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11/24/97

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Atty. Docket No. 17814-5.20

"Express Mail" Label No. EM 284 724 908US

Date of Deposit November 24, 1997

**PATENT APPLICATION**  
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Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:  
Transmitted herewith for filing is the  patent application,  
 design patent application,  continuation-in-part patent application of

Inventor(s): Robert L. Packer  
For: SYSTEM FOR MANAGING FLOW BANDWIDTH

UTILIZATION AT NETWORK, TRANSPORT AND APPLICATION LAYERS IN STORE AND FORWARD NETWORK

This application claims priority from each of the following Application Nos./filing dates:  
60/032,485 /12/09/96; \_\_\_\_\_; \_\_\_\_\_

By John P. Bein

Please amend this application by adding the following before the first sentence: --This application claims the benefit of U.S. Provisional Application No. 60/032,485, filed December 9, 1996, the disclosure of which is incorporated by reference.--

Enclosed are:

- 20 sheet(s) of  formal  informal drawing(s).
- An assignment of the invention to Packeteer, Inc.
- A  signed  unsigned Declaration & Power of Attorney.
- A  signed  unsigned Declaration.
- A Power of Attorney by Assignee with Certificate Under 37 C.F.R. Section 3.73(b).
- A verified statement to establish small entity status under 37 CFR 1.9 and 37 CFR 1.27  is enclosed  was filed in the earliest of the above-identified patent application(s).
- A certified copy of a \_\_\_\_\_ application.
- Appendices A-D
- A petition to extend time to respond in the parent application of this continuation-in-part application.
- The filing fee has been calculated as shown below:

	(Col. 1)	(Col. 2)
FOR:	NO. FILED	NO. EXTRA
BASIC FEE		
TOTAL CLAIMS	26 -20=	6
INDEP CLAIMS	5 -3=	2
<input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENTED		

SMALL ENTITY		OR	OTHER THAN A SMALL ENTITY	
RATE	FEE		RATE	FEE
	\$395	OR		\$790
6 x11=	\$ 66	OR	x22=	\$
2 x41=	\$ 82	OR	x82=	\$
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TOTAL	\$543	OR	TOTAL	\$

\* If the difference in Col. 1 is less than zero, enter "0" in Col. 2

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- Filing fee \$480.00
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A check for \$ \_\_\_\_\_ is enclosed.  
2 extra copies of this sheet are enclosed.

Respectfully submitted,  
TOWNSEND and TOWNSEND and CREW LLP  
Paul A. Durdik  
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Patent Attorney

Telephone:

PATENT APPLICATION

SYSTEM FOR MANAGING FLOW BANDWIDTH UTILIZATION AT NETWORK, TRANSPORT AND APPLICATION LAYERS IN STORE AND FORWARD NETWORK

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5           **SYSTEM FOR MANAGING FLOW BANDWIDTH UTILIZATION AT  
NETWORK, TRANSPORT AND APPLICATION LAYERS IN STORE  
AND FORWARD NETWORK**

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15           **CROSS-REFERENCE TO RELATED APPLICATIONS**

20           The following related commonly-owned copending application is being  
filed concurrently and is hereby incorporated by reference in its entirety for all purposes:  
U.S. Patent Application Serial No. \_\_\_\_\_, in the name of Robert L. Packer, entitled  
"Method for Managing Flow Bandwidth Utilization at Network, Transport and  
Application Layers," (attorney docket number 017814-000510).

              This application claims priority from the following U.S. Provisional  
Application, the disclosure of which, including all appendices and all attached  
documents, is incorporated by reference in its entirety for all purposes:

25           U.S. Provisional Patent Application Serial No. 60/032,485, Robert L.  
Packer, entitled, "Method for Managing Flow Bandwidth Utilization at Network,  
Transport and Application Layers in Store and Forward Network", filed December 9,  
1996.

