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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53 (c).

INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Sanchaita	Datta	Salt Lake City, Utah
Bhaskar	Ragula	Salt Lake City, Utah

☐ *Additional inventors are being named on the ___ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (280 characters max)

TOOLS AND TECHNIQUES FOR DIRECTING PACKETS OVER DISPARATE NETWORKS

CORRESPONDENCE ADDRESS

Direct all correspondence to:

☐ Customer Number 23484 → *Type Customer Number here*

OR

☐ Firm *or* Individual Name	John W L. Ogilvie				
Address	Computer Law++				
Address	1211 East Yale Avenue				
City	Salt Lake City	State	Utah	ZIP	84105
Country	USA	Telephone	801-582-2724	Fax	801-583-1984

ENCLOSED APPLICATION PARTS *(check all that apply)*

- [X] Specification *Number of Pages* 6
- [ ] Small Entity Statement
- [X] Drawing(s) *Number of Sheets* 2
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Respectfully submitted,

SIGNATURE _____

TYPED or PRINTED NAME John W L. Ogilvie

TELEPHONE 801-582-2724

Date 2/8/02 (8 Feb 2002)

REGISTRATION NO *(if appropriate)* 37,987

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PATENT APPLICATION
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UNITED STATES
PROVISIONAL PATENT APPLICATION

OF

SANCHAITA DATTA AND RAGULA BHASKAR

FOR

TOOLS AND TECHNIQUES FOR DIRECTING PACKETS OVER DISPARATE NETWORKS

CERTIFICATE OF MAILING UNDER 37 CFR 1.10

I hereby certify that the correspondence listed below is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on February 8, 2002 addressed to the Commissioner for Patents, Box Provisional Patent Application, P.O. Box 2327, Arlington, VA 22202:

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The present invention provides methods and devices for combining frame relay/point-to-point WANs and VPNs, to obtain greater reliability and permit additional load-balancing.

Organizations have used frame relay networks and point-to-point leased line networks for interconnecting geographically dispersed offices or locations. These networks have been implemented in the past and are currently in use for interoffice communication, data exchange and file sharing. These networks tend to be expensive. Also, there are few options for reliability and redundancy. As the data communication becomes critical to the day-to-day operation and functioning of the organization, the need for lower cost alternatives for redundant back-up for wide area networks becomes important.

Internet-based communication solutions such as Virtual Private Networks (VPNs) and Secure Sockets Layer (SSL) offer alternatives to frame relay and point-to-point leased line networks. These solutions are advantageous in the flexibility and choice they offer in cost, in service providers, and in vendors. Accordingly, some organizations have a frame relay (FR) or leased line connection (a.k.a. point-to-point or P-to-P) for intranet communication and a connection for accessing the Internet (Figure 1).

Organizations are still looking for better ways to use Internet-based redundant connections to backup the primary FR networks. Also, organizations wanting to change from FR and P-to-P solutions to Internet-based solutions currently do not have the option of transitioning in a staged manner. They have to decide between the two solutions and deploy the solution in the entire network in one step. This is a barrier for deployment of Internet-based solutions, since an existing working network would be replaced by a yet-untested new network. Also, for organizations with several geographically distributed locations a single step conversion is very complex. Some organizations may want a redundant Internet-based backup between a few locations while maintaining the FR network for the entire organization.

The present invention allows FR and VPN wide area networks to co-exist for redundancy as well as for transitioning from FR/P-to-P to Internet-based solutions in a staged manner. The present invention allows configurations which use both WAN

connections with the data traffic being load-balanced across the two connections, as well as configurations which use one of the WANs as a backup for use in case the primary connection through the other WAN fails.

The network topology for one embodiment of the invention is shown in Figure 2. In this topology the three locations are connected to each other via a FR or leased line network. All three locations are connected via a FR network. Locations 1 and 2 are also connected to each other via a VPN connection; VPN tunnels are established between locations 1 & 2 in the VPN pairs Line 1 to Line 3 and Line 2 to Line 3. There can be only one VPN tunnel between Location 1 and 2 as well. There is no VPN connection between locations 3 and either location 1 or location 2.

Therefore, locations 1, 2, and 3 can communicate with each other over the FR network, and locations 1 & 2 can communicate over the VPN connection as well. Communication between locations 1 and 3 and between locations 2 and 3 can take place over the FR network only. Communication between location 1 and 2 can take place over FR, or the lines 1 and 3 pair, or the lines 2 and 3 pair. When the source and destination IP address pairs are the same between locations 1 and 2 but different types of networks connect those locations, a traffic routing decision that selects between network types cannot be made with an existing commercially available device. By contrast, the invention allows an organization to deploy an Internet-based solution between locations 1 & 2 while maintaining the FR network between locations 1, 2, and 3, and to select between the Internet and the FR network on a packet-by-packet basis.

Let us look at the operation of the device at location 1. The device examines the IP data traffic through it and makes determinations like the following:

1. Is the traffic destined for Internet? If so, send the traffic over the Internet using lines 1 and/or 2. Load balancing decisions can be based on criteria such as the load of a given network, router, or connection relative to other networks, routers, or connections, to be performed dynamically in response to actual traffic. Load-balancing may be done through a round-robin algorithm which places the next packet on the next available line, or it may involve more complex algorithms that attempt to measure and track the throughput, latency, and/or other performance characteristics of a given link or path element. Load-balancing is preferably done on a per-line basis, as

opposed to prior approaches that use a per-department and/or per-router basis for dividing traffic. Load-balancing algorithms in general are well understood, although their application in the context of the present invention is believed to be new.

2. Is the traffic destined for location 2? If so, then there are three paths to location 2: the Frame Relay line, line 3, or line 4. The invention then decides whether the three connections are in load-balance mode or on-failure backup mode or a combination thereof. For a load-balance mode, it chooses the communication line based on load-balancing criteria. For backup mode, it chooses the communication line that is either the preferred line or (if the preferred line is down) the currently functional (backup) line.
3. Is the traffic destined for location 3? If so, then send the traffic on the Frame Relay line.

Now let us look at the operation of the device at location 2. The device examines the IP data traffic through it and makes determinations like the following:

4. Is the traffic destined for Internet? If so, send the traffic over the Internet lines (line 3 and/or line 4). Load balancing decisions are based on the criteria described above.
5. Is the traffic destined for location 1? If so, then there are two paths to location 1: the Frame Relay line, or line 3. The invention then decides whether the two connections are in load-balance or on-failure backup mode, and chooses line(s) accordingly as discussed above.
6. Is the traffic destined for location 3? If so, then send the traffic on the Frame Relay line.

To operate as discussed herein, the invention uses information about the IP address ranges in the locations as input data. For instance, a packet destined for the Internet is one whose destination address is not in any of the address ranges of the known locations (e.g., locations 1, 2, 3 in the example above are known locations). In some configurations, this is the same as saying that a packet destined for the Internet is one whose address is not in the address range of any of the organization's locations. However, although all the known locations may belong to a single organization, that is not necessary to use the invention since known locations may belong to multiple

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