International Journal of Advances in Engineering and Management (IJAEM)
Volume 5, Issue 8 Aug 2023, pp: 584-588 www.ijaem.net ISSN: 2395-5252

Observe and Prescription of Computer network Functioning

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Date of Submission: 15-08-2023 Date of Acceptance: 25-08-2023

ABSTRACT
Regardless of fast functioning improvements in the field of network technologies and their pervasiveness, today's computer-demanding and service-oriented applications require efficient management of networks. Besides monitoring collision, broadcast and errors, utilization functioning of a local commutated network was carried out by means of a software tool. Functioning was carried out at two different levels of artificially generated continuous workload and by varying workload caused by intensive use of network resources. In our experiments, the monitored network showed that it is resistant to collisions and errors, but also sensitive to workload dynamics characterized by utilization changes. These changes show certain regularity and periodicity and can be considered as a good behavior pattern of a network. The approach proposed enables prediction of accessibility of computer resources by their engagement in complex distributed computer environments.

I. INTRODUCTION

When we talk about computer intensive and timecriticalapplications, i.e. service-oriented applications andapplications on demand, special attention should be paid toefficient network management. The aforementioned isadditionally worsened by many users, their heterogeneity,service providers and network infrastructure.As to theseconditions, it is necessary to detect factors determiningnetwork performances and to have an overview ofperformance evaluation possibilities. All network performance modeling and evaluation tools,the most complete overview of real performances as well asprediction of performance patterns can be provided byoperational analysis. It can be used if network performancemonitoring is enabled by corresponding software andhardware tools which yield necessary experimental resultsreferring to the observed interval. Oneof the important performance indicators is definitelynetwork utilization.

II.NETWORK PERFORMANCE INDICATORS

Factors affecting network performance:

Network communication is limited byvarious factors, such as available bandwidth, networkcongestion, delay, server performance, and complexity ofthe protocol for network management. In addition to a greatnumber of network users, there are several factors which,when combined, test usability bounds of a traditional localarea network (LAN):

- Multitasking environment present in current operatingsystems enables concurrent network transactions.
- Intensive network applications such as theWorldWideWeb have also been used increasingly.
- Applications based on the client-server model do notrequire workstations to store information or to ensurespace on the hard disk for their storage.

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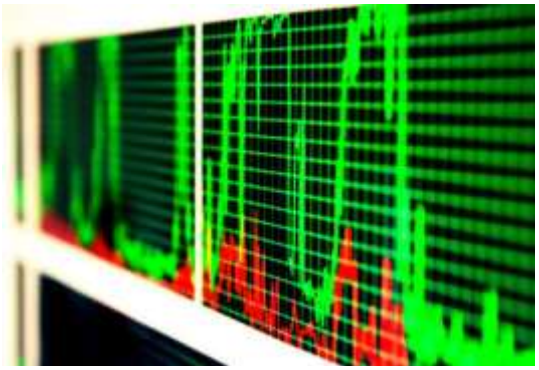
According to, such applications will be probably used moresignificantly, but in a more sophisticated form.



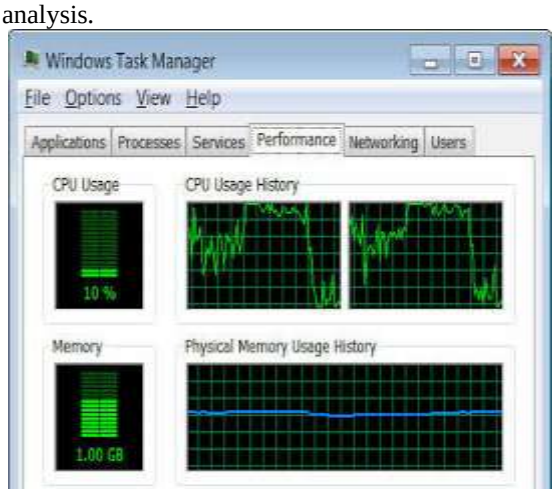
Performance of the LANcommon medium Ethernet/802.3 can be affected negativelyby many factors. Ethernet uses the carrier sense multipleaccess/collision detects (CSMA/CD) method described inand supports high transmission rates. The goal of theEthernet is to offer the best possible delivery services andenable all devices on the common media to have equalconditions referring to data transmission. Collisions takeplace regularly on the Ethernet networks and can become amajor problem.

III.NETWORK CONGESTION

A combination of powerful workstations and intensive network applications, i.e. usage of huge files, real-video, aswell as demanding multimedia applications in general, requires an increasingly greater network throughput. On theother hand, the number of network users is on the rise aswell. Network congestion is caused by an increase in thenumber of users using the network for sharing big files,access to file servers, and connection to the Internet. Theconsequences are increased response time, slowertransmissions of files, and thereby less productive networkusers. In order to reduce network congestion, what isnecessary is either a larger bandwidth or a more effectiveuse of the available bandwidth. Network efficiency isimproved significantly by monitoring and management ofits performance.

