university are gradually being employed in the federal and provincial government offices and the private sector. Employment policies of the government are not gender specific and there are equal employment opportunities for both male and female. The female workers are in great demand for employment in the private sector [10].

3. Methodology: A Case Study of LAN/WAN at IUB

The university has three campuses namely, new campus, old campus and railway road campus. The internal automation and connectivity of three campuses of the Islamia University of Bahawalpur is the major objective, thus about 6000 students and 500 employees are benefited by modern and better working environment with the state of the art infrastructure to compete in the ever changing the world of IT. The figure 1 depicts the interconnection between new and old campuses of the IUB.
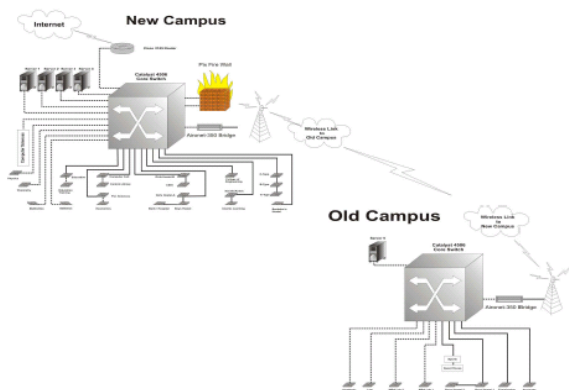

Figure 1 Interconnection of New and Old Campuses

The major network equipment is installed at the new campus of the university and from this campus the other two campuses are connected. The network contains a 'Cisco Catalyst Switch' and different departments are attached through this 'Switch'. The 'Switch' is connected with different 'Application Servers' serves the different departmental applications and some servers are for storage and some application for network monitoring as well. The Switch is connected to 'PIX firewall' which provides security to network. The switch is connected with a 'Cisco Router' which is connected with Internet gateway. The switch is connected with 'Cisco Aironet Bridge' for wireless connection because the connection of two different campuses is through wireless link. The old campus has one server which is used to connect different clients and provides the internet facility to the users of the campus. The server at the old campus is connected through 'wireless link' with new campus therefore the internet facility at old campus is coming from the new campus. Figure 2 illustrates the communication architecture.
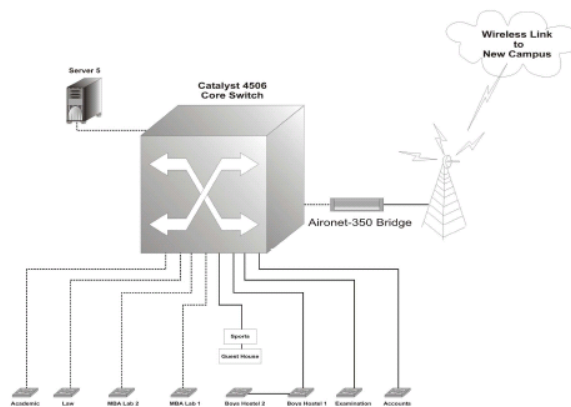

Figure 2 Internet at Old Campus of the IUB

Similarly, the internet facility is extended to the railway road campus (Khawaja Fareed Campus). Figure 3 summarizes the interconnection of three campuses of the IUB.
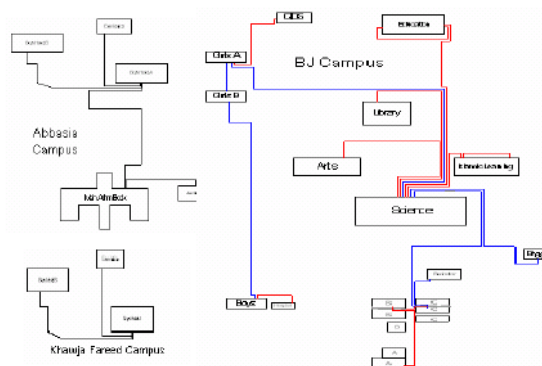

Figure 3 Interconnection of three Campuses of the IUB

We provide some detail of the devices used in the interconnection of three campuses and the communication between three campuses.

