

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ZTE (USA) Inc.,

Petitioner

v.

WSOU Investments LLC D/B/A Brazos Licensing and Development

Patent Owner

Case No. IPR2023-00499

U.S. Patent No. 7,872,973

Issue Date: Jan. 18, 2011

**DECLARATION OF STEPHEN GRAY IN SUPPORT OF PETITION FOR
INTER PARTES REVIEW OF U.S. PATENT NO. 7,872,973**

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I. INTRODUCTION

1. I have been retained on behalf of ZTE (USA) Inc. for the above-captioned inter partes review (IPR) proceeding. I am being compensated for my time in connection with this IPR at my standard hourly consulting rate. I understand that this proceeding involves U.S. Patent No. 7,872,973 (“the ’973 patent”) titled “Method and system for using a queuing device as a lossless stage in a network device in a communications network” by Jason Sterne et al., and that the ’973 patent is currently assigned to WSOU Investments, LLC.

2. I have reviewed and am familiar with the specification of the ’973 patent filed on March 17, 2006. I understand that the ’973 patent has been provided as Ex. 1001. I will cite the specification using the following format: Ex. 1001, 1:1-10. This example citation points to the ’973 patent specification at column 1, lines 1-10.

3. I have reviewed and am familiar with the prosecution history of the ’973 patent. I understand that the prosecution history has been provided as Ex.1002.

4. I am informed by ZTE’s counsel that March 17, 2006, is the ’973 patent’s earliest possible priority date.

5. In preparing this Declaration, I have also reviewed and am familiar with the following prior art used in the Petition for *Inter Partes* Review of the '973 patent and/or in my declaration below:

- **U.S. Patent No. 7,369,498** to Ma et al. ("*Ma*") (Ex. 1005), filed on December 13, 1999, published on June 21, 2011.
- U.S. Patent Publication No. 2005/0157723 to Kim et al. ("*Kim*") (Ex. 1006), filed December 13, 2004, and published on Jul. 21, 2005.
- **U.S. Patent Publication No. 2005/0213504** to Enomoto et al. ("*Enomoto*") (Ex. 1007), filed February 23, 2005, and published on Sep. 29, 2005.
- U.S. Patent No. 7,391,787 to McCrosky et al. ("*McCrosky*") (Ex. 1008), filed September 10, 2004

6. I have been asked to provide my technical review, analysis, insights, and opinions regarding the '973 patent and the above-noted references that form the basis for the grounds of rejection set forth in the Petition for *Inter Partes* Review of the '973 patent.

II. QUALIFICATIONS

7. In formulating my opinions, I have relied upon my training, knowledge, and experience in the relevant art. A copy of my current *curriculum*

vitae is provided as Ex-1004, and it provides a comprehensive description of my academic and employment history over the last thirty-plus years.

8. I received a B.S. degree in Economics from California Polytechnic University in 1973.

9. I have over thirty years of experience in the computer and communications industries. My background includes systems and software architecture, design and development, as well as senior management positions in development, marketing, and general management.

10. From 1973 to 1977, I worked as a systems programmer and a systems analyst at Burroughs Corporation. I worked on data communications software and held several design and product implementation positions in a mid-range and small system development groups.

11. From 1977 to 1979, I worked as a regional support manager at Olivetti Corporation. I worked on software support for a series of mini- and micro-computer systems. Applications of these computer systems included general business and on-line front-office banking.

12. From 1979 to 1982, I worked as a manager in communication controller software development at Computer Communications, Inc. I worked as a leader of architecture, design, development, and testing of a Systems Network Architecture (SNA) communications controller in the Multiple Virtual Storage

(MVS) operating environment. Our group successfully designed, developed, and deployed the controller's operating software, diagnostics, host-based compilers, and system support software.

13. From 1982 to 1985, I worked as a manager in foreign system interconnect at Xerox Corporation. I Managed four professionals who defined and developed the technical interconnect strategy for electric page printers to wide-and local-area networks. Our group delivered host software, network, and printer engineering services. We developed a new printer interconnection technique, interfaces to Ethernet local area network, and designed connections to IBM mainframes using SNA and the System/370 channel.

14. From 1985 to 1987, I worked as a general manager in host software products at Xerox Corporation. As the founder and leader of the product delivery organization of a Xerox independent business unit, I managed 22 employees and 33 contract professionals. I directed the definition, architecture, design, development, test, product transfer and sustaining engineering of six products for electronic page printers connected to IBM mainframes (MVS, VSE, VM), Digital Equipment Corporation (DEC), virtual address extension (VAX), and IBM PC's.

15. From 1987 to 1988, I worked as a director in product marketing at Simpact Associates, Inc. I directed the full life cycle of definition, delivery, marketing and enhancement of four sets of IBM connectivity products, including:

(a) systems network architecture (SNA) protocol support hardware and software for Digital Equipment Corporation (DEC) virtual address extension (VAX) systems, (b) An IBM PC-based gateway product that supports SNA and other industry-standard communications architectures, (c) A Netware-based Token Ring Network adapter board and software for DEC VAX systems, and (d) A hardware/software product that receives financial market feeds and reformats the information for presentation to programs running a VAX via a proprietary applications programming interface (API).

16. From 2000 to 2001, I worked as a chief technical officer at NTN Communications, Inc., which is the parent corporation of two operating divisions: Buzztime Entertainment, Inc. and the NTN Network®. I developed and distributed sports and trivia games to a variety of interactive platforms including interactive television, the Internet, PDS and mobile phones. I was responsible for all of the technical aspects of the corporations as well as forward looking programs and business opportunities.

17. From 2001 to 2002, I worked as a chief technical officer at Networld Exchange Incorporated (NEI). NEI provides Fortune 2000 companies private trading exchange (PTX) solutions that automate their B2B commerce activities. NEI is a restart. NEI is funded by institutional investors in New York and Florida. I was recruited in 4Q01 by the investors as part of the new management team.

18. From 1984 to now, I have been working as a principal at Gray & Gray, LLC. I provide consulting services in a variety of technical area including communications, computer system and software.

19. My *curriculum vitae* contains further details on my education, experience, publications, and other qualifications to render an expert opinion. Ex-1004. My work on this case is being billed at a flat rate of \$425 per hour, with reimbursement for actual expenses. My compensation is not contingent upon the outcome of this *inter partes* review proceeding.

III. MATERIALS CONSIDERED

20. In forming my opinions, I have reviewed the following documents, and any other document cited in this declaration:

Exhibit	Description
Ex. 1001	U.S. Patent No. 7,872,973 (“the ’973 patent”)
Ex. 1002	Prosecution History of the ’973 patent
Ex. 1005	U.S. Patent No. 7,369,498 to Ma et al. (“Ma”)
Ex. 1006	U.S. Patent Publication No. 2005/0157723 to Kim et al. (“Kim”)
Ex. 1007	U.S. Patent Publication No. 2005/0213504 to Enomoto et al. (“Enomoto”)
Ex. 1008	U.S. Patent No. 7,391,787 to McCrosky et al. (“McCrosky”)
Ex. 1009	U.S. Patent No. 6,556,541 to Bare (“Bare”)
Ex. 1010	U.S. Patent No. 6,862,622 to Jorgensen (“Jorgensen”)
Ex. 1011	U.S. Patent No. 7,701,963 Rezaiifar et al. (“Rezaiifar”)
Ex. 1012	<i>WSOU Investments LLC v. Huawei Techs. Co.</i> Claim Construction Order
Ex. 1013	<i>WSOU Investments LLC v. Huawei Techs. Co.</i> Joint Claim Construction Statement
Ex. 1014	U.S. Patent No. 7,724,660 to Segel (“Segel”)
Ex. 1015	U.S. Patent No. 7,068,602 to Davari et al (“Davari”)

21. I have also relied on my education, experience, research, training, and knowledge in the relevant art, and my understanding of any applicable legal principles described in this declaration.

22. All the opinions contained in this declaration are based on the documents I reviewed and my knowledge and professional judgment. My opinions have also been guided by my understanding of how a person of ordinary skill in the art would have understood the claims of the '973 patent at the time of the alleged invention. For purposes of this declaration, I have been asked to assume that the date of the alleged invention is the earliest claimed priority date: March 17, 2006.

23. I reserve the right to supplement and amend any of my opinions in this declaration based on documents, testimony, and other information that becomes available to me after the date of this declaration.

