It Infrastructure of SZABIST
(Issues, Challenges and Recommendations)

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Abstract: *SZABIST is increasingly becoming dependent on computer-supported information processing. Its increasing dependency on computers for operational support can impose disasters that could seriously affect the overall performance of this Institute. In this Independent Study SZABIST network analysis of all campuses and assessment of core IT services of SZABIST is under consideration. By seeing the best practices of industry, a comprehensive solution will be proposed for the all SZABIST campuses, which emphasizes on making sure the inter-connectivity of all campuses. Also, in assessment of core services of SZABIST, the major IT services at SZABIST will be analyzed and appropriate recommendations will be given so to enhance the quality of major services to an acceptable level.*

Keywords: Infrastructure, IT, network.

INTRODUCTION

Computer networks are becoming general items in office and in business environments. Computer networks provide distributed systems and applications in both wide area and local area networks .Basically Information Technology Infrastructure includes Performance of IT infrastructure, security of IT infrastructure that basically includes network connectivity and issues and Service quality /delivery of IT infrastructure in SZABIST. Thus, network analysis plays a very important role in any organization or institution.

Organization or Institute like SZABIST is increasingly becoming dependent on computer-supported tasks for retrieval of information's. So, any risk or gap could seriously affect the overall performance of this Institute. In this Independent study, after analyzing gaps and risks factors recommendations will be given that provides the strategy to maintain and manage the network more readily and effectively in an agile way and tries to mitigate the security issues in network.

To remove the flaws at SZABIST's network, a solution is proposed. Strategies are proposed that keep the SZABIST network alive or keep all systems inter-connected in case of any unpleasant situation or disaster.

In this independent study, the network of SZABIST and services is intended to analyze and asses. First analysis of network architecture has been performed that includes all SZABIST campuses i.e. Karachi, Larkana, Islamabad and Dubai campuses respectively. On the other hand logically connection or inter-connectivity of all SZABIST campuses also comes in context.

Secondly, Study of services/quality /delivery of IT in SZABIST , which will be analyzed by Service Strategy or Service Design, Service Operation and continual service improvement. Services at SZABIST are audit network penetration testing bcp/dr availability. In this independent study, major core services will be discussed and analyzed than appropriate recommendations will be given so to maintain an acceptable level of quality of services that could seriously affect the overall performance of this Institute.
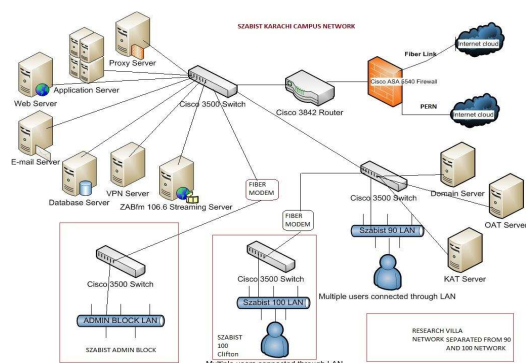
OBJECIVES

Following are the objectives with respect to the network analysis and core services of SZABIST.

• Analyzing gaps in network interconnectivity between campuses and have recommendations for better support to major operations in case of any unpleasant situation or disaster.

• To evaluate this planning and information into a document so that the information is easy to maintain (and hence up to date) and sufficiently well understood by, and available to, all relevant staff or administration.

• To make sure that utmost promising service levels are sustained by analyzing it through service operation and providing some quality continual service improvement points to ponder so that to make sure utmost availability of services.

• To evaluate the utmost services quality and delivery a questioner will also been filled by SZABIST students and results will be accommodate by graphs and charts so that it could be well understood by administration of SZABIST for future implementation.

CURRENT ARCHITECTURE OF SZABIST (KARACHI CAMPUS)

SZABIST Karachi campus is divided into two campuses i.e.90 campus and 100 campuses. After assessment and analysis of current architecture SZABIST (Karachi campus), we found some flaws that could dangerously affect the overall connectivity of the institute. We found some security issues, redundancy issues and so on. The detail about the current and proposed architecture is defined in Proposed Architecture and Appropriate Solutions section.

Figure 1: SZABIST Karachi campus current network architecture.

Proposed Architecture and Appropriate Solutions.

