A Theoretical Concept for Improving Network Routing Using Communicating Packets and an Intelligent Network

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***Abstract*—Networks are complicated meshes of wireless and wired links and most of the times these links are disconnected due to some fault or simply the link fails due to congestion in the network. These networks are generally used only for sending packets, which are nothing but the basic communication units or units of data sent from one computer or from one terminal to another. This paper demonstrates an entirely new type of packets, which help in improving the efficiency of routing these packets over the network. A theoretical concept for allowing to packets to communicate with each other in the network itself has also been used. Just by using some small extra set of protocols the probability of the packet reaching the destination is increased drastically. This paper explains in detail the working of such protocols. This paper also provides the hypothesis of an intelligent network.**

***Index Terms*—Networks, Packets, Collisions, Optimal Routing, Router, Intelligent Network, Packet Communication, Protocols, TCP, terminal, links, nodes, ant colonization, IP, congestion**

I. INTRODUCTION

Networking today implements a lot of protocols for the proper functioning of the networks yet even with all these protocols the sending of packets fail deterministically if the packet is being sent through a congested or a faulty network and there is an alternate good path available. For e.g. TCP keeps sending packets if collisions take or if the packets have not been send successfully even if in a similar situation if an alternate route is present that could take the packet to its destination. This paper provides a protocol that solves this particular problem and provides a chance for the packets to choose an alternate route to reach their destination. This paper provides an intelligent network that can be used by any terminal as most of the protocol implementation is done over the network itself. We provide this intelligent network with the help of a few basic concepts like the train concept in which compartments linked together follow the same path. Also the traditional structure of the packets should be changed to implement these protocols. With the help of these new packets and a mechanism to provide communication between these packets and with the help of the ant concept a intelligent network can be formed that provides some intelligence in the network to provide efficient routing of packets.

II. PREREQUISITE INFORMATION

A. Packet Structure

i) Traditional Packet Structure:

The traditional packet structure for an IPv4 structure has always had two different sections one is the header section, which consists of the source IP address, the destination IP address, the version, the protocol used along with the time to live etc. and along with it the packet also contain the data section that is used to contain the data that is to be transmitted using the packets. In the traditional packet structure the header part completely takes care of the routing part of the packet and the data part is routed along with it and once the destination is reached then the data part is transmits the data.

ii) New Packet Structure:

This new packet structure will have an addition to traditional packet structure. This new packet will consist of three sections namely the header section, the data section and the path section. In this the previous two sections are similar to the traditional packet structure and provide the same functionalities. However the path section consists of the IP address of the second last hop point that the packet had visited and also the last hop point. This is essential as this is the part of the packet that is going to be communicated between the packets over the network. The entire communication part is explained later in the paper

B. Division of packets

The packets are generally sent as one whole compartment with both the sections wrapped up in one neat package. However to implement an intelligent network the packet needs to be divided according to its sections. In this way selective communications can be facilitated. In this division the lead compartment will be the path section, followed by the header section and then by the data section. These compartments will follow each other over the network using the ant colonization technique in which the path compartment will leave bit trails that are going to be followed by the other two compartments. The path section is shown below:

TABLE I.
THE PATH SECTION OF THE HEADER.

Last Hop Point – 4 Bytes	Second Last Hop Point - 4 Bytes	7 Bit Trail to be followed by Header	Exchange Bit

The header section will include 1 byte extra, which is nothing but the 7-bit trail of the path section along with its own extra bit to create a new trail for the data section.

The data section will include an extra byte to encode the bit trail that is going to be left by the header section.

Therefore a total of 11 bytes will be added to every packet.

Thus in the new protocols the new packets are implemented as mentioned above.

III. THE INTELLIGENT NETWORK

A. The Collision Concept

In traditional networks the occurrence of collisions decrease the efficiency of the networks as it results in garbage data, which makes no sense. However in the new protocols the entire concept of collisions is changed. In these new protocols collisions are actually favored, as in these collisions instead of production of garbage data it will actually exchange some data.