IV. LEGAL PRINCIPLES

24. For purposes of this declaration, I have been asked to opine on issues regarding obviousness and anticipation under pre-AIA 35 U.S.C. §§ 102 and 103. I have been informed of the following legal standards, which I have applied in forming my opinions.

25. I have been asked to provide my opinions as to whether the cited prior art renders obvious claims 1-31 of the '973 patent from the perspective of a

person of ordinary skill in the art at the '973 patent's priority date in 2006, as described in more detail below.

26. I have been asked to provide my opinions as to whether the cited prior art anticipates/renders obvious claims 1-31 of the '973 patent.

27. For purposes of this declaration, I have been informed and understand certain aspects of the law as it relates to my opinions.

28. I have been advised and understand that there are two ways in which prior art may render a patent claim unpatentable. First, the prior art can "anticipate" the claim. Second, the prior art can make the claim "obvious" to a person of ordinary skill in the art. I understand that for an invention claimed in a patent to be patentable, it must not be anticipated and must not be obvious based on what was known before the invention was made.

29. I have been advised and understand the information used to evaluate whether an invention was new and not anticipated or obvious when made is generally referred to as "prior art." I understand that prior art includes patents and printed publications that existed before the earliest filing date of the patent (which I have been informed is called the "effective filing date"). I have been informed and understand that a patent or published patent application is prior art if it was filed before the effective filing date of the claimed invention and that a printed publication is prior art if it was publicly available before the effective filing date.

30. I have been advised and understand that a dependent claim is a patent claim that refers back to another patent claim. I have been informed and understand that a dependent claim includes all of the limitations of the claim to which it refers.

31. I have been advised and understand that a patent claim may be invalid as anticipated under 35 U.S.C. § 102 if a prior art reference discloses each element of the claimed subject matter.

32. I have been advised and understand that a patent claim may be invalid as obvious under 35 U.S.C. § 103 if the differences between the subject matter claimed and the prior art are such that the claimed subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made. I have also been advised that several factual inquiries underlie a determination of obviousness. These inquiries include (1) the scope and content of the prior art, (2) the level of ordinary skill in the field of the invention, (3) the differences between the claimed invention and the prior art, and (4) any objective evidence of non-obviousness (which I have been informed may also be called “secondary considerations”).

33. I have also been advised and understand that, where a party alleges obviousness based on a combination of references, that party must identify a reason why a person skilled in the art would have been motivated to combine the

asserted references in the manner recited in the claims and to explain why one skilled in the art would have had a reasonable expectation of success in making such combinations.

34. I have been advised and understand that the law permits the application of “common sense” in examining whether a claimed invention would have been obvious to a person skilled in the art. For example, I have been advised that combining familiar elements according to known methods and in a predictable way may suggest obviousness when such a combination would yield nothing more than predictable results. I understand, however, that a claim is not obvious merely because every claim element is disclosed in the prior art and that a party asserting obviousness must still provide a specific motivation to combine the references as recited in the claims and explain why one would have reasonably expected to succeed in doing so.

35. I have been advised and understand that two references are considered to be in the same field of art when the references are either (1) in the same field of endeavor, regardless of the problems they address, or (2) reasonably pertinent to the particular problem being solved by the inventor in his patent.

36. I am not aware of any evidence of secondary considerations that would support a determination of non-obviousness of the claimed subject matter in the '973 patent.

37. I have been informed that in *inter partes* review proceedings, such as this one, the party challenging the patent bears the burden of proving unpatentability by a preponderance of the evidence. I understand that a preponderance of the evidence means “more likely than not.”

V. THE '973 PATENT

A. Overview

38. The '973 patent discloses only a trivial modification, if even a modification at all, over the prior art—reducing the rate at which an upstream device sends packets to a queuing device.

39. The '973 patent introduces a "method for incorporating a queuing device as a lossless processing stage in a network device in a communications network between an upstream device and a downstream device in the network device." Ex-1001, Claim 1.

40. The '973 patent discloses steps beginning with “monitoring a depth of a queue in the queuing device, wherein the queue receives packets from the upstream device within the network device.” *Id.* “[T]he queuing device acts as a discard point by discarding packets when the queue is full.” *Id.* Finally, “if the depth of the queue passes a predetermined threshold,” then the claimed method “prevent[s] packet discarding and loss by the queuing device” by “sending a

message to the upstream device to reduce a rate at which packets are sent to the queuing device.” *Id.*

B. Prosecution History

41. During prosecution, Applicant admitted that changing a transmission rate was known. Ex-1002, 51. Applicant admitted that in the cited art, a “**mobile station** is the device that changes its transmission rate.” *Id.* (emphasis in original). To convince the Examiner to issue a notice of allowance, Applicant recognized that the only aspect of the independent claims that deviates from the cited art is “sending a message to the **upstream** device to **reduce** a rate at which packets are sent ... to **prevent the queue from filling.**” *Id.*, 50 (emphasis in original). The only purported point of novelty during prosecution was the upstream device being the device that adjusts the transmission rate.

C. Level of Ordinary Skill

42. A person of skill in the art (“POSITA”) would have had at least a bachelor’s degree in electrical engineering, computer engineering, or a related engineering discipline and two or more years of industry experience in the field of telecommunications, or equivalent experience, education, or both. Lack of professional experience could be remedied by additional education, and lack of education could be remedied by additional professional experience.

VI. CLAIM CONSTRUCTION

43. I understand in *WSOU Investments LLC D/B/A Brazos Licensing and Dev., v. Huawei Technologies Co., LTD.*, 6-20-cv-00538, Dkt. 61 (WDTX Jun. 17, 2020) the district court construed several terms in the '973 patent. I understand during that case Patent Owner put forth constructions. I understand Petitioner is advancing these constructions and I have been asked to apply them.

44. The constructions I applied are in the table below.

CLAIM	TERM	CONSTRUCTION
[9g] and [26e]	“a module for, if the depth of the queue passes a predetermined threshold, sending a message to the upstream device to reduce a rate at which packets are sent to the queuing device to prevent the queue from filling, thereby preventing packet discarding and loss by the queuing device”	(PO’s Position) Plain and ordinary meaning <i>Alternatively—</i> (Partially Adopted by the WDTX) Subject to 35 U.S.C. § 112, ¶ 6 Function: if the depth of the queue passes a predetermined threshold, sending a message to the

		upstream device to reduce a rate at which packets are sent to the queuing device to prevent the queue from filling Structure: a processor Algorithm: N/A because pursuant to “sending” is a function a general-purpose processor can do without requiring special programming. Ex. 1012., 16-17.
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CLAIM	TERM	CONSTRUCTION
[9h] (similar limitation in [26f])	“a module for sending a message reporting the depth of the queue to the upstream device to thereby enable the upstream device to determine whether to reduce or increase the rate at which the	(Adopted by the WDTX) Subject to 35 U.S.C. § 112, ¶ 6

	upstream device sends packets to the queuing device”	Function: sending a message reporting the depth of the queue to the upstream device Structure: a processor Algorithm: N/A because pursuant to “sending” is a function a general-purpose processor can do without requiring special programming. Ex. 1012, 17.
[9i] (similar limitation in [26g])	“a module for sending the message from the e stream device to an upstream network device to thereby control a rate at which the upstream device receives packets from the upstream network device”	(Adopted by the WDTX) Subject to 35 U.S.C. § 112, ¶ 6 Function: sending the message from the upstream device to an upstream network device to thereby control a rate

		at which the upstream device receives packets from the upstream network device Structure: a processor Algorithm: N/A because pursuant to “sending” is a function a general-purpose processor can do without requiring special programming. Ex. 1012, 15.
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CLAIM	TERM	CONSTRUCTION
[9c] (similar limitation in [26c])	“a module for monitoring a depth of a queue”	Plain and ordinary meaning <i>Alternatively—</i> Subject to 35 U.S.C. § 112, ¶ 6

		Function: monitoring a depth of a queue Structure: a processor Algorithm: N/A because “monitoring” is a function a general-purpose processor can do without requiring special programming.
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VII. GROUNDS: CLAIMS 1-31 ARE UNPATENTABLE

A. Grounds 1a and 1b: *Ma* alone (Ground 1a) and *Ma* in view of *Kim* (Ground 1b) Renders Obvious Claims 1, 2, 4-10, 12-14, 16, 18-20, 22, 24-27, and 29-31

