Campus Network Management : Best Practice by Kuvempu University

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Abstract

This paper discusses the technical aspects of the campus network which was undertaken at Kuvempu University under UGC-Infonet Digital Library e-consortium programme. The UGC-Infonet programme in the campus is explained. Further, how the university library is taken up the task to complete campus network programme is highlighted. The various issues needed in the campus network is also discussed in this paper such as LAN, WLAN, WAN, Anti-virus server, Web server, Mail Server, security arrangements, etc. The prerequisites in designing LAN under campus network in Kuvempu University explained such as three layer level approach, etc. The optimum and effective utilization of the UGC-Infonet programme under the campus network is also discussed. The study also highlights the challenges, expansion and future plans of the campus network in Kuvempu University.

Keywords: LAN, WAN, Campus Network, UGC-Infonet Digital Library Consortia

1. Introduction

UGC has launched an ambitious programme to bring about a qualitative change in higher education and research centers. In this direction UGC is extending help to modernize the ICT infrastructure in university campuses with state-of-the-art campus wide networks under UGC-Infonet programme. Under this programme, it is proposed to use Information and Communication Technology and Internet to transform learning environment from a mono-dimensional one to a multi-dimensional one. Campus wide network is the basic required infrastructure in the universities for the effective utilization of UGC-Infonet Digital library e-consortium as well as the internet e-resources. Therefore, the structured campus network is a sine qua non for every university.

The term 'campus' as used here refers to a main university location consisting of one or more buildings in close proximity to one another at the same locale. All buildings and floors on the campus are connected to shared resources and services in a data center, the campus network may also be connected to remote location such as Off campus via a WAN.

With the establishment of the well structured campus network most administrative, academic and research processes are carried out online, so any campus network down time or inefficiency has a negative impact on the university bottom line. Secure, high performance, high available LAN services are crucial to ensure that each campus facility is always online, so that administrative, academic, research productivity as well as user satisfaction are maximized. This article focuses on the issues and challenges in establishing and maintaining the campus network at Kuvempu University for effective utilization of the UGC-Infonet e-resource, internet services and for other administrative and academic applications through adopting proper planning and implementation.

A campus network design that meets campus security, connectivity, and performance challenges while enabling key IT initiatives is needed. It also must scale, offer operational simplicity and flexibility, accommodate new computing trends without much alterations in the original structure and design.

2. Objectives

♦ To highlight the issues on how the Kuvempu University has planned and established campus network for effective utilization of UGC-Infonet programme.

♦ To know the issues and challenges faced in establishing the campus Network.

♦ To know the issues related to changing campus needs.

♦ To know how best the UGC-Infonet and internet services reaches the end users of Kuvempu University

♦ To know the use of campus network for different administrative and academic services.

3. UGC-Infonet Digital library E-consortia programmes at Kuvempu University

The Kuvempu University was established in year 1987. Till then it was functioning as a post-graduate center of University of Mysore. The university has started to get the benefits and assistance provided by the UGC through Inflibnet Center, Ahamadabad for automation of its library as early as 1995. In 1997, the university library has received financial assistance of Rs. 6.50 lakhs from Inflibnet for its automation activity. The university library has taken a lot of initiatives in automating its library activities by making use of the grants and other assistance of the UGC. Again in 2004 the UGC has sanctioned Rs. 7.14 lakhs and considered the Kuvempu University as one among the 50 universities in the First phase of the UGC-Infonet programme. Under this programme the UGC has initially given 128 kbps BB VSAT for Internet purpose during 2004 and later it was upgraded to 256 kbps BB VSAT. In 2008 the bandwidth was upgraded to 2 MB leased line for better utilization of UGC-infonet programme and other internet services for the benefit of the administrative, academic and research community.