In these new protocols during a collision between two packets the path section of both those packets will be exchanged. This facilitates a lot of things and this is the primary concept behind the intelligent network. The exchange can be simply facilitated by just exchanging the IP bytes of each of the packets.

The advantage of this exchange is that each of the packets knows the at least the partial path that the other packet has taken to reach that link. This provides the packet with an alternate route to reach its destination. This is especially beneficial in cases when the path that the packet was following previously is broken or congested. In such cases this alternate path can be taken by the packet to reach the destination. For e.g. refer the diagram below.

In the figure given below the red router is the faulty router and it is a part of path one. If in normal circumstance the packet was to follow its normal path of path 1 without any kind of collision then the packet is sure to be lost till the router is ready and working normally again. However if collision took place then the IP addresses contained in the path section of the packet would be exchanged i.e. packet one contains 0 as the last router and the second last router IP address is null, however packet 2 consists of 1 as the last router address and 6 as the second last router's address and once exchanged the packet 1 will have 6 as the second last routers IP and exchange bit as one. So as soon as packet 1 reaches router 1 the router will check the exchange bit and as it is one the packet will be directly routed to the router 6 i.e. the IP in the second last router section of the path field.

Hence the exchange provided packet 1 with an alternate route to reach its destination that is terminal 2.

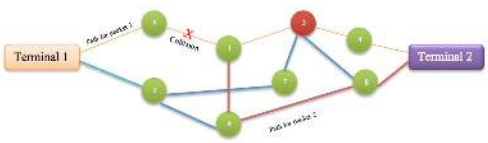

Figure 1. A Sample Example Network

IV. THE ENTIRE PROCESS IN A GIST

This section explains all the entire process by first giving the general working and then the case wise protocol implementation.

A. The general process and the general protocols

In the intelligent network when the packet is first sent the path section consists of the null value for the last hop point and the second last hop point. It consists of the bit trail encoded into it and the header section is filled as usual with the inclusion of the seven bit trail of the path section and an extra bit to set a bit trail for the data section and the data section is filled with the data and the bit trail of the header section.

Then the packet is put onto the network and pushed towards the first router that is the gateway router for that particular network.

The general procedure that takes place in a router is that the router first moves the last IP hop field in path to the second last IP hop and stamps its own IP in the last IP hop field. In case of a collision exchange the router behaves a bit differently. It first checks the exchange bit of the path section. If it is one then the packet is immediately routed to the IP of the second hop and stamps it's own IP in the last hop IP field.

If a collision takes place then the last IP hop and the second last IP hop are exchanged and the exchange bit is set to one.

i) Case 1 – Normal Network Status

In case of normal network status the general procedure is implemented with the protocols explained above. If collisions take place and the packet is led astray from its normal path then a small latency may be introduced into the networks, however it is a very small tradeoff and the chances of that latency being introduces are very slight.

ii) Case 2 - Faulty Network Status

In case of a faulty network if no collision takes place in the link before the faulty area and no alternate path is found then the packet is definitely lost and the TCP protocols have to be implemented. But if the collisions take place then the general procedure is implemented with its protocols. With consistent resending of packets the chance of a collision and finding an alternate path increases tremendously hence it provides a significant chance of the packet reaching the destination.

Note: Along with the above-mentioned protocols the already existing protocols are also implemented so as to provide the aspect that the network can never be degraded, it will either remain the same or it will improve the network.

V. CONCLUSION

These types of intelligent networks strive to be as close as possible to the close networks. This helps in bringing a lot of advantages primarily it gives assurance that the packet will reach the destination in cases of collision and

provides a significant chance that the packet will reach the destination in cases of congestion and router failures with the help of TCP and the above mentioned protocols. Such types of networks drastically reduce the network latency in transferring the packet to the destination for a simple tradeoff of introducing 11 extra bytes in every packet and a small piece of software installed in the routers to implement the above-mentioned protocols. This theoretical concept helps the network to be more efficient and reduces the chances of congestion too. We are moving to a smarter world every day and crucial aspects of our lives such as networks that provide us with the connectivity must grow smart too for us to move to the ultimate goal of a smart and a healthy planet.

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