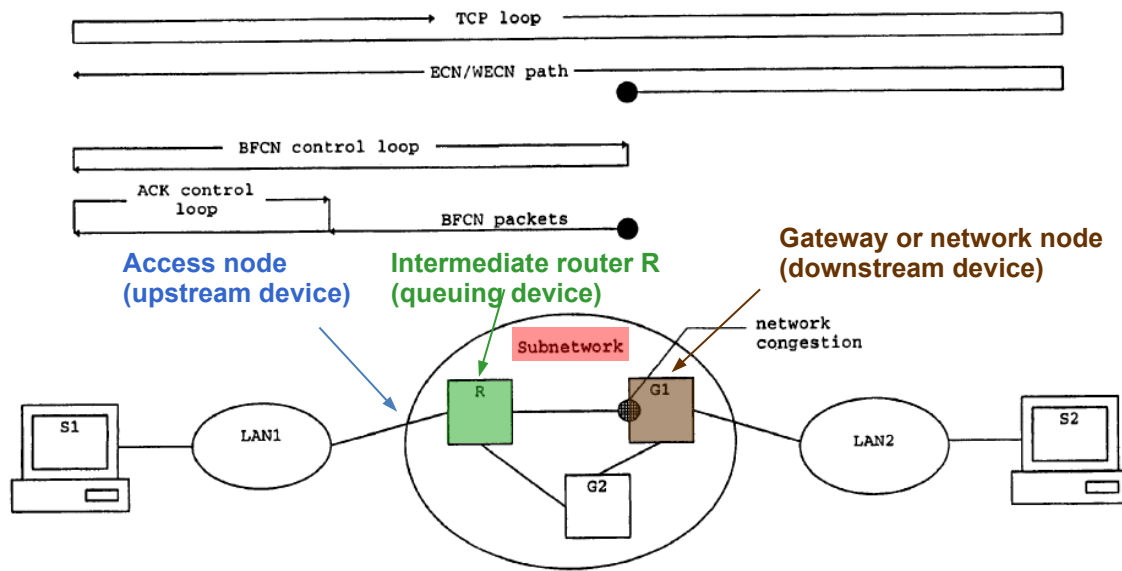
1. Claim 1

a. [1Preamble]: “A method for incorporating a queuing device as a lossless processing stage in a network device in a communications network between an upstream device and a downstream device in the network device, comprising:”

45. *Ma* discloses [1Preamble] because *Ma* discloses a method for incorporating an intermediate router R (“queuing device”) as a lossless processing stage in an IP subnetwork (“network device”) in a communications network between an edge device, such as an access node (“upstream device”), and a gateway (“downstream device”) in the IP subnetwork.

46. *Ma* recognized the problem of packet loss in a communication network, stating, “packet losses result in a significant degradation in TCP throughput.” Ex. 1005, 1:40-42. *Ma* provides a solution to this problem by introducing “a method and network for controlling congestion in a packet-switched network” in which a “[burst] of source traffic can be constrained and unnecessary packet losses can be avoided already at an intermediate access node and within the network.” *Id.*, Abstract.

47. *Ma*’s FIG. 1 shows a network configuration where “TCP sources S1 and S2 are connected via respective local area networks LAN1 and LAN2 to an IP subnetwork comprising network nodes such as an intermediate router R and gateways G1 and G2, through which data packets are transmitted in the IP subnetwork. Each of the local area networks LAN1 and LAN2 is connected to the subnetwork via a respective edge device, e.g. access node (not shown).” *Id.*, 6:50-57.



Ex. 1005, FIG. 1 (annotated).

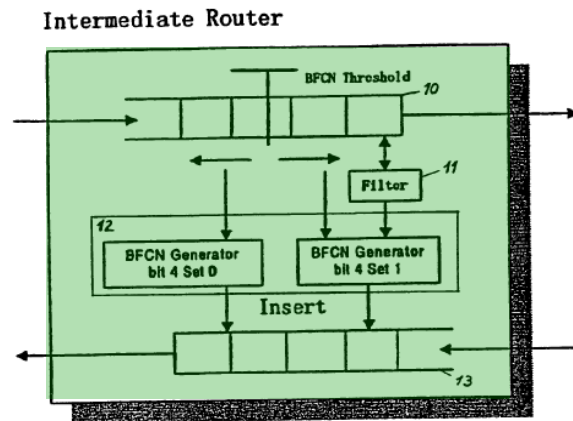
48. *Ma* discloses that “a packet queue length in a network node is determined and a congestion notification is transmitted back towards the source address of an incoming data packet received at the network node, if the detected packet queue length exceeds a predetermined threshold. Then, congestion control is performed at a predetermined intermediate network node in response to the receipt of the congestion notification.” Ex. 1005, Abstract.

b. [1a]: “monitoring a depth of a queue in the queuing device,”

49. *Ma* discloses or renders obvious [1a] because *Ma* discloses monitoring a queue length (“depth of a queue”) in the intermediate router R (“queuing device”).

50. *Ma*'s intermediate router R includes "a forward buffer 10, a backward buffer 13, a filter 11 and a congestion notification unit 12." Ex. 1005, 7:48-52. "The congestion notification unit 12 comprises a mechanism for active queue management to detect incipient congestion in the forward buffer 10. For simplicity, only one FBCN threshold is set before the queue in the forward buffer 10 overflows. The congestion notification unit 12 **determines an average queue length** and compares this average queue length with the predetermined BFCN threshold. When the average queue length exceeds the BFCN threshold, an incipient network congestion is determined. When the average queue length drops below the BFCN threshold, a release of the congestion in this intermediate node is determined." ¹ Ex. 1005, 7:53-63 (emphasis added); *see also id.*, 4:11-16, 5:3-6.

¹ "BFCN" in the specification and the drawings appears to be a typographical error. The correct term is "FBCN" which is used throughout the specification when referring to the Fast Backward Congestion Notification.



Ex. 1005, FIG. 2 (annotated).

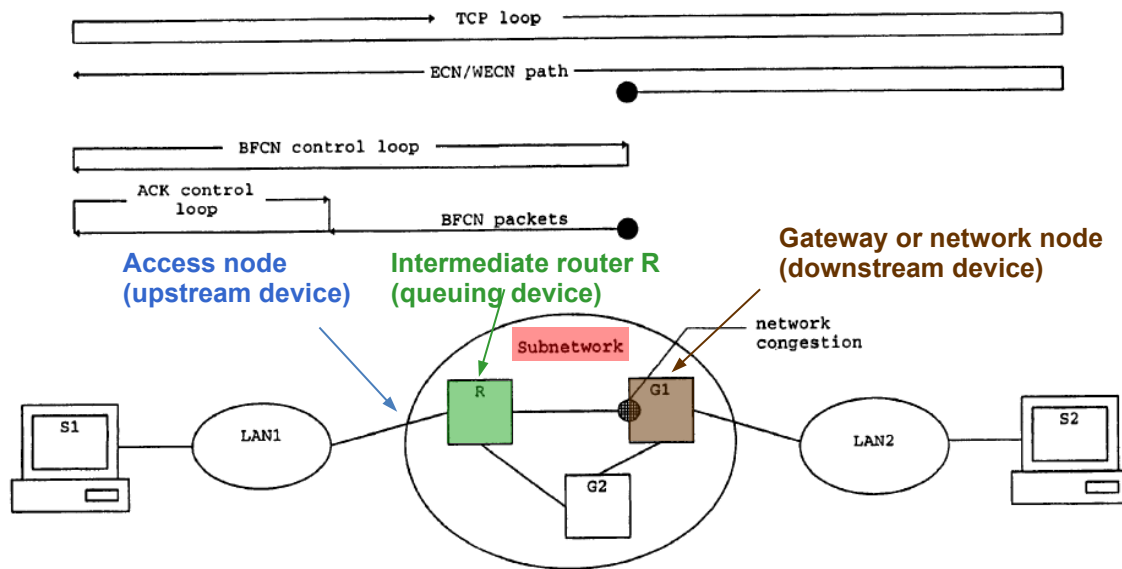
51. The '973 patent similarly discloses that “monitoring a depth of a queue in the queuing device, the queue for receiving packets from an upstream device within the network device, the queuing device acting as a discard point by discarding packets when the queue is full.” Ex. 1001, Abstract. Thus, the claimed “depth of a queue” is a fullness (or a level of filling) of the queue by packets. Just like the '973 patent, the packet queue length disclosed in *Ma* is a fullness (or a level of the filling) of a queue by packets. For example, *Ma* discloses that “congestion notification means for **determining a packet queue length in a buffer means**, and for generating a congestion notification and transmitting said congestion notification back towards the source address of an incoming data packet received at said network node, if the detected packet queue length exceeds a predetermined threshold.” Ex. 1005, 4:21-28 (emphasis added). Thus, the packet

queue length of *Ma* constitutes the claimed “depth of a queue” in the queuing device.