In proposed architecture of SZABIST Karachi campus, appropriate solutions has been given and defined so that if an event or unpleasant situation occurs it could not merely affect the inter-connectivity of campus and services. In contrast to current architecture we also assume some risks that could merely affect the over-all connectivity of the institute. Proposed architecture and appropriate solutions has been defined below

Figure 2: SZABIST Karachi campus proposed network architecture.

In the proposed architecture we have come to following possible solutions.

Redundant Link among Switches

In the proposed scenario if current link between switches goes down in case of any broadcast storm or traffic congestion, switches must have redundant link if one goes down then second link goes up .So, there must be a redundant link among all switches so to avoid and control the creation of loops in the network. There are two protocols for avoiding loop creation i.e. STP(Spanning Tree Protocol) and RSTP(Rapid Spanning Tree Protocol).we recommended RSTP(Rapid Spanning Tree Protocol) as it response more faster normally within few milliseconds if a physical link failure occurs in a specific network.

Radio link between 90 and 100 campuses

Proposing Radio link between 90 and 100 campuses because in SZABIST Karachi campus there should be an option for connecting both campuses wirelessly so architecture does not only depends on physical existence of connections, so proposing Radio link between 90 and 100 campuses so that we can get a system of transmitters and receivers that connects and maintain two locations connectivity by means of radio signals.

Redundant servers

In the proposed architecture of SZABIST Karachi campus redundant servers is recommended because in the current architecture there is only one server running for every core and vital applications i.e. database server or web server etc. So there must be at least two redundant servers so that if one goes down, other one gets up, in this approach application

will not be stop working and continuation of all operations will keep continue.

In the proposed architecture it is suggested that all these redundant servers should be placed somewhere near the 90 and 100 buildings or it can be placed on ISLAMABAD campus so it can be easily access through VPN.

ACL (Access Control List)

In the proposed architecture of SZABIST Karachi campus ACL (Access Control List) of extended type is suggested and recommended because extended ACL (Access Control List) is more secure and more powerful than standard ACL (Access Control List) as it not just verified source address, it check and verified both source and destination packet addresses which leads to have more flexibility and control on the entire network.

DMZ (Demilitarized zone)

In the proposed architecture DMZ (Demilitarized zone) between the two firewalls has been added, which is a more secure approach than the existing one. The first firewall also called the "front-end" firewall works in such a way that it allow only traffic that is designated to the DMZ area only i.e. equipment or servers (Web server, E-mail server) that reside in DMZ. The second firewall also called the "back-end" firewall that allows traffic from DMZ to the internal network. This proposed solution allows traffic from the external network to the internal network will be prohibited .This results in increasing more security and reliability in the network.

Leased line or another fiber link between 90 and 100 campuses

In the current architecture of SZABIST Karachi campus there are 2 fiber optics installed.one fiber optics connect 90 campus to 100 campus and second fiber optics connect ADMIN BLOCK 108 to core switch of the network. In case of any unpleasant situation or disaster there is no other link to connect 90 and 100 campuses.so, in proposed architecture we recommended that there should be another fiber link connected between 90 and 100 campuses in order to maintain the connectivity between campuses and ADMIN BLOCK as well. Other suggestion is that SZABIST should take leased line from any reputable company or vendor like PTCL or WATEEN, so that connectivity between campuses remains alive.

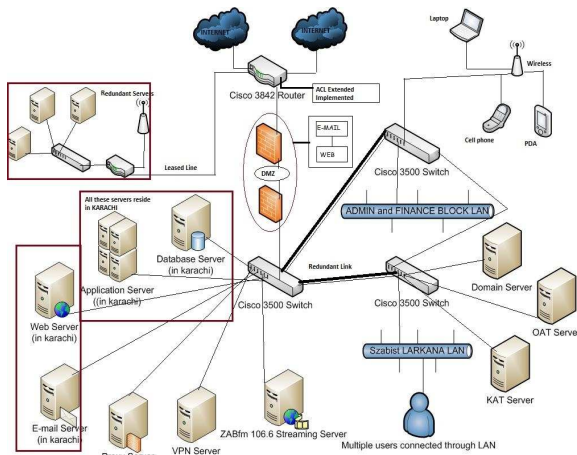### CURRENT ARCHITECTURE SZABIST (LARKANA CAMPUS)

SZABIST Larkana campus opened in August 2004.. After assessment and analysis of current architecture SZABIST (Larkana campus), we found some flaws that should be taken in considered so that SZABIST institute of LARKANA could not face the connectivity problem. The detail about the current and proposed architecture is defined in Proposed Architecture and Appropriate Solutions section.