The university library was instrumental to initiate and implement the campus network, establishing Network Operation Center in library building itself. Initially, the programme was confined to library by creating a LAN with 24 nodes for all its users. Then it was extended by establishing a campus network throughout campus to all the academic and administrative blocks in the campus by creating number of virtual LANs, by laying OFC backbone. Later through different stages the LAN network was extended to the other blocks in the campus including hostels, Guest House and Residence of the Statutory Officers. As for as the bandwidth of the internet is concerned the university on its own has subscribed additional 2 MB (1:4) BSNL leased line connectivity and integrated the same with the 2 MB(1:1) of UGC-infonet to meet the speed requirement. The integrating techniques have been applied to integrate the Two 2 MB leased lines connectivities, by making use of Sonicwall Firewall and is as shown in the figure-1 below, for effective utilization of the UGC-infonet programme and other internet based applications.

Network Diagram of Internet Setup
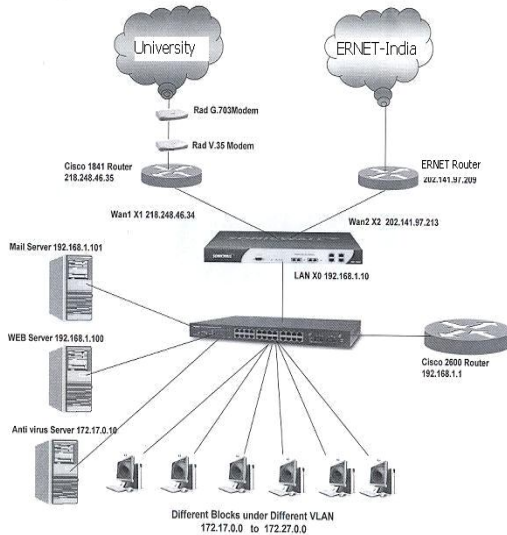
Figure1. Integration of Two 2 MB Leased Line connectivity

4.   Services Under Campus Network

Any campus network must provide the following high level services to optimize the administrative, academic and research activity in the university. In this direction the Kuvempu University has taken several measures under campus network. They are:

a). **LAN (Local Area Network) Connectivity:** The entire campus has been covered by extending secured wired and wireless LAN connectivity by creating independent virtual LANs.

b). **WAN Connectivity:** The WAN connectivity has been created through reliable, and secured Network Operation Center for maintaining servers for different application like Web server, Mail server, Proxy server, Antivirus server and Database server.

c). **Remote Access Server:** Remote Access Server is also enabled for effective use of the e-

resources, and other database service by the remote users.

d). **Antivirus, Anti-spy ware, Anti spam, Content Filter, & Intrusion Prevention Services:** The Kuvempu University has taken much and top priority to protect the network and the data by applying antivirus solution by creating network based antivirus server with a powerfull antivirus as well as the antivirus control at the firewall level to avoid the virus from outside, along with Anti-spyware, Anti-spam, Content filtering and Instruction prevention facilities also taken at the firewall level.

e). **Security:** Security is critical to all campus network services. Access to network and application must be open and pervasive, yet remain secure and controlled. Today's networks not only need to effectively handle unmanaged devices and guest users attempting network access, they also need to address support for unmanageable devices, post admission control, application access control, visibly and monitoring. A high end firewall with antivirus, anti-spyware, anti-spam, content filtering, and intrusion prevention etc., installed at Network Operation Centre in the library takes care of the security.

f).   **High Performance:** The higher performance of the speed in the wired & wireless LAN must be provided at all time throughout the campus. Due to the creation of number of VLANs and strong OFC backbone the speed performance in both wired and wireless LANs is good. LAN-like speed must also be maintained over the WAN when accessing any centralized applications or resources.

g). **High Availability:** Downtime of the internet connectivity either by the services provider side or by the user side is not an option in today's campus network but it must offer at least 99% of reliability with a goal of approaching the level of service. For this the university has taken several measures like opting high end core network devices, Softwares, and redundancy in the network structure, etc.

h). **Centralized Management:** The centralized management is very much required to maintain the campus network activity. Kuvempu University has set up main Network Operation Center at its central library and the library staff with the help of computer programmer is maintaining and controlling the entire campus network at all levels. From this Network Operating Center all network switches, firewalls, routers and other security devices and servers are installed and maintained. Centralized management solutions reduce the time and expense required to configure and manage network devices. In addition network traffic can be more easily analyzed with such a system facilitating network performance optimization.