c. [1b]: “wherein the queue receives packets from the upstream device within the network device, and”

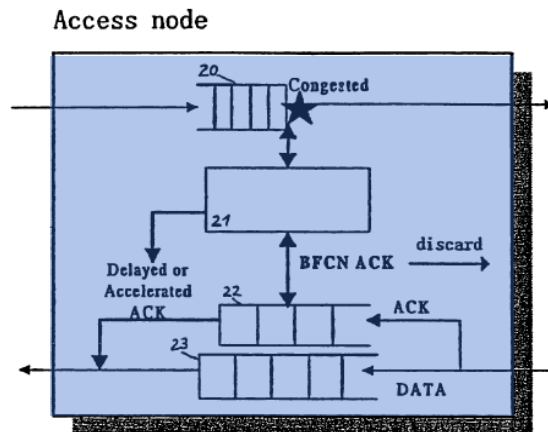
52. *Ma* discloses [1b] because *Ma* discloses that the queue in the intermediate router R (“queuing device”) receives packets from an edge device such as an access node (“upstream device”) within the subnetwork (“network device”).

53. *Ma* discloses that “TCP sources S1 and S2 are connected via respective local area networks LAN1 and LAN2 to an IP subnetwork comprising network nodes such as an intermediate router R and gateways G1 and G2, through which data packets are transmitted in the IP subnetwork. Each of the local area networks LAN1 and LAN2 is connected to the subnetwork via a respective [edge device](#), e.g. [access node](#) (not shown).” *Id.*, 6:50-57 (emphasis added). Because the packets are transmitted from the TCP source S1 to the subnetwork via LAN1, and the LAN1 is connected to the subnetwork via the access node, the access node is a device within the subnetwork and the queue of the intermediate router R receives packets from the access node.



Ex. 1005, FIG. 1 (annotated).

54. *Ma* also discloses the structure of the access node. As shown in FIG. 3 below, *Ma*'s access node includes “a forward buffer 20 for **storing data packets to be transmitted in the forward direction**, a backward acknowledgement buffer 22 for storing extracted acknowledgement packets received from the IP network, a backward data buffer 23 for storing data packets received from the IP network, and a congestion control unit 21 for performing congestion control based on a detection of an FBCN packet (i.e. FBCN ACK) received from the IP network or based on a detection of a congestion at the forward buffer 20.” Ex. 1005, 10:8-17.



Ex. 1005, FIG. 3 (annotated).

55. The '973 patent similarly discloses that “[t]he upstream device may be another queuing device.” Ex. 1001, 3:21-22. Just like the '973 patent, as discussed above, the access node in *Ma* is another queuing device that stores data packets to be transmitted in the forward direction to the intermediate router R. Thus, the access node of *Ma* constitutes the claimed “upstream device” from which the intermediate router R receives packets.

d. [1c]: “the queuing device acts as a discard point by discarding packets when the queue is full,”

56. *Ma* alone (Ground 1a) or in combination with *Kim* (Ground 1b) renders obvious [1c].

57. As explained for [1a] (Section VII.A.1.b), *Ma*’s intermediate router R (“queuing device”) determines whether the queue is full by monitoring the queue length. It would have been obvious to a person of skill that *Ma*’s intermediate router R further acts as a discard point by discarding packets when the queue is

full, because that is one of the two obvious choices that the intermediate router R can do—sending back the packets to the access node or discard the packets.

58. For **Ground 1b**, to the extent Patent Owner argues that *Ma* does not explicitly disclose that the queuing device acts as a discard point by discarding packets when the queue is full, *Kim* does.

59. *Kim* discloses that “[t]ypical stream control methods include: 1. Tail-drop: a method in which **packets coming in late are discarded when a full queue or overflow occurs.**” Ex. 1006, [0010]-[0011]. *Kim* also discloses that “[i]f the received packet is an exception packet (S3), a flow_control flag set by the token driver 210 of the host processor 200 is checked to determine whether to enqueue or discard the received packet (S4).” *Id.*, [0087].

60. A person of skill would have been motivated to implement *Kim*’s method of discarding packets when the queue is full because discarding packets from a full queue was a routine feature of network devices. A person of skill would also have been motivated to implement *Kim*’s packet dropping within *Ma*’s system to provide additional ways to alleviate congestion. *Ma* is directed to detecting and alleviating traffic congestion. Additionally dropping packets would have provided an additional way to alleviate congestion in the network, and a person of skill would have been motivated to use packet dropping to improve *Ma* at least in

circumstances where rerouting traffic is insufficient to alleviate the congestion. *See* Ex. 1005, Fig. 4 (step 106).

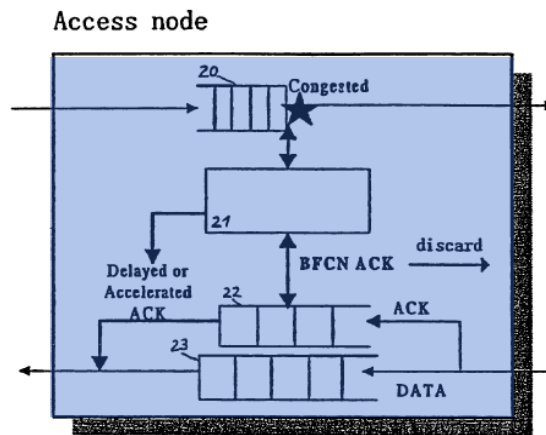
61. A person of skill would have had a reasonable expectation of success in implementing packet dropping, as taught by *Kim*, in *Ma*'s system because packet dropping was a commonly used technique that would have required only routine skill to implement. Ex. 1009, 31:25-63, 70:20-25 (filed in 1999, and describing a method for packet dropping in wireless communication systems); Ex. 1010, 20:17-30 (also filed in 1999, and describing packet dropping); Ex. 1011, 4:2-14, claim 2 (filed in 2003, and describing packet dropping).

e. [1d]: “wherein the upstream device is a traffic manager;”

62. *Ma* discloses [1d] because *Ma* discloses that the access node (“upstream device”) that manages packet transmission between the intermediate router R and the TCP sources S1 also performs congestion control of the packet transmission.

63. *Ma*'s access node includes “a forward buffer 20 for storing data packets to be transmitted in the forward direction, a backward acknowledgement buffer 22 for storing extracted acknowledgement packets received from the IP network, a backward data buffer 23 for storing data packets received from the IP network, and a **congestion control unit 21 for performing congestion control**

based on a detection of an FBCN packet (i.e. FBCN ACK) received from the IP network or based on a detection of a congestion at the forward buffer 20.” Ex. 1005, 10:6-17; *see also, id.*, 7:9-14.



Ex. 1005, FIG. 3 (annotated).

64. *Ma* also discloses that “the congestion control mechanism according to the preferred embodiment of the present invention will be called Fast Backward Congestion Notification (FBCN). As can be gathered from FIG. 1, the BFCN control loop ranges from the network node at which the network congestion is detected to the source of the respective data packet. However, BFCN packets are only transmitted to the access node, where a congestion control based on an acknowledgment (ACK) control loop is initialized in response to the receipt of a BFCN packet. Thus, flow-control time in the IP network is reduced by the BFCN mechanism.” Ex. 1005, 7:25-35.