Figure 3: SZABIST Larkana campus current network architecture.

Proposed Architecture and Appropriate Solutions.

In contrast to current architecture we have seen that Larkana campus network architecture has not as many flaws as Karachi campus faces. Proposed architecture and appropriate solutions has been defined below.

Figure 4: SZABIST Larkana campus proposed network architecture.

In the proposed architecture we have come to following possible solutions.

Redundant Link among Switches

Currently SZABIST Larkana campus has 10-15 manageable switches which are all connected together .In the proposed scenario if current link between switches goes down in case of any broadcast storm or traffic congestion, switches must have redundant link if one goes down then second link goes up. So, there must be a redundant link among all switches so to avoid and control the creation of loops in the network. We recommended RSTP (Rapid Spanning Tree Protocol) as it response faster normally within few milliseconds if a physical link failure occurs in a specific network.

ACL (Access Control List)

In the proposed architecture of SZABIST Larkana campus ACL (Access Control List) of extended type is suggested and recommended because extended ACL (Access Control List)

is more secure and more powerful than standard ACL (Access Control List) as it not just verified source address, it check and verified both source and destination packet addresses which leads to have more flexibility and control on the entire network.

DMZ (Demilitarized zone)

In proposed architecture DMZ (Demilitarized zone) between the two firewalls has been added, which is a more secure approach than the existing one. The first firewall also called the "front-end" firewall works in such a way that it allow only traffic that is designated to the DMZ area only i.e. equipment or servers (Web server, E-mail server) that reside in DMZ. The second firewall also called the "back-end" firewall that allows traffic from DMZ to the internal network. This proposed solution allows traffic from the external network to the internal network will be prohibited .This results in increasing more security and reliability in the network.

Redundant servers

In the proposed architecture of SZABIST Karachi campus redundant servers is recommended because in the current architecture four servers i.e. Database server, Application server, Web server and E-mail server all reside in Karachi campus which will be accessible through VPN. So, there must be at least two redundant servers so that if one goes down, other one gets up. In this approach application will not be stop working and continuation of all operations will keep continue.

CURRENT ARCHITECTURE OF SZABIST (ISLAMABAD and DUBAI CAMPUS)

SZABIST ISLAMABAD and DUBAI campus has almost same architecture. After assessment and analysis of current architecture SZABIST (ISLAMABAD and DUBAI campus), we found some flaws that should be taken in considered so that SZABIST institutes of ISLAMABAD and DUBAI campuses could not face the connectivity problem. Both these campuses have one custom building which decreases the risks and gaps unlike SZABIST Karachi campus. The detail about the current and proposed architecture is defined in Proposed Architecture and Appropriate Solutions section.
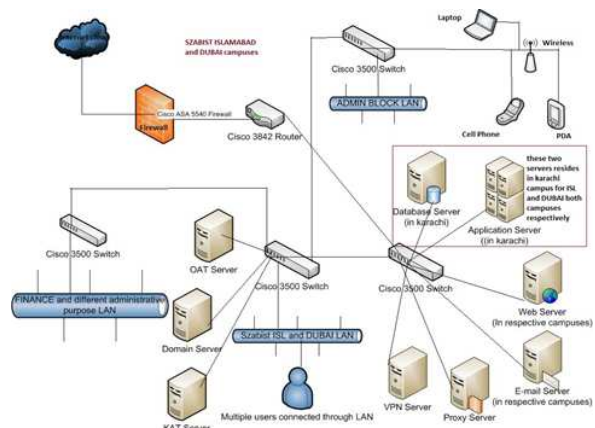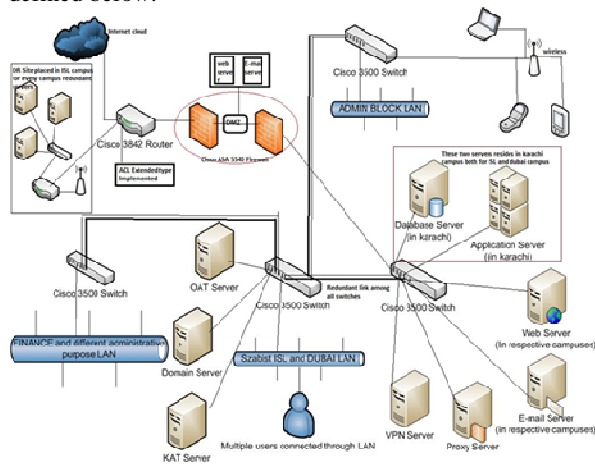