5. Prerequisites for Campus Network LAN design

The following are the minimum basic prerequisites which we have considered under the functionality, scalability, adaptability and manageability issues while designing and establishing the campus network:

a). The proposed network should be aimed at the goals of the organisation.

b). Set up a technical expert committee chaired by the head of the institution comprising the technical experts from both inside/outside the institution.

c). Campus Network must scale and accommodate emerging computing trends and additional network services without an entire redesign of the campus network.

d). The adoption of unified communications including voice and data services is on the rise such deployments have a direct impact on the high performance and high availability requirements of a campus network.

e). Requirements of suitable bandwidth from the service provider like BSNL in addition to the UGC allotted Bandwidth based on the load and requirement.

f). Care should be taken for the network must be leveraged with high end service such as wireless coverage and remote access to maximize productivity by avoiding any LAN downtime or inefficiency that impacts the institution bottom line.

g). Security issues to avoid any sort of internal and external attacks.

h). Wireless services: One of the main drives of better business decisions is access to key information and resources at all times from all location in the campus. Administrators, Faculties, Students and researchers use their laptops, expect wireless access to all of their applications, data stores, resources and services. For this reason the wi-fi provision should be made available throughout the campus with suitable secure to access it. Such wireless services enable users to access whatever materials are needed to support their requirement.

i). Server centralization or centralized operation : Is highly opted to centralize and control the server and their operations from a single point. For this there is a need to establish Network Operation Center to operate, control, maintain the campus network to reduce costs, simplify operations and comply with regulatory guidelines.

j). Upgradation and expansion activity: The network infrastructure in today's campus is no longer sufficient to satisfy the user requirements. Also due to the fast advancement in the computer and communication technology and in their services inevitably we have to invite and accept for upgrading the existing setup regularly.

Based on the increase in the number of users in the campus and new applications both in administrative and academic environment we have to expand the campus network for effective use of different resources.

k). Survey of the Campus : Survey of the campus and all building blocks in the campus is very much needed before starting planning and establishing the campus network.

l). Manpower: Skilled, technically qualified and sufficient number of staff required at different levels to operate and maintain campus network.

m). Budget: Appropriate budget provision should be made for planning required campus network project.

6.   Kuvempu University Campus Network Architecture

Three layer approach of campus network at Kuvempu University consists of the following:

6.1.   Core Layer Level

The Core Layer Level consists of all high end network accessories, Servers, and WAN Connectivity, established

and installed in the centralized Network Operation Centre.

The Network Operation Centre of Kuvempu University consists of

- ♦ 2 MB (1:1) plus 2 MB (1:4) leased line connectivity from ERNET-BSNL and KU-BSNL respectively.

- ♦ Both the connectivities have been integrated by using high end sonicwal Firewall device.

- ♦ High End CISCO Routers are used for Leased Line connectivity.

- ♦ CISCO-2600 series Router used for routing purpose.

- ♦ Sonic-wall Firewall device used as a Gateway and Firewall also used as a Anti-Virus, Anti-Spam, Anti-Spyware and Intrusion Prevention Control tool.

- ♦ Cisco L2 Catalyst Manageable Switch is used for maintaining different VLANs.

- ♦ Sufficient number of OFCs have been terminated by using appropriate OFC terminating network accessories.

- ♦ Proxy server with Linux OS platform is configured and using for campus net maintenance.

- ♦ WEB server is configured and hosted with university website(www.kuvempu.ac.in).

♦ Email services is also configured and implemented and maintained for university mail services(mail -.kuvempu.ac.in).

♦ Importantly Antivirus server is also maintaining by installed 250 users Trend Micro network based antivirus software for taking care of antivirus problem in the campus network.

♦ Some D-link manageable switches are also used to maintain the Local LAN of the Library.

6.2. Aggregation Level Layer

The aggregation level layer sometimes referred to as the distribution layer aggregates connection and traffic flows from multiple access layer switches to provide high density connectivity to the LAN core.

