ANALYSIS OF HYBRID ACADEMIC NETWORK PROTOCOLS (**HANP**)

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ABSTRACT

The modern communication and development process supported to the teaching learning process in many elements. This Information and communication technology is facilitated many resource accessibility for the learners in the teaching learning environment. The modern teaching learning environment facilitated with many technological resources such as computer network and its connected peripherals. This analysis aims to observe the intranet and internet usage of academic stakeholders and their bandwidth utilization across and between the academic hybrid network. The educational network environment allows mobile hosts that are multiple hops from an access point to use centralized services; which are not available in pure ad hoc networks. The current network is characterized by its increasing distribution, dynamic nature, and the complexity of its sharable resources due to the increasing demand of different services in the academic community. This analysis observes the data transformation process across and between networks using different network and data transfer service protocols. This paper analysis the utilization of protocol and packet transformation issues on the existing academic hybrid network with the specific case study of salalah college of technology. The result of the observation and recommendations are presented this paper.

Key Words: *Network, Service protocol, hybrid network, HANP*

1. INTRODUCTION

The modern teaching learning process is facilitated with computer aided tools.The computer and its technology development influenced the teaching learning process in many ways specially the information transformation, analysis and learning process. The education pedagogy also integrated with computational network for sharing the teaching resources and knowledge. Academic network environment adopted computational networking system for information transaction and facilitates the teaching learning system. To increase the efficiency, upcoming network technology included now and then with basic network where all the services are supplementary to teaching-learning and education management system of academic network environment. Over the period of time the academic network has become an unstructured due to the requirements of the user, increase of resource need and the contribution of add on services. While increasing the add on services in the basic network the application complexity raised in terms of availability , accessibility and applications of devices leads to convert the structured network to the unstructured network. This analysis aimed to analyze the protocols run over this network for its effective utilization and support of teaching learning and educational management system.

The Academic network environment consists of wired and wireless with internet, intranet, and extranet using LAN and WAN architectures to provide the services for the students, staff, administrators . This network used for file transfer(FTP), Remote access(TELNET), Active Directory Services(DNS), NETBIOS, Print server, IP telephony (Internal),Wireless Fidelity, Bluetooth, VPN , Email(IMAP), SMTP, E-Learning(Web server-HTTP) , PING-ICMP, etc services. While providing the above specified services the network response and its Quality of Services varies due to the protocols which is used for the specific service. To reach the maximum service utilization, existing services are observed based on its protocol in and between the networks.

The observation made usual and unusual condition of the network performance. The unusual performance of the network and its conflicts considered as a area of improvements. These observed conflicts are determined based on the packet transformation during the appropriate peripheral utilizations by the user. There are many protocols running over the network to facilitate various requests and services. In this analysis we considered few services and its related protocol for the observation and analysis. The following part of the paper provides more details on various protocols, services and reason for selection for this analysis.

2. SCOPE

SCT network infrastructure analysis for the effective teaching-learning and educational management services via observing the established and using network protocols such as Telnet, SMTP , IMAP ,DNS,ICMP, HTTP, NETBIOS in the hybrid network structure communication and data transformation.

3. SCT NETWORK

The following diagram show the Network architecture of SCT which connect three academic department and four non academic departments. This network provides Teaching- learning and educational management service over 3000 students and the faculties in the campus. This consist of LAN and the following technological configurations

SCT network is framed as three clusters to provide the educational services. For the effective administration and maintenance of this network services, the classification and cluster made in the department level. In this analysis, the SCT network structure and its laboratories' setup data communication and transformation architecture is adopted.

The SCT network architecture constructed with modern technological equipments such as cisco switches(Core Switch)-4503E, SAN-SWITCH-IBM-2005-16B, cisco-routers-1700,2800 series; Firewall-CISCO-ASA-5510, cisco IP phones encompass of CISCO-MCS-7800-KQGCY35-Pentium-D- 2.80GHz call manager. This also integrated with High end servers' such as HP Proliant-DL380 - GB8639NHPS-Xeon 3.4Ghz; IBM-3850-99B5265-Xeon-3.5GHz ; DVR- Proline- DVR-UK; SAN SWITCH- A device that routes data between servers and disk arrays in a storage area network . Its' 800 nodes are typically Conduit with UTP CAT-5, CAT-5E,CAT-6 and Fiber Channel switch made up of fiber multimode channels.