According to, computer architecture, operating system, database and LAN represent elements for improvement of efficiency of application execution. In caseof improper use, efficiency might be reduced. Computersystems based on decentralized, parallel and distributedarchitectures are constantly being designed and brought intouse. Computer system components are becoming morecomplex, and at the same time requests referring toreliability and availability are higher, as in.

The main types of modeling tools areanalytic, simulation, testbed and operational analysis.



Analytic modeling tools refer to a skill of describinga model by means of mathematical expressions. If thesystem can be considered as a set of queues by which servicedelivery time and waiting time may be defined analytically,then queuing analyses can be applied to problem solving.

Simulation implies that a real system model is shown bymeans of a certain programming language for simulationexecution. Simulations enable laboratory conditions forsystem testing without influencing the real system.Testbedsare used for studying system components and their mutualinteraction in order to reach the heart of the real system.

They are made of prototypes and parts of components of thereal system. This method is focused on a subset of the wholesystems. It might be used for the analysis of variouscomponents of networks. Compressionand simplification of the system are not important inoperational analysis, but rather getting information from thereal system. Analysis of this information provides a goodprojection of future behavior, i.e. system operation.

Operational analysis covers functioning and estimation ofthe real system. Functionings are carried out by usingsoftware and hardware monitoring devices. Hardwaremonitoring devices include probes and sensors, counters, aswell as devices for data display and recording. Softwaremonitoring records certain events and information about thesystem state. Analysis results can be used for improvingperformances and setting

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up new bounds of the system, i.e.for improvement of the existing system.

Selection criteria for modeling and evaluation tools:-

Selection of a more appropriate performanceevaluation method is directed by the following criteria:level of computer system development, limitation of timenecessary for analysis, hardware and software toolsavailability, possibility of a simple and completecomparison of various methods and costs of performanceanalysis. Due to its advantages described in [18], NetworkInspector, a software tool for network monitoring, isselected for utilization functioning and monitoring of thelocal network.

IV. TESTING ENVIRONMENT

Network Inspector

Network Inspector is aWindows application. In combination with Fluke Networksequipment it enables network monitoring, capacityplanning and error detection. The version used in thisresearch can enable an insight into the network as well as thestate of devices. It also generates network collisions,warnings and messages. Network Inspector consists of thefollowing components:

1. Which detects and analyzes informationabout network and subnetworks.
2.In which the Agent stores information aboutnetwork and devices.
3. Which enables the information from theselected database, as well as a general or detailedoverview of this information? It is possible to select adisplay of the problems that have emerged, devicesdetected on the network and information about aparticular device as well as local networks.Network Inspector can make the following reports: Top Interfaces by Collision Rate, Top Interfaces by BroadcastRate, Top Interfaces by Error Rate, Top Interfaces byAverage Utilization, Switch Performance, Details andProblem Log.Utilization is, according to, a measure ofeffective activity of the resources observed. A utilizationdiagram shows the percentage of available bandwidth usedon that port. Network Inspector generates a warning ifutilization crosses the warning threshold of 50 %. Also, ifthe error threshold is crossed (greater than 80 %), an errorreport is generated.

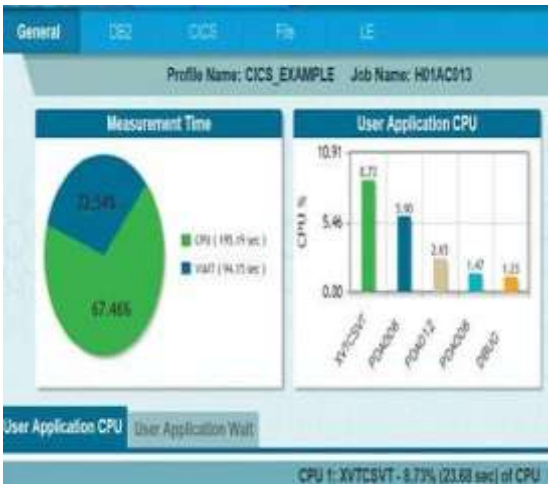
Cisco Catalyst 2950SX-24 commutator:-

Cisco Catalyst 2950SX-24 described in is acontrolled commutator with two permanent 1000BASE-Xascending connections, which enables users' connection. Itis very suitable for optical networks.Also, it is characterizedby increased redundancy and availability, as well asadequate commutator connection. For the Catalyst 2950series a Cisco Network Assistant is available, a freeapplication for centralized management which simplifiesadministration tasks referring to Cisco commutators,routers and wireless access points.