Due to their location in the network aggregation layer switches must provide scalability, high-density wire-rate ports, and high availability hardware and software features that deliver carrier class, reliability and robustness. OFC- Optical Fiber cable with 4 Core and 6 core used and laid between the different blocks from the main network operation centre with redundancy between some important blocks/ segments.
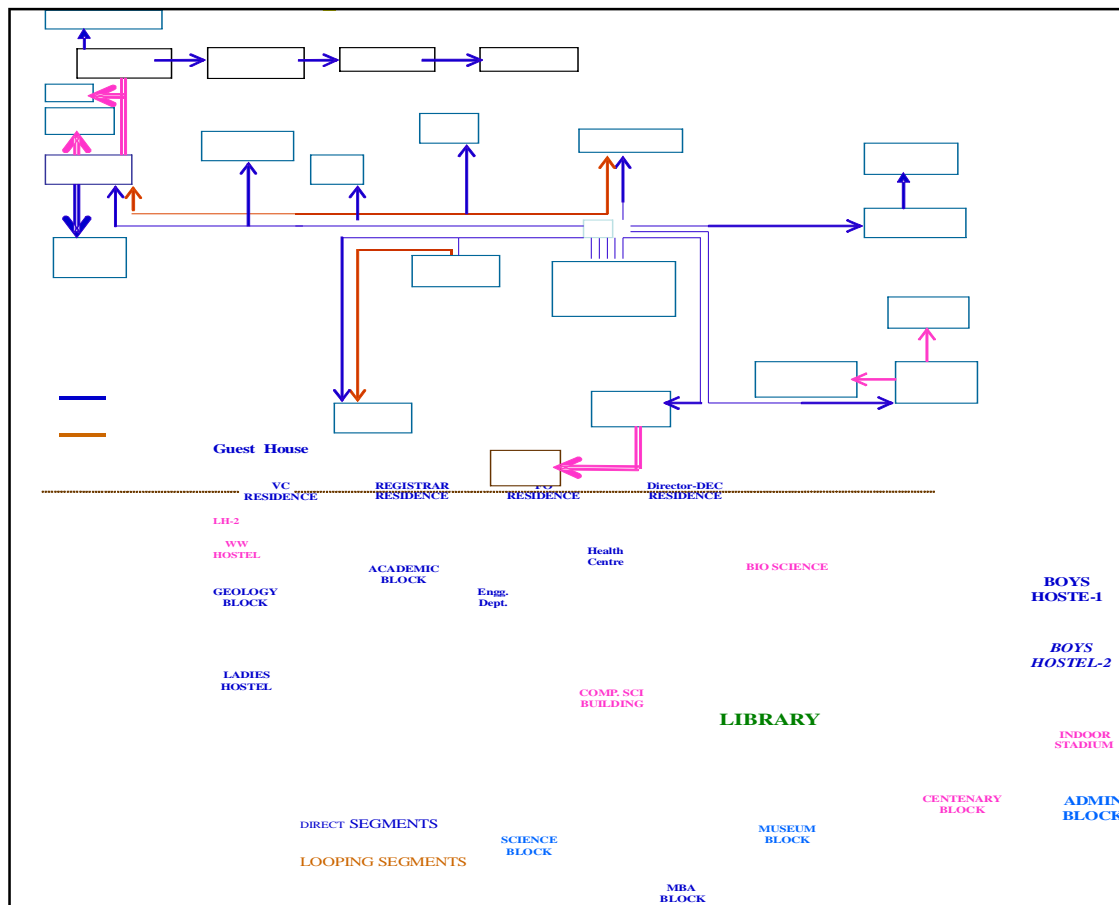

Figure 2. Kuvempu University Layout Of Campus Wide Network

6.3 Access Level Layer

On a campus, the access level layer provides network connectivity to end users by connecting devices such as PC's Printers, IP Phones etc., via wired and wireless LAN access points. In the access level layer the switches typically reside in the wiring closest of each floor in each campus facility. The access level layer provides connectivity Power over Ethernet (PoE), QoS, and Security with policy services and network access control.