30           Further, this application makes reference to the following commonly  
owned U.S. Patent Application, which is incorporated herein in its entirety for all  
purposes:

              Copending U.S. Patent Application Serial No. 08/762,828, in the name of  
Robert L. Packer, entitled "Method for Rapid Data Rate Detection in a Packet  
Communication Environment Without Data Rate Supervision," relates to a technique for  
automatically determining the data rate of a TCP connection.

35           Further, this application makes reference to the following U.S. Patent  
Application:

Copending U.S. Patent Application Serial No. 08/742,994, in the name of Robert L. Packer, entitled "Method for Explicit Data Rate Control in a Packet Communication Environment Without a Data Rate Supervision," relates to a technique for automatically scheduling TCP packets for transmission.

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#### PAPER APPENDIX

The following paper appendices are included herewith and incorporated by reference in their entirety for all purposes:

10 Appendix A: Source code listing of bandwidth allocation processing an embodiment of the invention comprising ten (10) sheets;

Appendix B: Source code listing of URL classification processing an embodiment of the invention comprising twenty-four (24) sheets;

15 Appendix C: Source code listing of classification processing an embodiment of the invention comprising nine (9) sheets; and

Appendix D: Source code listing of speed scaling processing an embodiment of the invention comprising ten (10) sheets.

#### BACKGROUND OF THE INVENTION

20 This invention relates to digital packet telecommunications, and particularly to management of network bandwidth based on information ascertainable from multiple layers of OSI network model. It is particularly useful in conjunction with data flow rate detection and control of a digitally-switched packet telecommunications environment normally not subject to data flow rate control.

25 The ubiquitous TCP/IP protocol suite, which implements the world-wide data communication network environment called the Internet and is also used in private networks (Intranets), intentionally omits explicit supervisory function over the rate of data transport over the various media which comprise the network. While there are certain perceived advantages, this characteristic has the consequence of juxtaposing very high-speed packet flows and very low-speed packet flows in potential conflict for network  
30 resources, which results in inefficiencies. Certain pathological loading conditions can result in instability, overloading and data transfer stoppage. Therefore, it is desirable to provide some mechanism to optimize efficiency of data transfer while minimizing the risk of data loss. Early indication of the rate of data flow which can or must be supported is

very useful. In fact, data flow rate capacity information is a key factor for use in resource allocation decisions.

Internet/Intranet technology is based largely on the TCP/IP protocol suite, where IP, or Internet Protocol, is the network layer protocol and TCP, or Transmission Control Protocol, is the transport layer protocol. At the network level, IP provides a "datagram" delivery service. By contrast, TCP builds a transport level service over the datagram service to provide guaranteed, sequential delivery of a byte stream between two IP hosts.

TCP flow control mechanisms operate exclusively at the end stations to limit the rate at which TCP endpoints emit data. However, TCP lacks explicit data rate control. In fact, there is heretofore no concept of coordination of data rates among multiple flows. The basic TCP flow control mechanism is a sliding window, superimposed on a range of bytes beyond the last explicitly-acknowledged byte. Its sliding operation limits the amount of unacknowledged transmissible data that a TCP endpoint can emit.

Another flow control mechanism is a congestion window, which is a refinement of the sliding window scheme, which employs conservative expansion to fully utilize all of the allowable window. A component of this mechanism is sometimes referred to as "slow start".

The sliding window flow control mechanism works in conjunction with the Retransmit Timeout Mechanism (RTO), which is a timeout to prompt a retransmission of unacknowledged data. The timeout length is based on a running average of the Round Trip Time (RTT) for acknowledgment receipt, i.e. if an acknowledgment is not received within (typically) the smoothed RTT + 4\*mean deviation, then packet loss is inferred and the data pending acknowledgment is retransmitted.

Data rate flow control mechanisms which are operative end-to-end without explicit data rate control draw a strong inference of congestion from packet loss (inferred, typically, by RTO). TCP end systems, for example, will 'back-off', i.e., inhibit transmission in increasing multiples of the base RTT average as a reaction to consecutive packet loss.

#### Bandwidth Management in TCP/IP Networks

Conventional bandwidth management in TCP/IP networks is accomplished

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