Figure 5: SZABIST ISLAMABAD and DUBAI campus current network architecture.

Proposed Architecture and Appropriate Solutions.

In proposed architecture of SZABIST ISLAMABAD and DUBAI campuses, appropriate solutions has been given and defined so that if a disaster event or unpleasant situation occurs it could not merely affect the inter-connectivity of campus and services. In contrast to current architecture we have seen that ISLAMABAD and DUBAI campuses network architecture has not as many flaws as Karachi campus faces. Proposed architecture and appropriate solutions has been defined below.

Figure 6: SZABIST ISLAMABAD and DUBAI campus proposed network architecture.

In the proposed architecture we have come to following possible solutions.

Redundant Link among Switches

In the proposed scenario if current link between switches goes down in case of any broadcast storm or traffic congestion, switches must have redundant link if one goes down then second link goes up. So, there must be a redundant link among all switches so to avoid and control the creation of loops in the network. We recommended RSTP (Rapid Spanning Tree Protocol) as it response faster normally within few milliseconds if a physical link failure occurs in a specific network.

ACL (Access Control List)

In the current architecture of SZABIST ISL and DUBAI campus, ACL (Access Control List) of standard type has been implemented on the core router for the list of permissions that can be granted for ingoing and outgoing traffic.

Whereas in the proposed architecture of SZABIST ISL and DUBAI campus ACL (Access Control List) of extended type is suggested and recommended because extended ACL (Access Control List) is more secure and more powerful than standard ACL (Access Control List) as it not just verified source address, it check and verified both source and destination packet addresses which leads to have more flexibility and control on the entire network.

DMZ (Demilitarized zone)

We proposed DMZ (Demilitarized zone) between the two firewalls which is a more secure approach than the existing one. The first firewall also called the "front-end" firewall works in such a way that it allow only traffic that is designated to the DMZ area only i.e. equipment or servers

(Web server, E-mail server) that reside in DMZ. The second firewall also called the "back-end" firewall that allows traffic from DMZ to the internal network. This proposed solution allows traffic from the external network to the internal network will be prohibited .This results in increasing more security and reliability in the network.

DR Site (Redundant servers) for every campus

In the proposed architecture of ISL and DUBAI campus a DR Site is maintained for every campus and it is placed in ISL campus so that each campus redundant servers can easily be access by ISL campus. So there must be at least two redundant servers so that if one goes down, other one gets up. In this approach application will not be stop working and continuation of all operations will keep continue.

CONNECTIVITY BETWEEN SZABIST CAMPUSES

All SZABIST campuses i.e. Karachi, Larkana, Islamabad and Dubai communicate and connected with each other through VPN (Virtual Private network) by the Internet cloud.
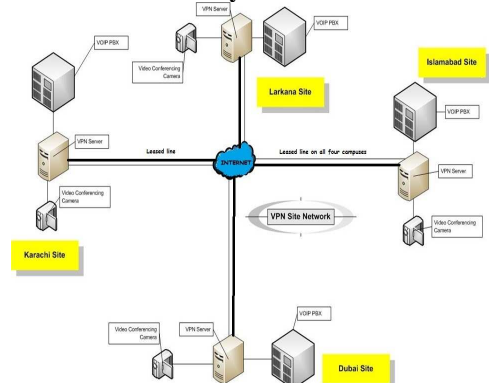
Current Connectivity between SZABIST Campuses
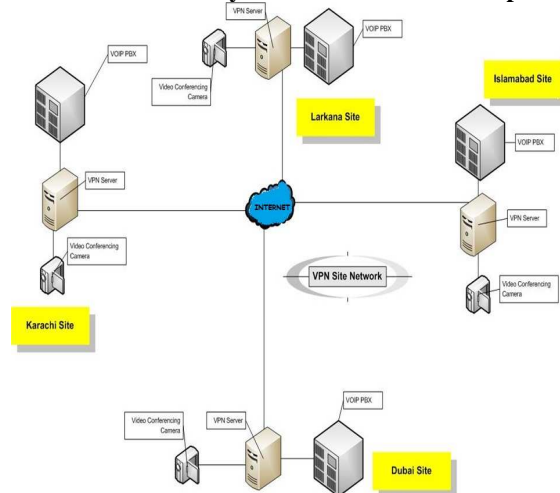
Figure 7: Current Connectivity between SZABIST Campuses.

