Congestion control and traffic management

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Abstract

By using a monitoring network software called "OBSERVER" [16] it will be shown a simulation of a congested network will be shown. This simulation software will guide the user on how to control the congestion. The other software called "CommTraffic 2.1"[17] will show a real time congestion inside a network. This software has three main networking tools that will be used; the first one is a *port scanner which* is a tool that is capable of finding the possible open systems inside a network. The other tool is a *package sender* which sends data packets to a predefined system. The third tool is a transmission analyzer. Its main objective is to determine what kind of congestion took place in order for the user to use a specific technique. This software will alert the user when the network is under critical congestion by sounding an alarm. This alarm will be activated as soon as the packets limits are exceeded.
This software will show the systems inside the network by specifying the transmission speed of each one and whether the system could be in danger or not of a possible congestion.

Different techniques that can be used to slow down a congestion (depending on the flaw) will be proven both theoretically and practically.

Keywords:

Observer, "   ", Port scanner, package sender, transmission analyzer.

1. Introduction

In today's fast paced technology, internet usage increases day by day. The unpredictable and stochastic nature of the traffic demands, lead to congestion. "Congestion is nothing but the degradation of the overall performance of the network" [2] when the subnet is dumped with too many packets. If congestion takes place, then buffer runoff occurs, leading to cell loss. So, it is essential to have congestion control for the network users to get the Quality of Service (QoS).
It is essential to know the techniques in order to see under which characteristics and situations they are detectable or treatable Inside the different techniques, we'll find some more advanced than others, like for example *the back pressure,* "which uses an old method to decrease the congestion" **[8]**. It's a bit old because it has to wait for the congestion to be critical in order to respond to it. On the other hand, we have the "*forwarded explicit signal*" **[14]** which is an efficient technique because it uses a package that first tells the node to slowdown the exit of packages.
We can also find "*The traffic management"* **[17]** which consist in a package of techniques that tries to block the congestion inside the network. An example of this technique is **Impartiality** and **Reserves.** These techniques try to show the priority that some applications should have and others shouldn't.

2. Congestion Control

In order to solve the above problem of congestion, it is necessary to help the subnet carries the presented amount of load on the network. The result is a development of a scheme called the congestion control, which assists in proper delivery of packets across the network. The contemporary works on congestion control enveloping the entire gamut, including congestion control in ATM, TCP/IP networks, Frame Relays, and TCP congestion control schemes in Internet.
Congestion is a dynamic problem. A particular scheme of congestion control is not suitable for all of the conditions.

¨Congestion Control occurs when the number of packages transmitted inside a network, start to reach the capacity limit" **[10]**.

Therefore, the main objective is to maintain the number of packages below the limit, so that the congestion can't take place.

Possible solutions:

- Get rid of the packages that don't have memory space.
- The node can use a flow control method in order to slow down the traffic.

Network's ideal functioning:

- Unlimited temporal memory (see figure 2).
- There is no associated cost to the transmission of packages and the congestion control.

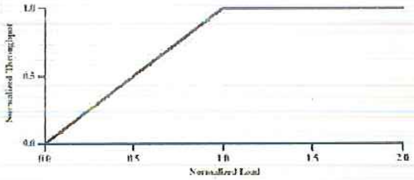

Fig. 1 Graphic of an ideal transmission [3]

The transmission boosts a first congestion and then it normalizes by it keeping it constant.

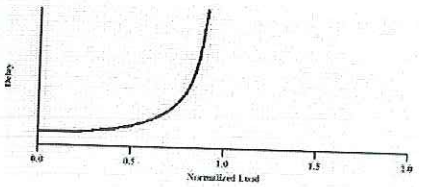

Fig 2 Graphic of an ideal delay [3]

This is an ideal delay of a network between two nodes where the packet flow boosts up and controls the congestion.

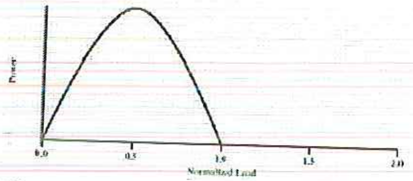

Fig 3 graphic of an ideal congestion control [3]

This graphic shows when the node is congested and how the congestion techniques react and control the overflow.

Network's real functioning:

- Limited temporal memory.
- The control congestion consumes network capacity in the signal control interchange.

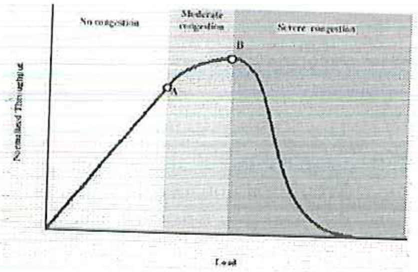

Fig. 4 Graphic of Congestion without control [3]

This graphic shows the real instability of a network when congestion occurs.