Campus network use VLANS to logically group sets of users, devices or data regardless of location into logical networks through software configuration instead of physically relocating devices on the LAN. The VLANs help to address issues such as scalability and network management.   One such VLAN established in Bioscience block is illustrated (fig-3)
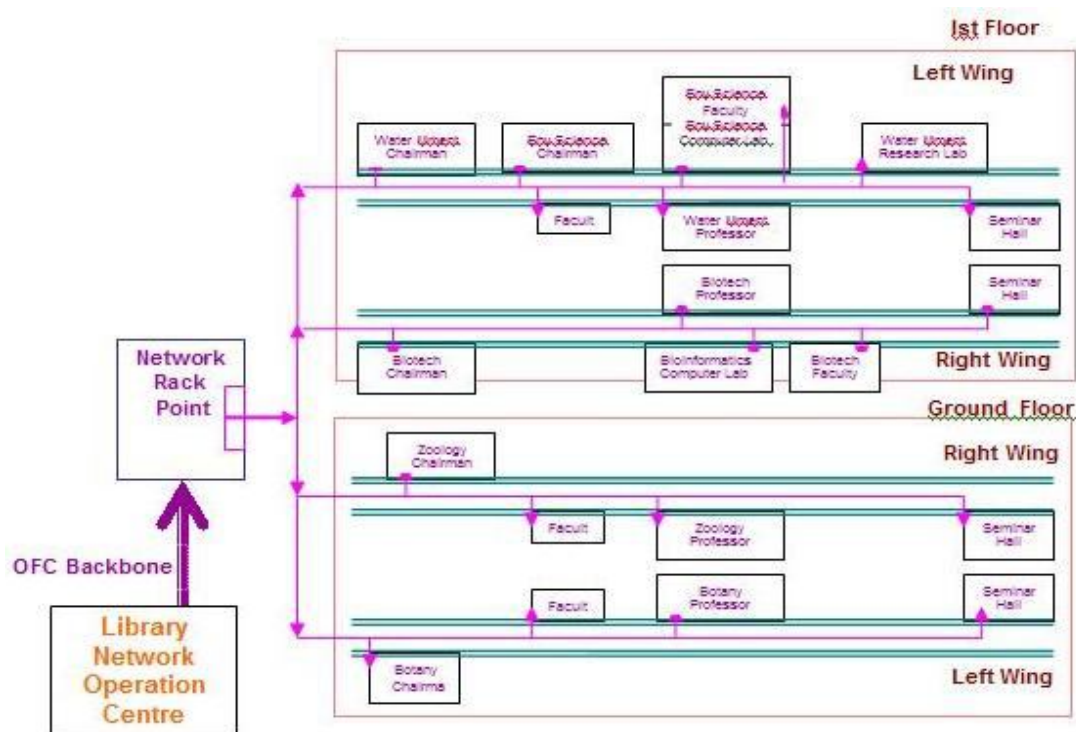

Figure 3. VLAN of Bioscience Block at Kuvempu University

Access Level Layer Design Consideration includes:

♦ Wired port connectivity
♦ Wireless LAN (WLAN) connectivity
♦ Power over Ethernet
♦ Virtual LAN (VLAN)

7. Optimisation in utilizing the UGC-Infonet Programme

The university has taken up some of the following initiatives in creating awareness among the academic community as well as administrative staff for

effective utilization of internet based resources and services .

♦ Training and awareness programme to educate, operate and maintain the campus network for selected technical professionals.

♦ Developing IT culture about the use and awareness of the existing available infrastructure.

♦ Creating awareness about the worthiness of internet as an information source.

♦ Accessibility to Internet Services.

♦ Education and training programme.

♦ Monitoring internet use for academics.

♦ Ensuring the access speed of Internet.

♦ Creation and compilation of websites.

8. Activities under Kuvempu University Campus Network

The University has established and utilizing the campus network to meet its administrative, academic, research and other activities as mentioned below.

♦ Establishment of Network Operation Centre to control and maintain the campus network.

♦ Creation OFC Backbone structured segment-wise Campus LAN.

♦ Creation of Block-wise LANs and WLANs under different VLANs connecting more than 450 nodes.

♦ Functioning of Wireless LAN in Dynamic mode.