At each side of the particular or individual campus VPN server is located so that connectivity between campuses can take place. Also, with VPN server VOIP PBX and Video conferencing camera is also attached.

Recommended Connectivity between SZABIST Campuses

Figure 8: Recommended Connectivity between SZABIST Campuses.

As the current architecture operate as VPN site-to-site connection which operates connecting any two sites via VPN server. It establishes a dedicated point-to-point connection across two sites. VPN server provides a routed connection to all the sites attached by VPN server. In this way a secure connection is established for communication across all sites or campuses.

In the recommended connectivity between campuses we have proposed an option of leased line between all campuses so that if any disaster occurs for e.g. Packet Payload increases from tunneled payload in this case traffic congestion problem will occur which causes the discontinuing transfers of data across a particular site through VPN. In this case a leased line will be a solution so that transfer or exchange of data across all sites should be maintained. SZABIST can buy the leased line from any private vendor which will be available at a cheap cost.

Core Services of IT in SZABIST

In the core services of IT in SZABIST we have discussed three core services of SZABIST. In this section we will be discussing three core services regarding service design, service operation and then continual service improvement. In service design we will discuss the particular service design that how the particular service is implemented or designed. In service operation we will discuss what goals are achieving regarding the particular service and then finally in continual service improvement we will be discussing some areas that need to be focus for improvement.

Academic Service

In Academic service we will be discussing a core service related to academic service i.e. Zabdesk service.

Zabdesk Service

In Zabdesk service three areas has been discussed .i.e. Zabdesk Design, Zabdesk Operations and Zabdesk for Continual Service Improvement.

Zabdesk Design

Zabdesk Design is accomplished by ZabSolutions. Zabdesk is one the highly rated project of ZabSolutions. Zabdesk is complete software to automate business processes and to provide complete academic facilities for students, faculty and staff. Zabdesk is designed in such a way so that students, faculty and staff can interact with each other via Visual interface.

Zabdesk Operations

Zabdesk mainly focus on interaction of students, faculty and staff with each other. These interactions take place via authorized users i.e. a unique registration number and password is given to every user. Students log on to Zabdesk to see the particular course outline, remarks and course numbers and grades.

Recommended-Zabdesk for Continual Service Improvement

In this section we will discuss some areas that need to be improved in Zabdesk. Suggestion and recommendation is the key concern in this section. The recommendation that be taken in context is the highly demand of electronically generating transcript via Zabdesk. Students face problem and

it became hectic to go for clearance from every department in order for the issuance of transcript. The other top ranked universities have adopted this feature to electronically generate transcript. This feature enhances the Information technology area in aspect of Zabdesk.

Digital Library

In digital library we will be discussing three areas i.e. Digital Library design, Digital Library Operations and Digital Library for Continual Service Improvement.

Digital Library design and Operations

Digital library has been designed and develop across the public and private sectors universities to provide the access of thousands of high quality journals, articles and e-Books under one roof. The main operation of Digital Library is to provide researchers to keenly access the required choice of journals, articles, e-Books and references that are easily available in an electronic format.

Recommendation - Digital Library for Continual Service Improvement

In this section we will discuss some areas that needed to be improved in Digital Library. Suggestion and recommendation is the key concern in this section. Firstly, the core problem that most of the students faced in aspect of digital library is the access of digital library outside the SZABIST premises. So, SZABIST should adopt policies that in reference of authenticate username and password digital library should be from the researcher's residence or any other place.