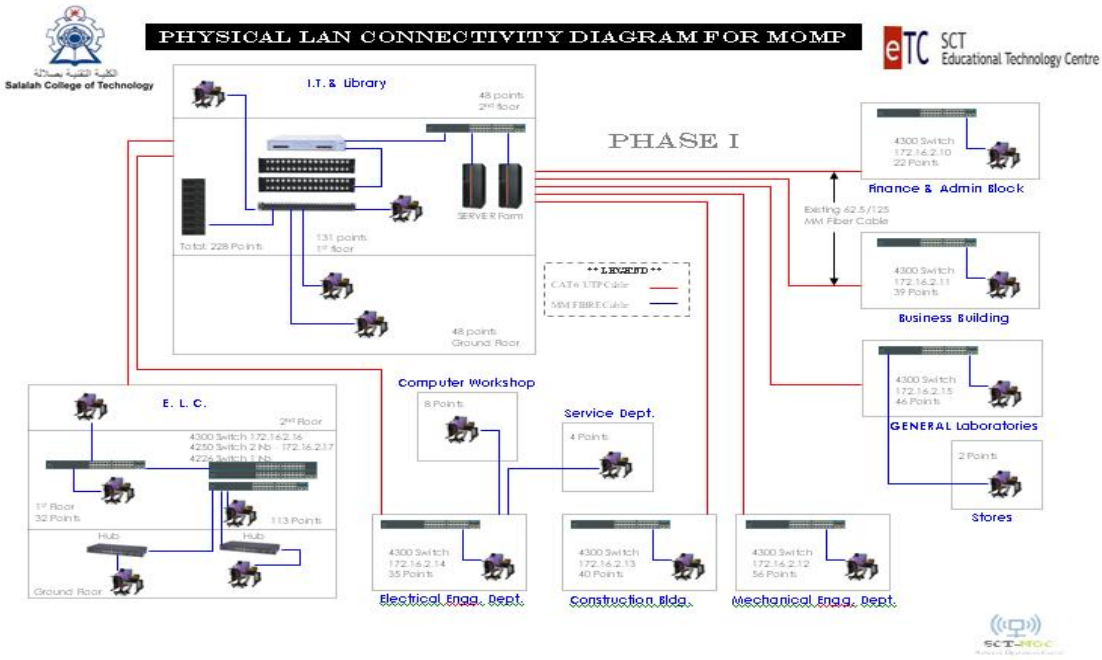


Figure 1. SCT network Architecture- IT

The established infrastructure integrated with wireless fidelity of various manufacturers. The network is enhanced with Video conferencing supported for inter and intra conferencing facility. The network connection also extended to reach oracle system of Ministry of Manpower via VPN extranet.

4. OBSERVATION TOOL

The SCT network is observed for its usage and service using PRTJ and Wireshark with following protocol and specified services. PRTG Network Monitor is the powerful network monitoring solution from Paessler AG. It ensures the availability of network components while also measuring traffic and usage. It saves costs by avoiding outages, optimizing connections, saving time and controlling service level agreements (SLAs)