V. ANALYSIS OF EXPERIMENTAL RESULTS

Experimental environment

Functionings were carried out on a local network with20 desktop and mobile computers and two serversnetworked through a commutator. Computers arecharacterized by processors with clock frequency rangingfrom 1 5 to 2 8 GHz and RAM ranging from 512 MB to 2GB, and the MS Windows XP. Servers have the sameprocessor and capacity. All computers are networked bypreviously described Cisco Catalyst 2950SX-24commutator. Network monitoring is carried out by FlukeNetwork Inspector, which communicates with the Ciscocommutator. Traffic generator TfGen generatesincreased workload of the commutated LAN.



Two functioning's were carried out for 24 hours, asproposed in. Network behavior was monitored bycontinuous workload of 50 % and 80 % and usual networkworkload. Network utilization was measured on everypossible port on the commutator. In accordance withcapacities of the Network Inspector tool, results aredisplayed for ten ports with the greatest utilization.

Experiment by continuous workload

The first functioning started at 10:00 a.m. and endedat 10:00 a.m. next day. Continuous

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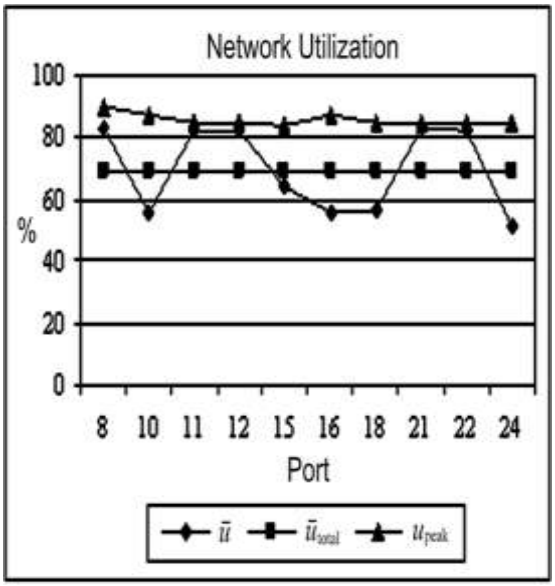
network workload of 80% is produced by a traffic generator TfGen, whereasadditional workload is achieved by searching the Internet,data transfer, video and audio streaming, and copying 4 GBimages from the server, similarly to.

In terms of generated and usual network traffic, thecommutator enables that computers receive the datasimultaneously from the preceding computer and transmitthem to the next computer. For the purpose of transmissionand reception of generated traffic 40 % of the bandwidthwas used, which combined gives continuous networkworkload of 80 % at every port with speed of 100 Mbps.After one day, Network Inspector reported us about 10 portswith the greatest network utilization.

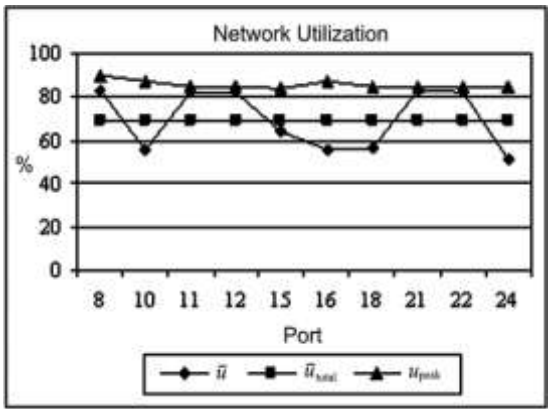


VI. CONCLUSION

Pervasive and rapid development of networktechnologies and computer systems needs preciseperformance monitoring, evaluation and control. This alsoimplies not only active network monitoring andmanagement by the administrator, but also a series ofprocedures related to autonomous network managementpossibly supported by hardware and software components.

That management was executed at operational,information, communication and functional level.

Operational analysis provides the best insight into networkperformance. Local commutated network utilization andother performance indicators were measured. Networkutilization and other parameters were measured in durationof 24 hours through two experiments. Workload wasgenerated by the traffic generator made by means ofsoftware. In the first and the second experiment continuousworkload was 80 % and 50 %, respectively. In addition tothat continuous workload, varying workload consisted ofvarious data transfers from the local server and the Internet.



By observing performance indicators we concludedthat the commutated network is not liable to errors,congestion and collision. Utilization at monitored portsindicates a possibility for determination of a utilization,performance and network capacity behavior patterns. For amore complete insight into network performance pattern, itis necessary to carry out functionings in a longer period oftime and observe seasonal changes. Network parameterpatterns provide important information which can initiateengagement of additional capacities of the observednetwork segment. In other words, intervals in which thenetwork is overloaded even without additional workload(low utilization) are proposed and no high performance is tobe expected from it. Current and further research deals withhigher network complexity, heterogeneity and dynamics. Itis targeted to inclusion of non-dedicated computers andwireless network resources in computational clusters andgrid infrastructure.

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