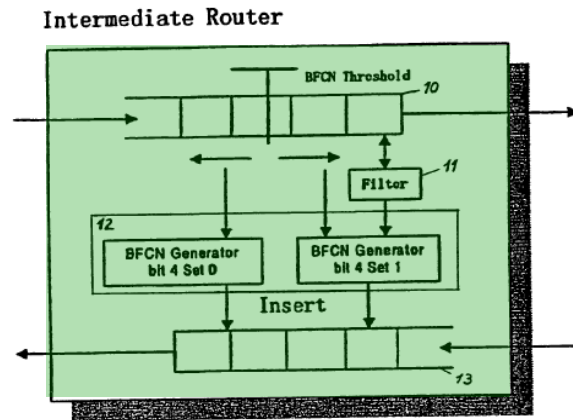
65. The '973 patent discloses that a traffic manager is equivalent to, for example, a queuing device or a network processor. *See* Ex. 1001, 3:22-23, 3:28-31, 4:17-21. A person of skill would have understood that an access node is a traffic manager because like the traffic manager in the '973 patent, the access node is optimized to support implementation of network protocols.

f. [1e]: **“if the depth of the queue passes a predetermined threshold, sending a message to the upstream device to reduce a rate at which packets are sent to the queuing device to prevent the queue from filling, thereby preventing packet discarding and loss by the queuing device;”**

66. *Ma* discloses or renders obvious [1e] because *Ma* discloses that if the packet queue length (“depth of the queue”) exceeds a predetermined threshold, sending a congestion notification message (“message”) to the access node (“upstream device”) to reduce a rate at which packets are sent to the intermediate router R (“queuing device”) to prevent the queue from filling, thereby preventing packet discarding and loss by the intermediate router R.

67. *Ma*’s intermediate router R determines whether the packet queue length passes a predetermined threshold. *Ma*’s intermediate router R includes a **“congestion notification unit 12** [that] determines an average queue length and **compares this average queue length with the predetermined BFCN threshold.**

When the average queue length exceeds the BFCN threshold, an incipient network congestion is determined.” Ex. 1005, 7:48-63 (emphasis added).



Ex. 1005, FIG. 2 (annotated).

68. *Ma*’s congestion notification unit 12 also sends a congestion notification message to the access node if the packet queue length exceeds a predetermined threshold. For example, *Ma* discloses that “[w]hen the buffer length in the network node exceeds or remains higher than the FBCN threshold, one **FBCN [Fast Backward Congestion Notification] packet** is generated by the congestion notification unit 12 for each forward incoming packet or, alternatively, only for one FBCN packet upon the reach of the FBCN threshold, wherein an FBCN bit is set in the FBCN packet.” Ex. 1005, 7:64-8:2 (emphasis added).

69. *Ma* also discloses how the congestion notification message is sent to the access node, explaining that “[w]hen the average queue length in the forward

buffer 10 exceeds the FBCN threshold, the FBCN packet is generated by latching the source and destination IP address of the incoming packets, setting or resetting the FBCN bit in the IP header, exchanging source and destination addresses in the generated FBCN packet in which the IP header is replicated from the forward passing packet. Then, the FBCN packet is inserted into the reverse direction stream of the backward buffer 13. Since the new destination address is equal to the source address of the forward packet, the FBCN packet can be returned towards the TCP source and passed through the respective access node of the IP network.” Ex. 1005, 9:31-42.

70. Upon receipt of the congestion notification message, *Ma*’s access node starts congestion control. For example, *Ma* disclosed that “[a]fter the congestion notification message has been received at the access node between the LAN1 and the subnetwork, a congestion control is started at the access node and the congestion notification message is discarded.” Ex. 1005, 7:9-13.

71. *Ma* also discloses that “in the adaptive congestion control according to the preferred embodiment, which is performed at the access node, the TCP source may automatically start to **slow down its transmission rate**, or at least it does not increase its transmission rate as fast as it otherwise would do, since the delay introduced at the access node slows down the rate at which the TCP source

increases the size of its congestion window.” Ex. 1005, 12:60-67 (emphasis added).

72. *Ma* further discloses that “a congestion notification is transmitted back towards the source address of an incoming data packet received at the network node, if the detected packet queue length exceeds a predetermined threshold. Then, congestion control is performed at a predetermined intermediate network node in response to the receipt of the congestion notification. Thereby, bursts of source traffic can be constrained and unnecessary **packet losses can be avoided** already at an intermediate access node and within the network. The congestion notification message generated due to an incipient congestion is immediately routed back according to its source address. As a result, control delay time is shortened, such that buffer size requirements and number of congestion notification messages are reduced.” Ex. 1005, Abstract (emphasis added).

g. [1f]: “**sending a message reporting the depth of the queue to the upstream device to thereby enable the upstream device to determine whether to reduce or increase the rate at which the upstream device sends packets to the queuing device; and**”

73. *Ma* discloses or renders obvious [1f] because, as explained for [1e] (Section VII.A.1.f), *Ma* discloses sending a congestion notification message to the access node (“upstream device”) to thereby enable the access node to determine to reduce the rate at which the access node sends packets to the intermediate router R

(“queuing device”). In addition, *Ma* discloses sending a congestion notification message to the access node (“upstream device”) to thereby enable the access node to determine to increase the rate at which the access node sends packets to the intermediate router R (“queuing device”).

74. *Ma* discloses that “[w]hen the average queue length drops below the BFCN threshold, a release of the congestion in this intermediate node is determined.” Ex. 1005, 7:61-63.

75. *Ma* also explains how to indicate in the message that the queue length drops below the threshold. *Ma* discloses that “[t]he congestion notification may be sent in a data packet generated at the network node. This may be achieved by setting a predetermined bit in the header of the data packet. Moreover, **another predetermined bit of the header of the data** packet may be used to indicate that the **queue length has dropped below the predetermined threshold**. In case, the congestion control is performed in an IP network, the predetermined bit and the other predetermined bit may be bit No. 3 and bit No. 4 in the IPv4 TOS octet, respectively.” Ex. 1005, 5:7-15 (emphasis added).

76. Thus, *Ma*’s congestion notification including a **predetermined bit of the header of the data packet to indicate that the queue length has dropped below the predetermined threshold** also constitutes the “message” claimed in [1f].

- h. [1g]: “sending the message from the upstream device to an upstream network device to thereby control a rate at which the upstream device receives packets from the upstream network device.”**

77. *Ma* discloses or renders obvious [1g] because *Ma* discloses sending acknowledgment (ACK) packet (“message”) from the access node (“upstream device”) to the TCP sources (“upstream network device”) to thereby control a rate at which the access node receives packets from the TCP sources.

78. *Ma* discloses that “the congestion control mechanism according to the preferred embodiment of the present invention will be called Fast Backward Congestion Notification (FBCN). As can be gathered from FIG. 1, the BFCN control loop ranges from the network node at which the network congestion is detected to **the source of the respective data packet**. However, BFCN packets are only transmitted to the access node, where a congestion control based on an acknowledgment (ACK) control loop is initialized in response to the receipt of a BFCN packet. Thus, flow-control time in the IP network is reduced by the BFCN mechanism.” Ex. 1005, 7:25-35 (emphasis added).

79. *Ma* explains, “[i]f it is determined in step S102 that bit No. 3 is set, i.e. the concerned ACK packet is an FBCN packet, the flow proceeds to step S108 and an initial processing module is activated. In the initial module, a detector of the congestion control unit 21 detects FBCN packets in the backward path besides

watching the queue length in the forward buffer 20 of the access node. Then, the **ACK rate control** in the access node is initiated and the FBCN packet is discarded in step S106. Thus, the FBCN packet does not reach the respective TCP source. Based on an acknowledgement rate determined in step S106, a slow down or speed up of the ACK flow towards the TCP sources is then performed in step S107.” Ex. 1005, 10:43-52 (emphasis added).

80. *Ma* also discloses that “in the adaptive congestion control according to the preferred embodiment, which is performed at the access node, the **TCP source** may automatically start to slow down its transmission rate, or at least it does not increase its transmission rate as fast as it otherwise would do, since the delay introduced at the access node slows down the rate at which the TCP source increases the size of its congestion window. Unlike FTCP, the FBCN mechanism is arranged to control the **ACK output rate** according to FBCN congestion notifications generated from each node of the network. Therefore, it can not only limit congestion at the access node, but simultaneously avoid unnecessary packet losses in the network due to the fact that bursts of the source traffic are constrained according to the whole network buffer occupancies, not just that of the access node.” Ex. 1005, 12:60-13:7 (emphasis added).