Traffic behavior of SCT network

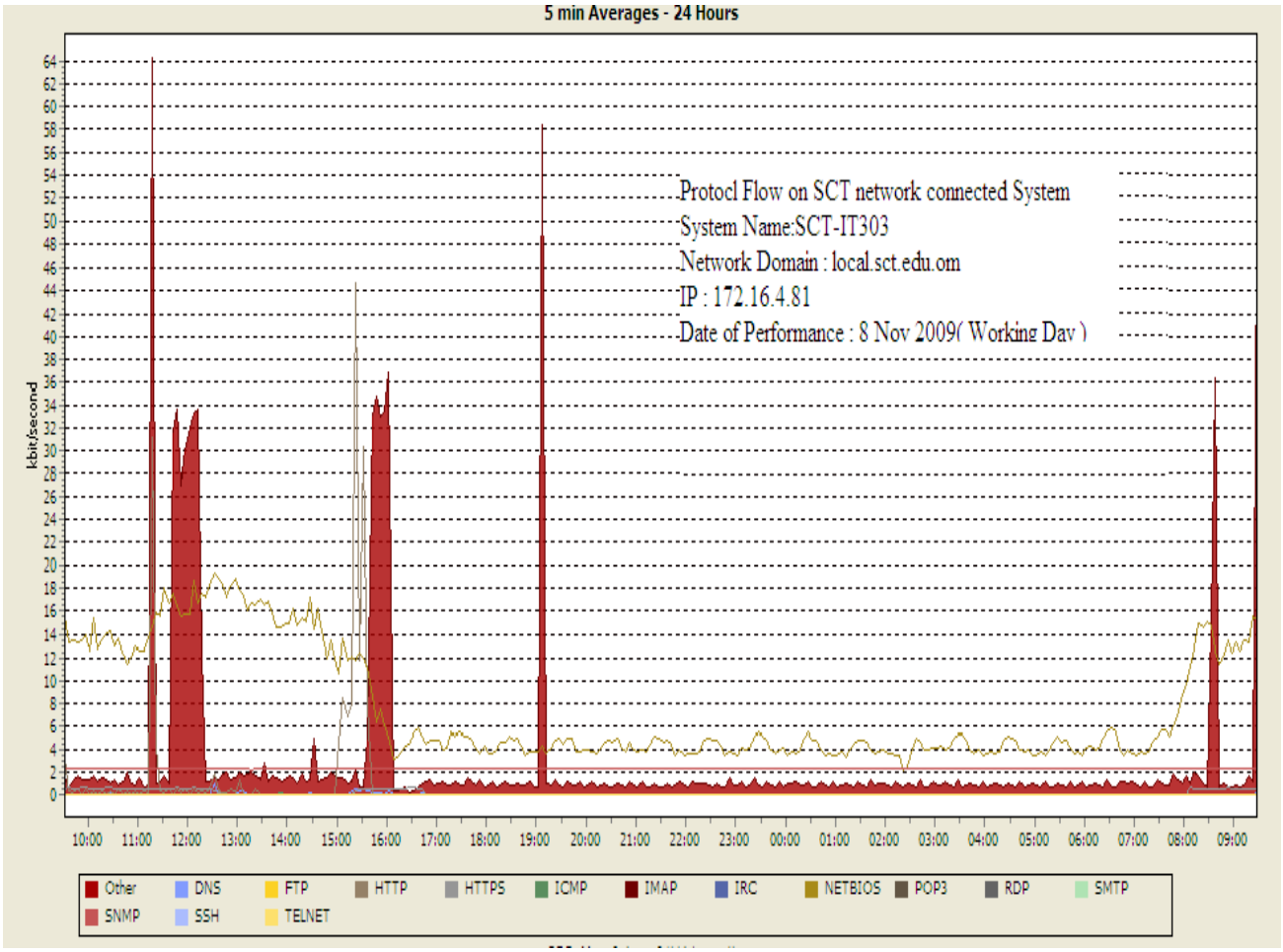
APPLICATION	TRAFFIC BEHAVIOR	QOS REQUIREMENT	DOMAIN SERVICES
Electronic Mail (SMTP) File Transfer (FTP) Remote Terminal (Telnet)	Traffic Behavior Small, batch file transfers	QoS Requirements Very tolerant of delay B/W requirement: low **Best effort**	Send Receive Mail ISASERVER ORACLESERVER
HTML Web Browsing	Series of small, bursty file xfer	Tolerant of moderate delay B/W requirement: varies **Best effort**	E-Learning Web Email IBMX385-WEBSERV
IP-based Voice (VoIP)	Constant or variable bit rate	Very sensitive to delay/jitter B/w requirement: low **Requires predictable delay/loss**	Campus communications
VPN	low variance	Low jitter, that is low variance of arrival of packet at the receiving station to provide a smooth data Transfer.	Communicate with Extranet for a specific domain

5. OBSERVATION AT SCT

The SCT network observed in two different juncture namely working and non working days . This observation made with the help of PRGT analyzer. During the observation the node and server gateway consider for observation in the educational network. The observation focused on the data communication and the data transformation in and between the network for the academic usage . In this performance mostly NETBIOS, SNMP, HTTPS, ICMP, DNS and HTTP protocols are used based on the academician request and their services.