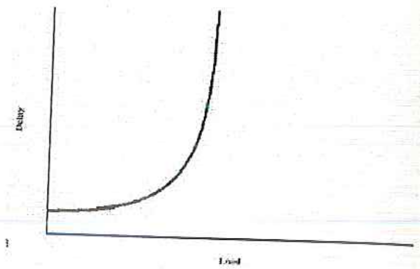

Fig. 5 Graphic of delay of packages [3]

2.1 Back pressure

It describes a technique of congestion control of packages inside a network. This technique was designed to slow down data congestion.

This technique is based on the congestion produced when too many data packages congest (see FIG 6). When the host tries to transmit them to a local node, these packages get stuck and, therefore, we obtain a slow transmission speed. This is where the counter pressure takes place and stops the flow of these packages and returns them to their original node (host).

"These techniques basically try to free the network transmission flow" **[13]**

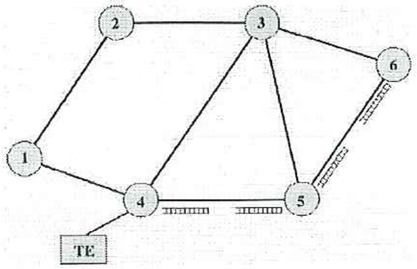

Fig. 6 Graphic of a back pressure technique [3]

"The congestion is dispersed within the nodes until it enters in the original node" [7].

Characteristics:

- It is used in logic connections.
- It is applied to linked levels.
- It is often applied to a high traffic flow connection.
- It is applied to a connection networking (package commutation network x.25).
- Useless in ATM networks.

2.2 Obstruction packages

An obstruction package is a control congestion technique, but different from the back pressure, for this technique involves a congested node that sends a package to the original node in order to reduce the traffic flow. "This package (source quench) can be sent by a router or a final system (final node). This way, the transmitting speed slows down until it stops receiving these packages" **[2]** because it's in that moment when the system understands that the connection is not congested and resumes its usual speed. These techniques are rustic because they have to reach a limit in order to show that a congestion has taken place in the system

2.3 Implicit congestion signal

"It is called implicit because it is a technique in which the same original system detects the delay that has been incremented" **[18]**. Therefore, the rejection of these packages is sent, and it is here where the original system infers that the network is congested. It then accomplishes its main objective, which is to drop down the data flow in order to ease the congestion.

In this case, when the congestion has taken place, these two factors can occur:

- A delay in the original system to the final system.
- Increase when it reaches a level higher than the predetermined one.
- Both packages can be rejected.

"This technique is not effective for non oriented connections, configurations, commutation package networks and IP networks. And also the ATM network "**[20]**

2.4 Explicit congestion signal

The primary objective of this technique is to react to any network congestion in a faster way .It can do this, either by the primary node or secondary node by alerting between each other that the network has increased the congestion. This process can be done by two sub techniques which, respectively, are divided into three major categories.

2.4.1 Forward

In this situation, the final system is informed that the exit of packages should be controlled in order to slow down the congestion from the same place where this notification was received. "This notification tries to inform the system that the package has encountered network traffic and that, due to this, the transmission speed must slow down" **[20]**..
This notification can be sent by a control package or an altered bits package. In some cases, the final system resends an ¨eco¨ to the primary node.

2.4.2 Backward

As the word indicates, it is contrary to the forward technique. In this case, the primary system is informed that it needs to control the exit of packages. This information is received contrary to where it is receiving the packages so that the congestion can be slowed down. "This notification is sent by a control package or by an altered bits package". **[6]** At the top of this package, is the address of the primary system that has to be controlled.

These two techniques can be divided into 3 sub categories:

2.4.3 Based on Speed

"Each primary system has a predefined speed connection (theoretically) this is how the system can only transmit data under a certain limit" **[21]**.. Therefore, in order to control any kind of congestion produced in the network, a congested node sends a package to the primary system, producing a low speed transmission, which will be found within a predefined limit.

Characteristics:

- This technique can be done by any node within the network
- A limit transmission of packets is set up for the node sender.

2.4.4 Based on Credit

It is a credit given to the primary system where it shows the maximum amount of packages that the system can transmit. "When this credit reaches the limit, the primary system must wait until its credit is reopened in order to begin a transmission" **[13]**. This technique is often used by ATM networks which work with a LAPF protocol that goes from a point to point link. In this special case, the secondary system has a counter that carries the credit of the primary system so that it doesn't produce an overload of packages.

Characteristics:

- Credits (packets) are given to the original node.

- When credits are overloaded, transmissions are suspended.
- Used in point to point flow controls.

2.4.5 Binary

"It is when a node activates a bit so that the primary system can detect from where it received the signal" **[12]**, there may exist a congestion and therefore it should slow down the traffic.

Characteristics:

- Uses altered bits.
- The original node reduces the flow after receiving the notification.