♦ Creation of Proxy Server for campus network maintenance on Linux Platform.

♦ Creation of Web server for hosting Kuvempu University website (www.kuvempu.ac.in) and its application.

♦ Creation of Mail Server for Kuvempu University mail services(mail.kuvempu.ac.in)

♦ Creation of Antivirus server with 250 users to maintain the antivirus.

♦ Creation of database servers on different applications.

♦ Setup of Tele Medicine service facility at University Health Centre connecting with one of the popular and prestigious cardiology centre in Karnataka i.e., Narayana Hrudayalaya, Bangalore for the 24 hours online treatment of cardiac diseases for the benefit of the university staff.

♦ Conducting regular training/awareness programmes to make use of campus network as well as UGC-Infonet programme with the co-operation of Inflibnet Centre, Ahmedabad.

♦ Arrangement of online demonstration of products/services.

9. Expansion Activities

The expansion of the campus network both physically and logically is a continuous process based on the requirements of the future programmes of the university and its Post-Graduate Centres. In this direction we have already planned and initiated the expansion task of campus network to the off campus at Post-Graduate Centre, Davanagere in the coming days. The execution of the task is in progress. The details of the expansion task is as shown in the figure-5 below:

PROPOSED LAYOUT OF P.G.CENTRE CAMPUS FOR CAMPUS NETWORK, CONNECTING FROM
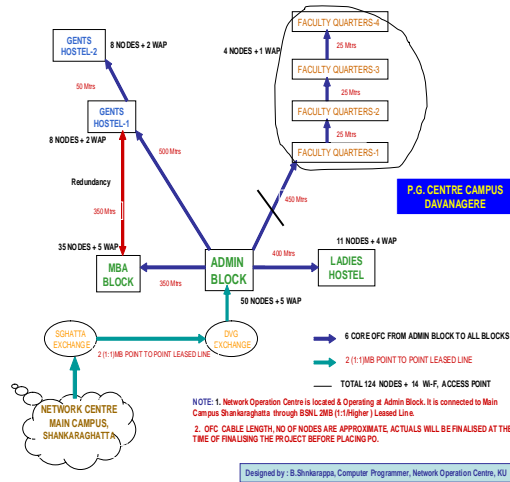MAIN CAMPUS SHANKARAGHATTA THROUGH 2 MB (1:1)POINT TO POINT LEASED LINE

Figure 4. Campus Network Expansion Diagram

10. Challenges

Any campus network task that should be in a position to accept the challenges at different levels and in different forms due to the continuous technological changes, environmental changes, financial constraints, human resources, user satisfaction, and for many other reasons as listed below:

♦ Maintenance of Campus Network by adopting new technologies as and when they available and discard the obsolete one.

♦ Constant upgradation of the existing setup along with upgradtion of bandwidth.

♦ Regular training to the technical staff and their retention.

♦ Recruitment of trained and skilled manpower to handle and maintain the campus network and its applications.

♦ Expansion activities.

♦ Effective utilization of campus network for administrative, academic, research and many other purposes.

♦ Regular training/awareness programmes to the administrative staff, faculties, researchers and students.

♦ Provisions for making appropriate budget for maintenance, expansion activities.

11. Future Plans

Because of the technological revolution and globalised situation all most all the organizational functionaries are network based online applications. For this there is a need to make use of this campus network to the university's all online and network based applications in the coming days. They are:

♦ Further strengthening of the digital library applications

♦ Implementation of university e-governance application.

♦ Addition of different servers for different applications.

♦ Video-conferencing/Teleconferencing facility between the Main campus to its post-Graduate centres.

♦ Permanent setup of training/awareness training cell.

♦ IP based camera services for connecting important areas in the campus.

♦ On-line registration, examination services

♦ Establishing e-learning centre.

♦ Online distance education mode.

12. Conclusion

Campus Network of UGC-Infonet project in the university setup is not merely for internet purpose, also to adopt all sorts of e-governance applications of the university. Also there is a need to update and create the awareness among the users about both the technology and the services available under campus network. The university could able achieve

all this because of the impetus and encouragement provided by UGC under its UGC-Infonet programme.

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