1. SERVER: A computer system in a network that is shared by multiple users. Servers come in all sizes from x86-based PCs to IBM mainframes. A server may have a keyboard, monitor and mouse directly attached, or one keyboard, monitor and mouse may connect to any number of servers via a switch. In large companies, servers often reside in racks in the datacenter, and all access is via their network connections.

2. CISCO 3745 ROUTER: A network device that forwards packets from one network to another. Based on internal routing tables, routers read each incoming packet and decide how to forward it. The destination address in the packets determines which line (interface) outgoing packets are directed to. In large-scale enterprise routers, the current traffic load, congestion, line costs and other factors determine which line to forward to. Main features of 3745 router are:

a) Two Integrated 10/100 LAN ports
b) Two Integrated Advanced Integration Modules (AIM) slots
c) Three Integrated WAN Interface Card (WIC) slots
d) Two (Cisco 3725) or four (Cisco 3745) Network Module (NM) slots
e) One (Cisco 3725) or two (Cisco 3745) High Density Service Module (HDSM)-capable slots
f) 32MB Compact Flash (default); 128MB maximum
g) 256MB DRAM (default, single 256MB DIMM); 512MB DRAM maximum
h) Optional In-Line Power for 16-port EtherSwitch NM and 36-port EtherSwitch HDSM
i) Support for all major WAN protocols and media: LL, FR, ISDN, X.25, ATM, fractional T1/E1, T1/E1, xDSL, T3/E3, HSSI
j) Support for selected NMs, WICs and AIMs from the Cisco 1700, 2600 and 3600 Series 2 RU (Cisco 3725) or 3 RU (Cisco 3745) Rack-mountable chassis [11][12][13][14].

3. CATALYST 4506 (Core Switch): A next-generation platform for intelligent switching, the Catalyst 4506 Series includes four chassis: Catalyst 4510R (10-slot: redundant Supervisor Engine capable), Catalyst 4507R (7-slot: redundant Supervisor Engine capable, Catalyst 4506 (6-slot), and Catalyst 4503 (3-slot). A primary component of Cisco Service-Oriented Network Architecture (Cisco SONA), the Catalyst 4500 Series extends control to enterprise wiring closets, branch offices, and Layer 3 distribution points. Table 4 shows the following features:

Table 4 Features of Core Switch

Component	Description
Total Number of Slots	6
Supervisor Engine Slots	1[1]

Supervisor Engine Redundancy	No
Supervisor Engines Supported	Supervisor Engine II-Plus, II-Plus-10GE, IV, V, V-10GE
Line Card Slots	5
Number of Power Supply Bays	2
AC Input Power	Yes
DC Input Power	Yes
Integrated Power over Ethernet	Yes
Minimum Number of Power Supplies	1
Number of Fan Tray Bays	1
Location of 19-inch Rack-Mount[2]	Front
Location of 23-inch Rack-Mount	Front (option)

[1] Slot 1 is reserved for supervisor engine only; slots 2 and higher are reserved for line cards.
[2] Chassis can be mounted in racks and cabinets that meet ANSI/EIA-310-D and ETS 300 119-3.
Note: Supervisor engine slots do not support switching line card modules. Line card slots do not support supervisor engines [11][12][13][14].

4. PIX (FIREWALL): The PIX runs a custom-written proprietary operating system originally called Finesse (Fast Internet Server Executive), but now the software is known simply as PIX OS. It is classified as a network layer firewall with state full inspection, although technically the PIX would more precisely be called a Layer 4, or Transport Layer Firewall, as its access is not restricted to Network Layer routing, but socket based connections (a port and an IP Address - Port communications occur at Layer 4). By design it allows internal connections out (outbound traffic), and only allows inbound traffic that is a response to a valid request or is allowed by an ACL (Access Control List) or a conduit. The PIX can be configured to perform many functions including NAT (network address translation) and PAT (port address translation) as well as serving as a VPN (Virtual Private Network) endpoint appliance.