2. Claim 9

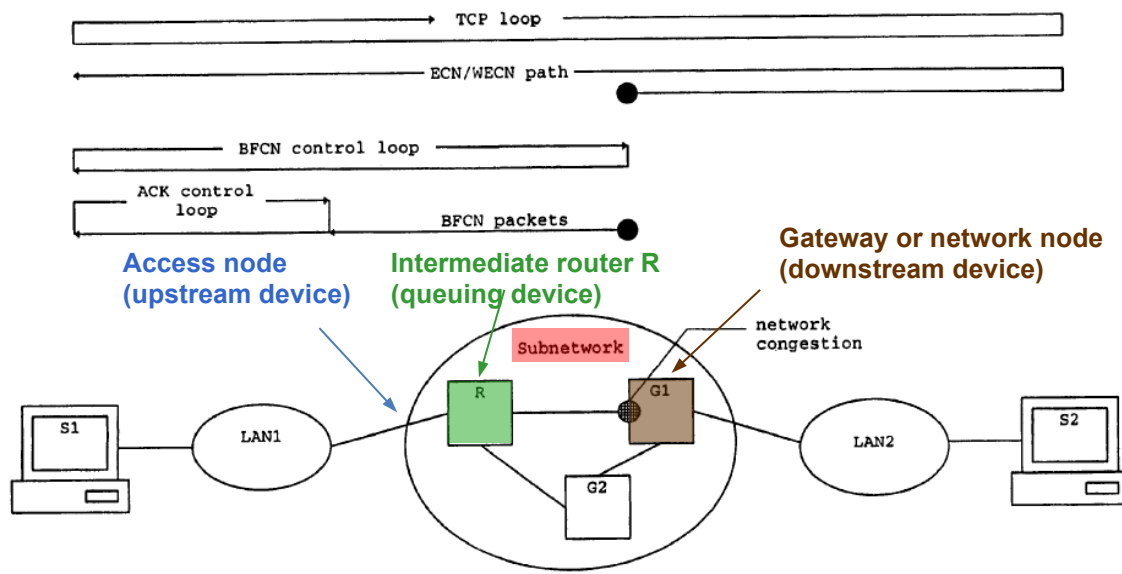
- a. [9Preamble]: “A system for incorporating a queuing device as a lossless processing stage in a network device in a communications network between an upstream device and a downstream device in the network device, the system comprising:”**

81. *Ma* discloses [9Preamble] because *Ma* discloses a method for incorporating an intermediate router R (“queuing device”) as a lossless processing stage in an IP subnetwork (“network device”) in a communications network between an edge device such as an access node (“upstream device”) and a gateway (“downstream device”) in the IP subnetwork.

82. *Ma* recognized the problem of packet loss in communication networks. For example, *Ma* discloses that “packet losses result in a significant degradation in TCP throughput.” Ex. 1005, 1:41-42. *Ma* provided a solution to the problem by introducing “a method and network for controlling congestion in a packet-switched network” in which “[bursts] of source traffic can be constrained and unnecessary packet losses can be avoided already at an intermediate access node and within the network.” *Id.*, Abstract.

83. As shown in annotated FIG. 1 below, *Ma* discloses a network configuration in which “TCP sources S1 and S2 are connected via respective local area networks LAN1 and LAN2 to an IP subnetwork comprising network nodes such as an intermediate router R and gateways G1 and G2, through which data

packets are transmitted in the IP subnetwork. Each of the local area networks LAN1 and LAN2 is connected to the subnetwork via a respective **edge device**, e.g. **access node** (not shown).” *Id.*, 6:50-57 (emphasis added).



Ex. 1005, FIG. 1 (annotated).

84. *Ma* also discloses that “a packet queue length in a network node is determined and a congestion notification is transmitted back towards the source address of an incoming data packet received at the network node, if the detected packet queue length exceeds a predetermined threshold. Then, congestion control is performed at a predetermined intermediate network node in response to the receipt of the congestion notification.” Ex. 1005, Abstract.

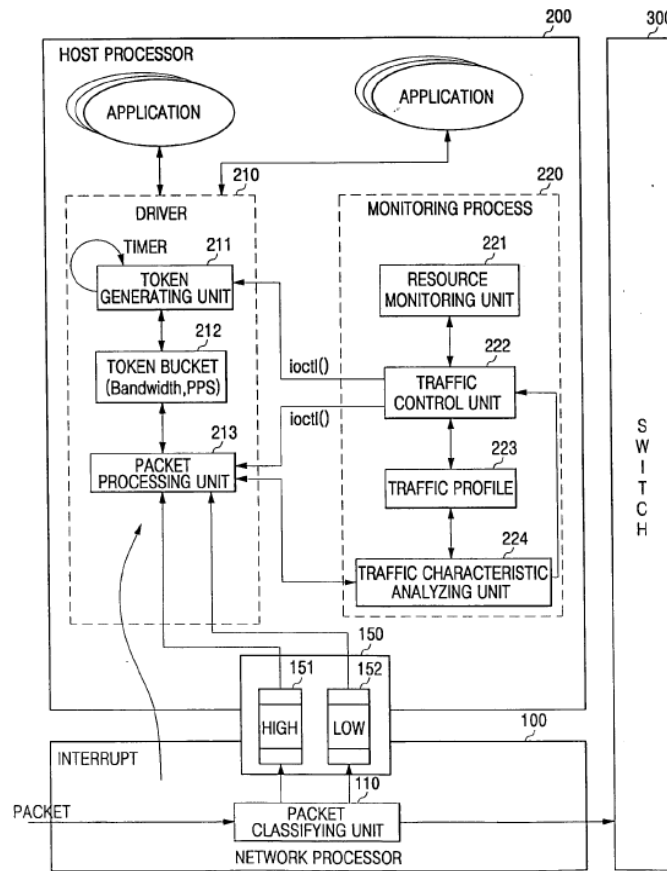
**b. [9a]: “a processor coupled to the queuing device;
and”**

85. *Ma* alone (Ground 1a) or in combination with *Kim* (Ground 1b) renders obvious [9a].

86. As discussed for [9preamble] (Section VII.A.2.a), *Ma* discloses determining a queue length (“depth of a queue”) in the intermediate router R (“queuing device”). While *Ma*’s disclosure is more directed to its method than the specific hardware for performing the method, a person of skill would have understood that *Ma*’s system included routine hardware components like a processor for performing its method. A person of skill would have understood that *Ma*’s system includes a processor coupled to a queuing device because monitoring the queue depth and instructing the system to act accordingly are steps that a person of skill would have understood to be performed by a processor.

87. For **Ground 1b**, to the extent Patent Owner argues that *Ma* does not explicitly disclose a processor coupled to a queuing device, *Kim* does.

88. As shown in FIG. 1 below, *Kim* discloses that “[w]hen the packet is being received in the host processor 200 according the above described process, the host processor 200 processes the received packet according to a series of algorithms, and the process is as follows.” Ex. 1006, [0094].



Ex. 1006, FIG. 1

89. Because *Ma*'s system performs steps that would be understood by a person of skill to be performed by a processor, a person of skill would have been motivated to look to references—like *Kim*—that disclose similar methodology using a processor. And, because the processor is used for its conventional and routine purpose, a person of skill would have reasonably expected success in implementing a processor in *Ma*.

c. [9b]: “modules executed by the processor, the modules including:”

90. *Ma* alone (Ground 1a) or in combination with *Kim* (Ground 1b) renders obvious [9b].

91. As explained for [9a] (Section VII.A.2.b), a person of skill would have understood *Ma* to disclose a processor to perform its disclosed method. A person of skill would further have understood that processors necessarily operate by executing software instructions, or modules.

92. For **Ground 1b**, to the extent Patent Owner argues that *Ma* does not explicitly disclose a processor executing software modules, *Kim* does. *Kim* discloses “[w]hen the packet is being received in the host processor 200 according the above described process, the host processor 200 processes the received packet according to a series of algorithms, and the process is as follows.” Ex. 1006, [0094]. A person of skill would have understood that the series of algorithms are software modules, as explained for each of the following sections.

93. Because *Ma*’s system performs steps that would be understood by a POSITA to be performed by a processor executing software modules, a person of skill would have been motivated to look to references—like *Kim*—that disclose similar methodology using a processor executing software modules. And, because the processor is used for its conventional and routine purpose (performing steps

coded into the software being executed), a person of skill would have reasonably expected success in implementing a processor in *Ma*.

d. [9c]: “a module for monitoring a depth of a queue in the queuing device,”

94. *Ma* alone (Ground 1a) or in combination with *Kim* (Ground 1b) renders obvious [9c] as explained for [1a] (Section VII.A.1.b).