The second recommendation that be taken in context is the high availability of journals and articles i.e. from digital library most of articles and journals has been locked that can only be view by means of purchasing that particular article or journal. There should be high availability of all articles/journals and e-books so that a student or a researcher have various options and feasibility to get the required journals or articles.

LAB Management and Facility Service

In LAB Management and Facility Service we will be discussing three areas i.e. LAB design, LAB Operations and LAB Management and Facility for Continual Service Improvement

LAB design and Operations

SZABIST LAB has been designed to provide and to facilitate all students; faculty and staff. LAB facility has been deigned on both 90 and 100 campuses with LAB 1&2 and LAB 3&4 on 90 campuses and LAB 5&6 on 100 campuses. There is also an internet exclusive LAB which has been recently established to facilitate students to fulfill their use of internet in a separate environment. SZABIST LAB has been fully equipped with IBM Net Vista Pentium-IV with 1.8/2.6 GHz, 256MB RAM with Windows XP Professional operating system. This configuration may vary with different LABs.

Recommended- LAB Management and Facility for Continual Service Improvement

Suggestion and recommendation is the key concern in this section. Firstly, the most significant and highly demanding recommendation is the more conveniently availability of printers for black and color printing as most of the time

printer is out of service which affect the overall continuity of LAB management and services. On the other hand, printing cost should be taken in consideration to minimal cost per page or free printing; SZABIST should take these recommendations in consideration in aspect of LAB management and services so that it improves the availability of services to an acceptable level.

SURVEY ABOUT CORE SERVICES OF IT IN SZABIST

This section mainly focuses on survey that has been taken from mostly SZABIST students and few from faculty and others .The questionnaire has been filled from SZABIST students to know their point of view about core services of SZABIST and to receive suggestions from SZABIST students. A sample of questionnaire is also attached at the end of this report.

Surveys-Questions Regarding Zabdesk

In this section questions' regarding Zabdesk as a course registration and overall performance has been answered. Whereas, in figure 9, pie chart shows that 30% students rate "good" which is the majority but on the other hand it also shows that 20% and 25% students rate "poor" and "fair" respectively, this means there is a space of improvement in course registration field.
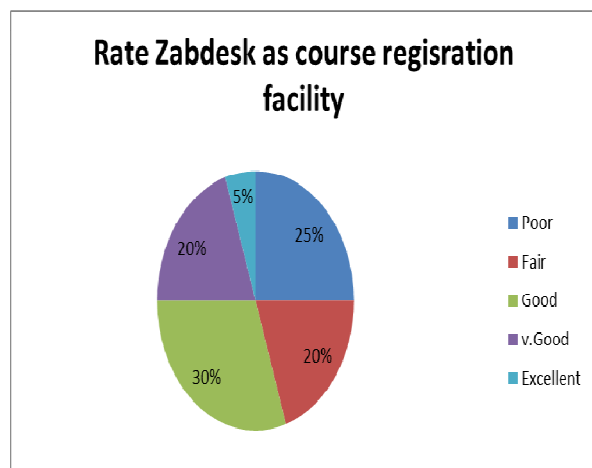

Figure 9: Pie chart showing Zabdesk as a course registration facility.

Surveys-Questions Regarding LAB management and Facility Service

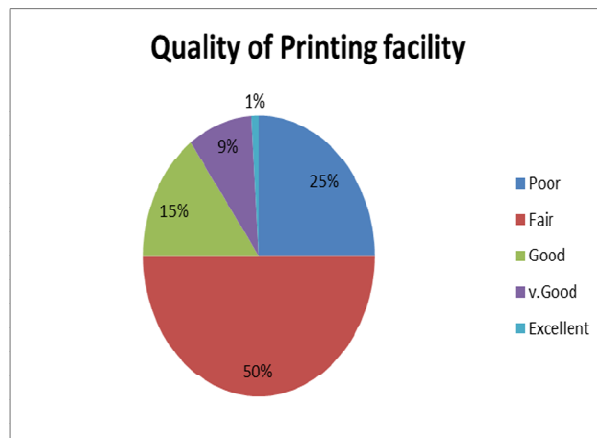In this section questions' regarding Improvement about LAB facilities and overall performance has been answered.