6. RESULT AND INTERPRETATION

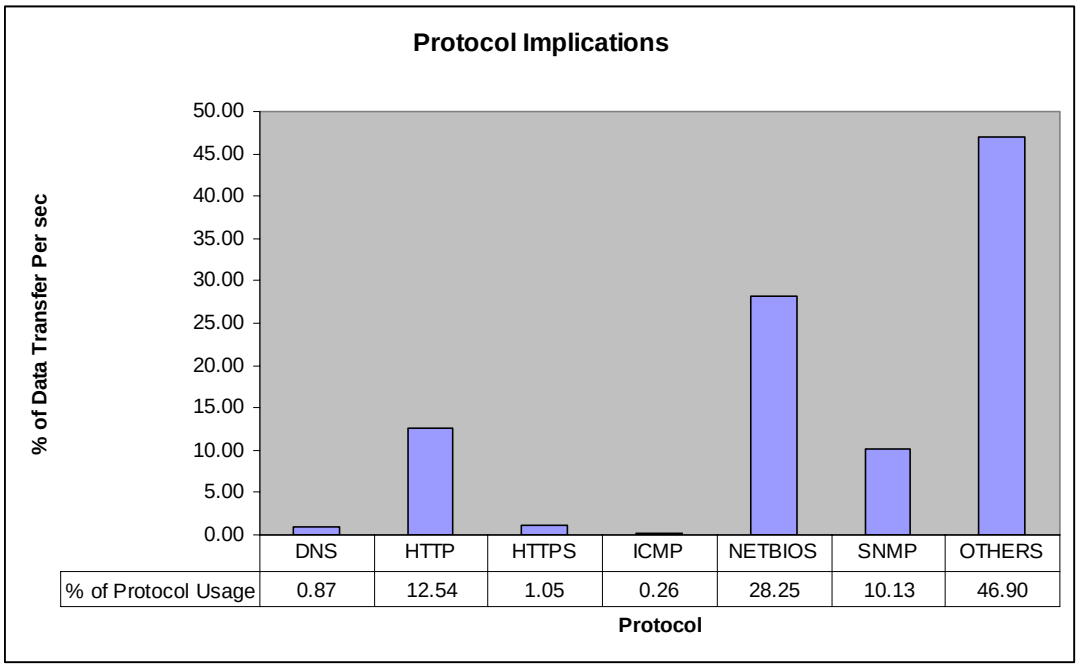
The following results are outcome of the observation from SCT network . The network performance of single node-SCT-IT 303 which is connected in the network observed. This system always connected via the router 172.16.0.31. The system high performance represented as a graph.