95. To the extent this limitation is interpreted under 35 U.S.C. § 112, ¶ 6, the following construction should apply:

Function: monitoring a depth of a queue

Structure: a processor

Algorithm: N/A because “monitoring” is a function a general-purpose processor can do without requiring special programming.

96. In this instance, *Ma* alone or in combination with *Kim* renders obvious the function as explained for [1a] (Section VII.A.1.b) and the structure as explained for [9a] (Section VII.A.2.b).

e. [9d]: “wherein the queue receives packets from the upstream device within the network device and”

97. *Ma* discloses or renders obvious [9d] as explained for [1b] (Section VII.A.1.c).

f. [9e]: “the queuing device acts as a discard point by discarding packets when the queue is full,”

98. *Ma* alone (Ground 1A) or in combination with *Kim* renders obvious [9e] as explained for [1c] (Section VII.A.1.d).

g. [9f]: “wherein the upstream device is a traffic manager;”

99. *Ma* discloses or renders obvious [9f] as explained for [1d] (Section VII.A.1.e).

h. [9g]: “a module for, if the depth of the queue passes a predetermined threshold, sending a message to the upstream device to reduce a rate at which packets are sent to the queuing device to prevent the queue from filling, thereby preventing packet discarding and loss by the queuing device;”

100. *Ma* alone (Ground 1a) or in combination with *Kim* (Ground 1b) renders obvious [9g] as explained for [1e] (Section VII.A.1.f).

101. To the extent this limitation is interpreted under 35 U.S.C. § 112, ¶ 6, the following construction should apply:

Function: if the depth of the queue passes a predetermined threshold, sending a message to the upstream device to reduce a rate at which packets are sent to the queuing device to prevent the queue from filling

Structure: a processor

Algorithm: N/A because pursuant to “sending” is a function a general-purpose processor can do without requiring special programming. Ex. 1012, 16-17.

102. In this instance, *Ma* alone or in combination with *Kim* renders obvious the function as explained for [1e] (Section VII.A.1.f) and the structure as explained for [9a] (Section VII.A.2.b).

- i. [9h]: “a module for sending a message reporting the depth of the queue to the upstream device to thereby enable the upstream device to determine whether to reduce or increase the rate at which the upstream device sends packets to the queuing device; and”

103. *Ma* alone (Ground 1a) or in combination with *Kim* (Ground 1b) renders obvious [9h] as explained for [1f] (Section VII.A.1.g).

104. To the extent this limitation is interpreted under 35 U.S.C. § 112, ¶ 6, the following construction should apply:

Function: sending a message reporting the depth of the queue to the upstream device

Structure: a processor

Algorithm: N/A because pursuant to “sending” is a function a general-purpose processor can do without requiring special programming. Ex. 1012, 17.

105. In this instance, *Ma* alone or in combination with *Kim* renders obvious the function as explained for [1f] (Section VII.A.1.g) and the structure as explained for [9a] (Section VII.A.2.b).

j. [9i]: “a module for sending the message from the e stream device to an upstream network device to thereby control a rate at which the upstream device receives packets from the upstream network device.”

106. *Ma* alone (Ground 1a) or in combination with *Kim* (Ground 1b) renders obvious [9i] as explained for [1g] (Section VII.A.1.h).

107. To the extent this limitation is interpreted under 35 U.S.C. § 112, ¶ 6, the following construction should apply:

Function: sending the message from the upstream device to an upstream network device to thereby control a rate at which the upstream device receives packets from the upstream network device

Structure: a processor

Algorithm: N/A because pursuant to “sending” is a function a general-purpose processor can do without requiring special programming. Ex. 1012, 15.

108. In this instance, *Ma* alone or in combination with *Kim* renders obvious the function as explained for [1g] (Section VII.A.1.h) and the structure as explained for [9a] (Section VII.A.2.b).

3. Claim 19

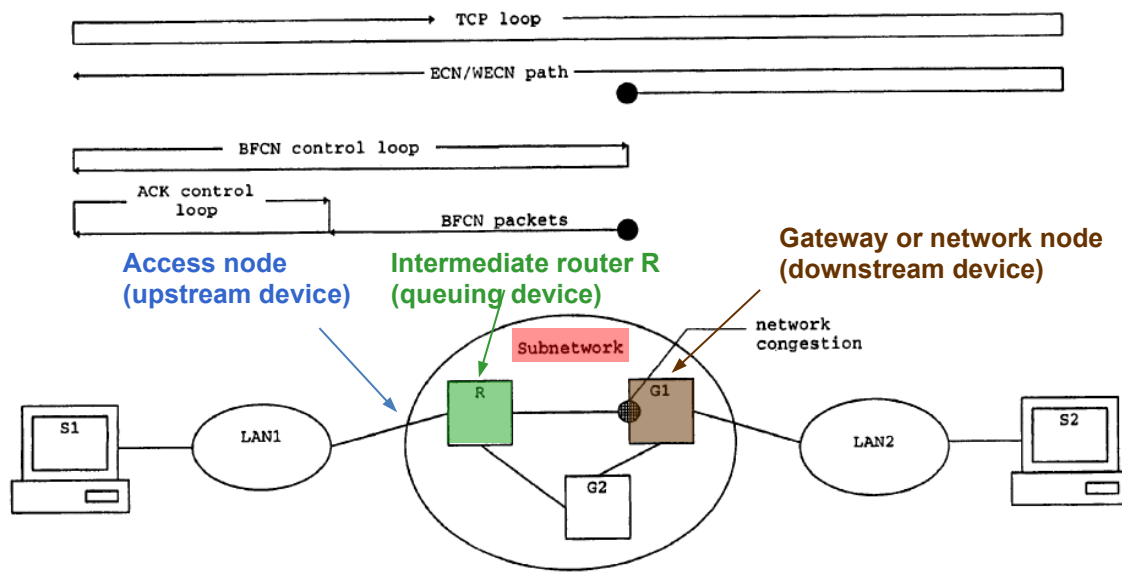
- a. [19Preamble]: “A method for incorporating an integrated queuing and packet processing device as a lossless processing stage in a network device in a communications network between an upstream device and a downstream device in the network device, the method comprising:”

109. *Ma* discloses [1Preamble] because *Ma* discloses method for incorporating an intermediate router R (“queuing device”) as a lossless processing stage in an IP subnetwork (“network device”) in a communications network between an edge device such as an access node (“upstream device”) and a gateway (“downstream device”) in the IP subnetwork.

110. *Ma* recognized the problem of packet loss in communication network. For example, *Ma* discloses that “packet losses result in a significant degradation in TCP throughput.” Ex. 1005, 1:41-42. *Ma* provided a solution to the problem by introducing “a method and network for controlling congestion in a packet-switched network” in which “[bursts] of source traffic can be constrained and unnecessary packet losses can be avoided already at an intermediate access node and within the network.” *Id.*, Abstract.

111. As shown in annotated FIG. 1 below, *Ma* discloses a network configuration in which “TCP sources S1 and S2 are connected via respective local area networks LAN1 and LAN2 to an IP subnetwork comprising network nodes such as an intermediate router R and gateways G1 and G2, through which data

packets are transmitted in the IP subnetwork. Each of the local area networks LAN1 and LAN2 is connected to the subnetwork via a respective **edge device**, e.g. **access node** (not shown).” *Id.*, 6:50-57 (emphasis added).



Ex. 1005, FIG. 1 (annotated).

112. *Ma* also discloses that “a packet queue length in a network node is determined and a congestion notification is transmitted back towards the source address of an incoming data packet received at the network node, if the detected packet queue length exceeds a predetermined threshold. Then, congestion control is performed at a predetermined intermediate network node in response to the receipt of the congestion notification.” Ex. 1005, Abstract.

b. [19a]: “monitoring a depth of a queue in the integrated device,”

113. *Ma* discloses or renders obvious [19a] as explained for [1a] (Section VII.A.1.b).

c. [19b]: “wherein the queue receives packets from the upstream device within the network device,”

114. *Ma* discloses or renders obvious [19b] as explained for [1b] (Section VII.A.1.c).

d. [19c]: “the packets from the upstream device include packets having different priorities arbitrated by the upstream device, and”

115. *Ma* alone (Ground 1a) or in combination with *Kim* (Ground 1b) renders obvious [19c].