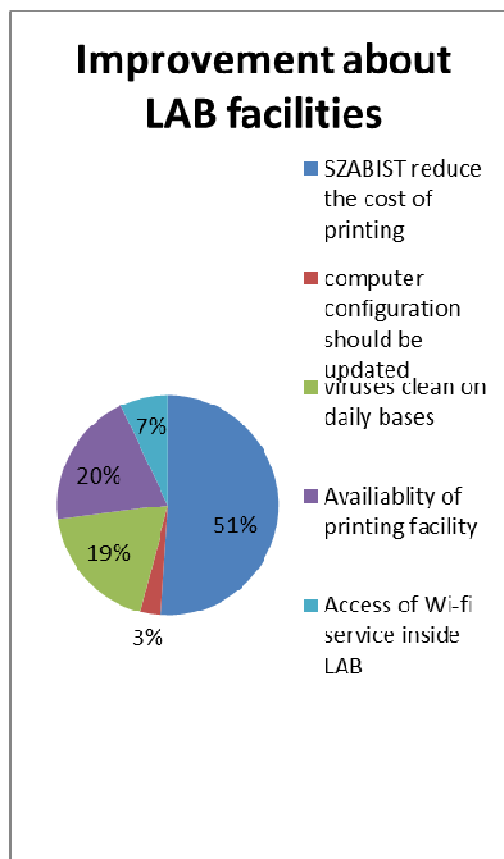**Figure 10**: Pie chart showing quality of printing facilities.

Figure 11: Pie chart showing Improvement about LAB facilities that should be considered.

Whereas, in figure 13, pie chart shows that 51% students rate that "SZABIST should reduce the cost of printing" i.e. make the printing cost minimal or free to students, which is the majority and on the other hand it also shows that 20% and 19% students says that "Availability of printers" and "viruses should be clean on daily bases" respectively, this means there is a space of improvement in the above high weighted areas.

Surveys-Questions Regarding Digital Library

In this section questions' regarding availability and accessibility of journals/articles in digital library and the

importance to access the digital library outside SZABIST has been answered.
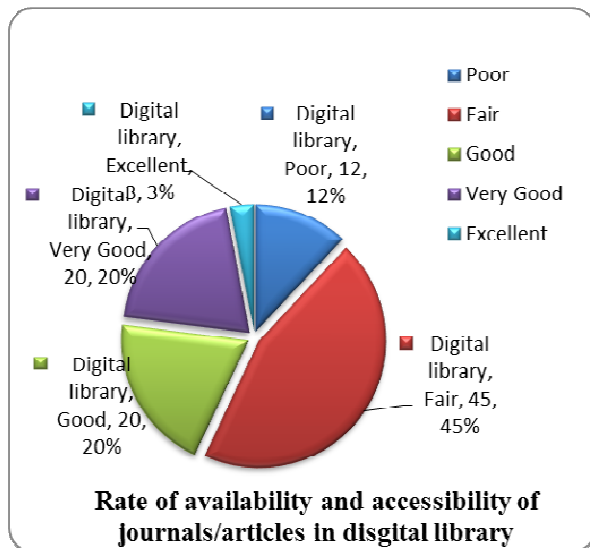
Figure 12: Pie chart showing rate of availability and accessibility of journals/articles in digital library.

Whereas, in figure 14, pie chart shows that majority of 45% students rate that "Accessibility and Availability of journals/articles in digital library" i.e. online journals/articles should be more accessible and highly demand of free availability of IEEE and ACM journals.

CONCLUSION

In this independent study, the network of SZABIST is intended to analyze and asses. Network analysis of all campuses and assessment of core IT services of SZABIST is under consideration. By seeing the best practices of industry, a comprehensive solution will be proposed for the all SZABIST campuses. Strategies are proposed that keep the SZABIST network alive or keep all systems inter-connected.

Also, in assessment of core services of SZABIST, the major IT services at SZABIST will be analyzed and appropriate recommendations will be given so to enhance the quality of major services to an acceptable level. A questionnaire result with pie-chart has also been discussed so to convey the ideas, suggestions and recommendations of SZABIST students in aspect of core IT services.

In future, if all recommendations and solution which are discussed in this study are applied, there will be very less chances of point of failure and less dis-connectivity issues will arise. Also services level will raise a mark up to an acceptable level.

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