3.0 Traffic Management

¨Congestion management features allows you to control congestion by determining the order in which the packets are sent out. Congestion management entails the creation of queues, assignment of packets to those queues based on the classification of the packet, and scheduling of the packets in a queue for transmission". **[7]** The congestion management QoS feature offers four types of queuing protocols, which allow you to specify the creation of a different number of queues, offering greater or lesser degrees of differentiation of traffic. One can also specify the order in which that traffic was sent.

3.1 Impartiality

"When the congestion occurs in the network, the transmission speed must slow down because the traffic of all data is increased in time lapses" **[9]**. In some cases, these time lapses can be shown in microseconds and in other cases, when the congestion is critical, a package loss can occur.

3.2 Service Quality

It's just about giving priority, depending on the kind of application to be transferred. For example, the risk is higher to upload a file with an extension mp3 transmission, but it is less probable to loose data. On the other hand, an email is less probable to produce traffic but more probable to loose data.
Therefore, "the priority should be based upon the traffic and not the application". **[11]** In this form, the node can give a priority depending on the application.

3.3 Reserves

"In order to control the congestion, this technique tries to avoid the congestion and at the same time to provide the best service" **[5]**. This technique is used in ATM networks.
The purpose is to have a relation between NETWORK AND SYSTEM where all the criteria is specified like the connection speed and the quantity of packages that are going to be sent) .This is where the transmission always stays within certain limits. If, at anytime, these boundaries are broken, the system can choose whether to reject the packages or not.

4 Methodology

For the development of this project we had follow an empiric and qualitative methodology. This experiment was probed and installed in each of the authors' personal computers and the telecommunications laboratory of UNAB.

4.1 Simulation

This simulation consists in constructing a network between two personal computers in which one of them will be the server and the other the client. We will then proceed to send info packages between them in order to analyze the info charts and decide which of the studied cases took place, and see if the theory was exact to that of the practice.

5 Results

Real cases where introduced in the laboratory where the network started to experience a congestion.

The software (Observer), demonstrated that the network started to experience congestion and slowness in the transmission speed when the packages exceeded the 100 limit in the network (see figure 7).

It was verified that the best technique to use for a congestion was the implicit congestion signal, because it showed that the results were less damaging for the network. This technique is the most accurate for a fast detecting congestion.

Software Tools for Network Analysis

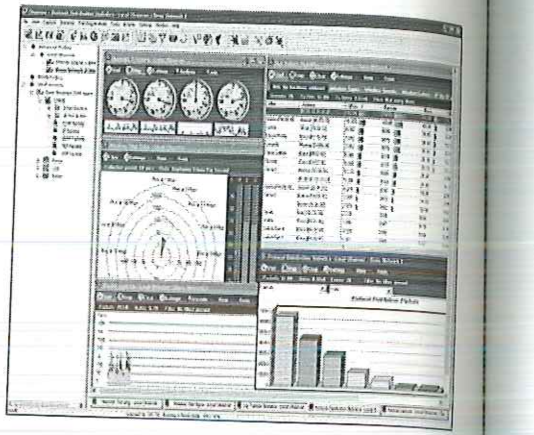

Fig. 7 simulation of packet transmission in observer [16].

Here we can see how the packets start to overflow in the network because of the limit overflow.

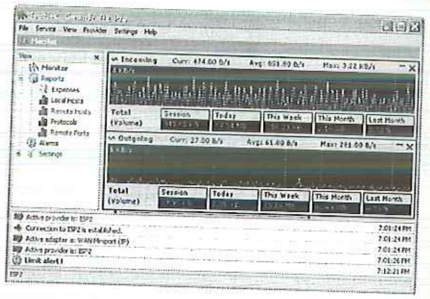

Fig 8 Commtraffic tool [24].

This figure shows how the incoming and outgoing packets are controlled.

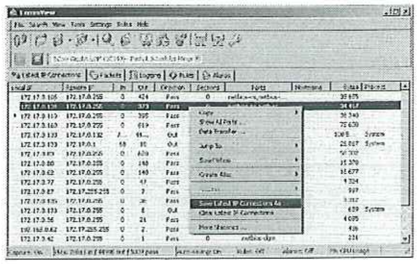

Fig 9 Commview tool [25]

This figure shows the window where all the IPs that are inside the flow control and congestion control techniques, administrated by the software inside the network.

6 Conclusions

It was verified and proven that a network has to use these techniques in order to have normal transmissions. There are many software for monitoring networks and these are tools for avoiding congested networks.

With respect to the Essential NetTools a local net diagnostic was obtained. The state of listening, the port and its service, and the remote IP for each conection was observed.

Information of the data processing of the net was gathered by the CommTraffic software. This was demonstrated by a traffic graphic showing both the incoming and outcoming traffic.

The internet deportment within the Lan net was monitored by the CommView software. The net packets and the velocity transference of these was captured. The logs were stored on order to later be analized in a more detailed manner.

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