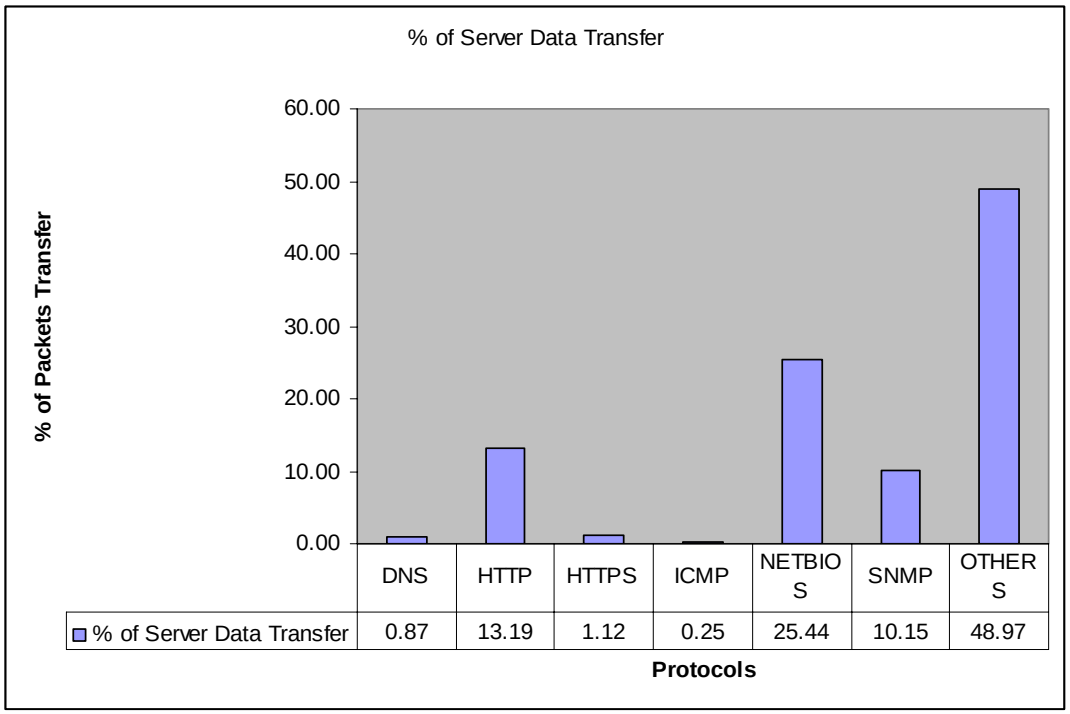
The maximum protocol and its packets transfer listed as a table. The NETBIOS protocol 19397 kb/s and HTTP 2265 kb/s are identified as high utilized protocol in the network.

TELNET: Max=0, Last=0 [kbit/second]
SSH: Max=0, Last=0 [kbit/second]
SNMP: Max=2.351, Last=2.3 [kbit/second]
SMTP: Max=0, Last=0 [kbit/second]
RDP: Max=0, Last=0 [kbit/second]
POP3: Max=0, Last=0 [kbit/second]
NETBIOS: Max=19.397, Last=15.241 [kbit/second]
IRC: Max=0, Last=0 [kbit/second]
IMAP: Max=0, Last=0 [kbit/second]
ICMP: Max=0.102, Last=0.057 [kbit/second]
HTTPS: Max=0.721, Last=0.563 [kbit/second]
HTTP: Max=44.65, Last=0 [kbit/second]
FTP: Max=0, Last=0 [kbit/second]
DNS: Max=0.921, Last=0.247 [kbit/second]
Other: Max=64.324, Last=48.859 [kbit/second]

The SCT 303 system data transfers observed and the pocket size transfer and the utilized protocols are represented as a graph. The individual system performance and the corresponding protocol represented below.



The data transfer observed in the connected server, the server CCC server used for all the communication. The DNS, HTTP, HTTPS, ICMP, NETBIOS, SNMP and OTHER protocols are observed. The percent of data transfer in all the protocol which is observed in the server system represented as in the following graph.