5. CISCO AIRONET-350 BRIDGE: The Cisco Aironet 350 Series Wireless Bridge enables high-speed long-range outdoor links between buildings and is ideal for installations subject to plenum rating and harsh environments. It is designed to meet the requirements of even the most challenging applications, with features including:

a) High-speed (11-Mbps), high-power (100-mW) radios, delivering building-to-building links of up to 25 miles (40.2 km)
b) A metal case for durability and plenum rating and an extended operating temperature rating for harsh environments

c) Supports both point-to-point and point-to-multipoint configurations
d) Broad range of supported antennas
e) Simplified installation, improved performance, and upgradeable firmware, ensuring investment protection [11][12][13][14].

4. Results and Discussion

The university is planning to transfer the present working of the administration from papers and files into electronic machines (Computers). The training programs of varying duration and nature keeping in view the specific requirement of the area senior, middle level management and junior staff of the university are started. The teaching and the other supporting staff is available at the university. The following results are drawn:

1. To provide an internal automation at the campuses of the IUB.
2. To develop infrastructure of e-offices in the university that includes local & wide area networks. The Internet and Intranet e-mail shall be used for inter office communication (necessary security, digital authentication and legal cover shall be provided to secure the validity of such communication). The university is planning to replace physical file system to computer based file system.
3. To provide online services through the development of web portal for the university. The primary purpose of this portal is to provide visibility of the services offered to the teaching departments, administration offices, and library functioning at the campuses, HEC and the other universities in Pakistan. This web site also shows the higher education facilities offered by the university, research publications and research in progress and miscellaneous data and information.
4. To provide better working environment with the state of the art infrastructure to compete in the ever changing world of IT.
5. To provide Intranet structure in the university and Internet facilities to all employees of the university.
6. To provide e-learning and e-education to the remote areas of country.

5. Conclusion

The main objective is to automate the work of the university in all areas namely teaching, research, library, examinations, finance, budgeting, maintenance of accounts, records, internal communications, and HR management functions of the administration and others, as per new technology. The administrative staff, faculty members, research scholars and general the public will be benefited. The following conclusions are drawn:

a) To improve the internal efficiency and operations of departments, faculties and administration sections through:

1. Improvement in the productivity of the university employees by automating function like meeting management, decision tracking, diary, scheduling, e-mail management.
2. Reduction in the cost of the university operations in the long term by reducing time and effort spent in information search, retrieval and dissention with the university.
3. Reduction in the cycle time for instant responses to the quarries of the students, researchers, scholars and the citizens.
4. The quality of education and research is improved.
5. Establishment of quick adoption of IT in the university through enhancement of skills of the university employees.

b) Improvement of services delivery to citizens:

1. Reduction in the cost of service to everyone by providing general information e.g. Examination results of the university degrees, educational programs, scholarships, rules and regulations, through a web portal.
2. Improvement in the delivery of educational information and services to the general public within and outside country.
3. On time availability of submission of all forms of the university. The provision of general information to the citizen like educational institutions, accreditation of universities, curriculum, equivalence of degrees etc.

c) Establishment of e-learning and e-education:

1. Nowadays the students want a web-based enrollment of courses and examinations.
2. The university is more realisitcs in this regard that the demand of the students is e-learning and e-education opportunities as part of their curriculum. The internet is becoming an essential part of education and research. The only and trivial solution is the integration of networking and computerization which is achieved through the successful implementation of LAN/WAN.

We conclude this paper that providing the Internet facility and internal automation of all important modules of the university, the quality of education and research is improved. Hence it is step towards e-learning and e-education, which is more benefited for the students living in the remote areas of the country.

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