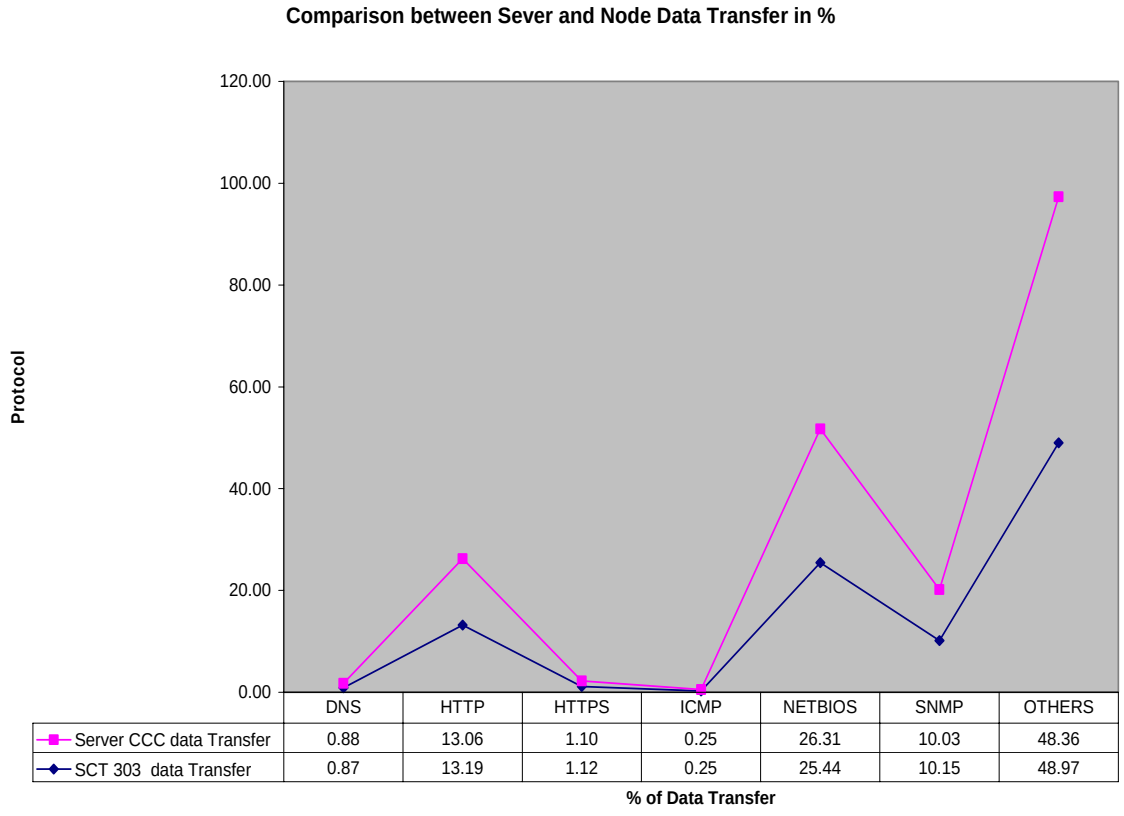


7. NOISE DETECTION OVER DATA TRANSFORMATION

In the observation NETBIOS and other protocol (voice) services between the server and the system differs one with another due to loss or collision of data. The percentage difference of data transfer consider as a factor to determine the collision and the loss. If the value of difference is negative its treated as a loss otherwise its treated as a collision. The sum of percentage of noise become zero because the packets are observed in other protocol of the network therefore its consider as a collision on the networks. The observation data as represented as a table below.

Data Transfer Analysis						
Protocol	**Total Size of Transfer**	**% of transfer - Server**	**% of transfer - Node**	**% Noise**	**Size of Noise**	**Remark**
DNS	13,336.50	0.87	0.88	-0.01	-11506.10	Loss
HTTP	201,201.98	13.19	13.06	0.13	201147.37	Collision
HTTPS	17,042.71	1.12	1.10	0.02	23642.91	Collision
ICMP	3,841.56	0.25	0.25	0.00	35.90	Collision
NETBIOS	388,156.52	25.44	26.31	-0.87	-1323837.83	Loss
SNMP	154,890.53	10.15	10.03	0.12	182107.79	Collision
OTHERS	747,128.66	48.97	48.36	0.61	928438.29	Collision
SUM	1,525,601.33	100.00	100.00	0.00	28.33	

The following graph constructed based on the values of difference between the protocol transfer percentages.



8. CONCLUSION

The network observations initiated for the usage of protocol in the network and identify the data transfer in and between the SCT network for better Quality of Services. As per the observation DNS, HTTP, HTTPS, ICMP, NETBIOS, SNMP and OTHER protocols are used for data transformation. Other protocol refers the voice transfer protocol. The values are observed and the noise and collisions are identified in the NETBIOS and DNS gained the loss remaining identified protocols gained the collision. This is an academic network, to provide the quality of Service in the academic network DNS, HTTP, HTTPS, ICMP, NETBIOS, SNMP protocols to be maintained and distributed properly along with its services. This work can be further extended for the observation and optimization of on line data transfer and E- learning process in Wide Area network at Oman.

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