116. As explained for [1b] (Section VII.A.1.c), *Ma*’s intermediate router R (“queuing device”) receives packets from an access node (“upstream device”). It would have been obvious to a person of skill that the packets from the access node would have had different priorities arbitrated by the access node because prioritizing packets was well known. *See* Ex. 1014, 1:63-2:7 (filed in 2005 and describing prioritizing packets); Ex. 1015, Abstract (filed in 2002 and describing managing data flow that considers priority of traffic). Moreover, *Ma* contemplates that the FBCN packets have a higher priority than the ENC or WECN packets. Ex. 1005, 10:60-66.

117. For **Ground 1b**, to the extent Patent Owner argues *Ma* does not explicitly disclose that the packets from the upstream device have different priorities arbitrated by the upstream device, *Kim* does.

118. *Kim* discloses that “[t]he packet classifying unit is adapted to classify the packets to be forwarded to a switch and the packets to be forwarded to the first and second host processors in accordance with a header of the packets received by the network processor. The queue comprises a variable length queue adapted to enqueue a packet having a high priority into a high queue and to enqueue a packet having a low priority into a low queue.” Ex. 1006, [0031]-[0032].

119. *Kim* also discloses that “[c]hecking the flag and transmitting the packet comprises: discriminating a flag value which indicates whether or not the receiving processor can receive a packet upon a packet to be forwarded to the receiving processor being generated by the network processor; discarding the packet when the flag value is set to a value indicating that the receiving processor is incapable of receiving the packet; comparing a priority of the packet when the flag value is set to a value indicating that the receiving processor is capable of receiving the packet; enqueueing the packet in a corresponding priority queue in accordance with the priority of the packet; and transmitting an interrupt signal to the receiving processor after enqueueing.” *Id.* at [0036].

120. *Ma* suggests having packets with different priorities. But *Ma* does not provide additional details about how packet priorities are arbitrated. A person of skill analyzing *Ma*'s system would, therefore, have looked to other references to supply the methodology for arbitrating packet priority—like *Kim*. Prioritizing packets was a well-known and routine function of packet management and transmission systems. *See* Ex. 1014, 1:63-2:7 (filed in 2005 and describing prioritizing packets); Ex. 1015, Abstract (filed in 2002 and describing managing data flow that considers priority of traffic). And a person of skill would have reasonably expected success in implementing *Kim*'s prioritization procedure in *Ma* to achieve the expected result as already suggested by *Ma*.

e. [19d]: “the integrated device acts as a discard point by discarding packets when the queue is full,”

121. *Ma* alone (Ground 1a) or in combination with *Kim* (Ground 1b) discloses or renders obvious [19d] as explained for [1c] (Section VII.A.1.d).

f. [19e]: “wherein the upstream device is a traffic manager;”

122. *Ma* discloses or renders obvious [19e] as explained for [1d] (Section VII.A.1.e).

g. [19f]: “if the depth of the queue passes a predetermined threshold, sending a message to the upstream device to reduce a rate at which packets are sent to the integrated device to prevent the queue

from filling and thereby preventing packet discarding and loss by the integrated device,”

123. *Ma* discloses or renders obvious [19f] as explained for [1e] (Section VII.A.1.f).

h. [19g]: “wherein a rate at which data is sent to the integrated device differs from a rate at which data is sent from the integrated device due to packet processing within the integrated device;”

124. *Ma* discloses or renders obvious [19g] because *Ma* discloses receiving packets (data sent to the integrated device) at a particular rate, processing those packets by determining the type of packet and congestion along the path, and sending packets (data sent from the integrated device) at a different rate based on ACK rate control.

125. *Ma* explains that in response to each “congestion notification received from the packet-switched network,” which a person of skill would have understood to be received at a particular rate, congestion control is performed by “controlling the rate of acknowledgments routed through the intermediate network node” by selecting a new acknowledgment rate including “a delay time” calculated “in response to each arrival of the congestion notification.” Ex. 1005, 5:36-6:22.

126. With reference to FIG. 4, *Ma* further discloses that “an ACK identification is performed in step S100 so as to extract ACK packets from the packet flow received from the IP network.” *Id.*, 10:27-32. A person of skill would

have understood these packets to be received at a particular rate because in wireless communication systems like *Ma* packets are transmitted at a given rate. Once the ACK packets are received and extracted, *Ma* discloses processing these received packets by performing congestion detection and determining the type of packet (FBCN, ECN, or WECN). *Id.*, 10:33-52. As a result of this processing, if the ACK packet is an FBCN packet, “an initial processing module is activated” to detect congestion, and “the ACK rate control in the access node is initiated” to either drop or adjust the acknowledgment rate. *Id.*, 10:43-52. Based on the determined acknowledgment rate, “a slow down or speed up of the ACK flow toward the TCP sources is then performed,” thus transmitting outgoing packets at a new rate, different from the received rate. *Id.*, 10:53-55; *see also id.*, 10:56-11:7, 11:8-44.

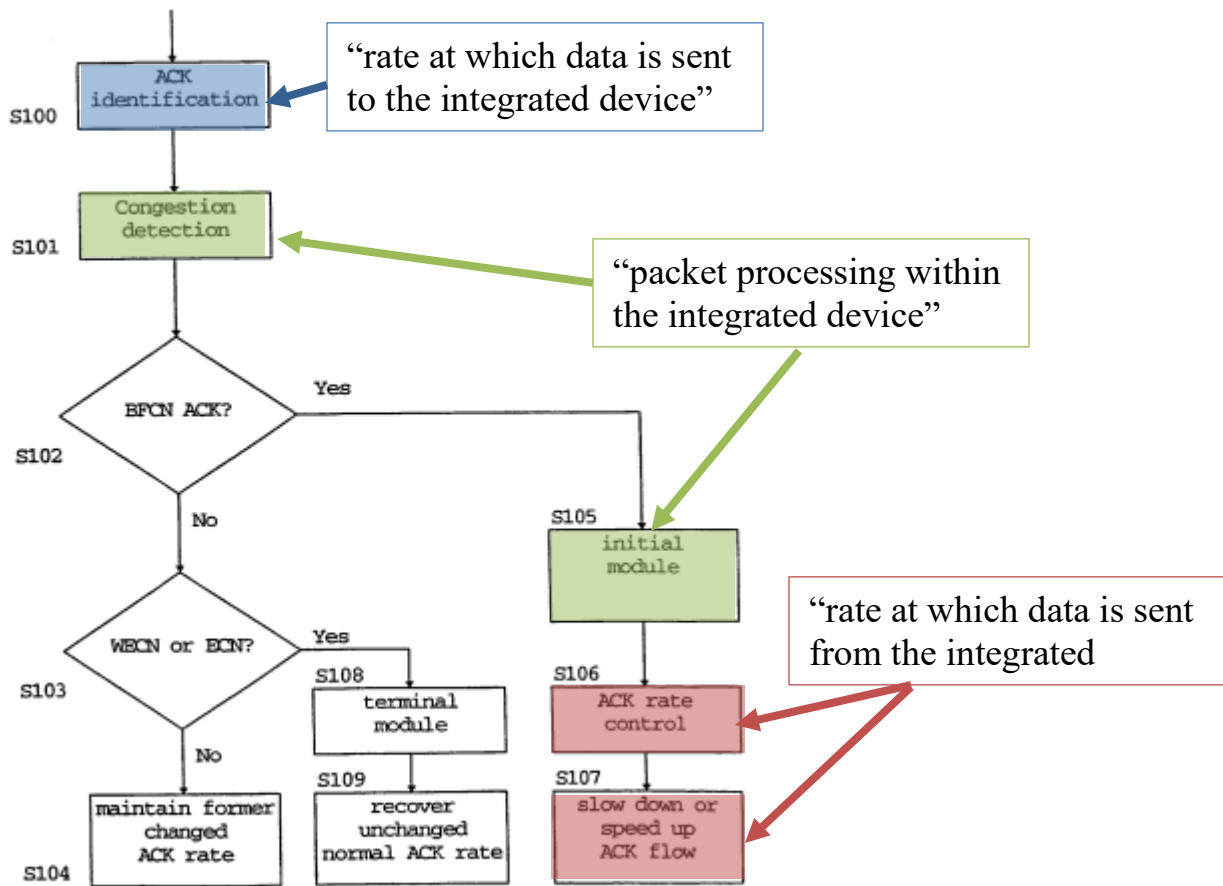


Fig. 4

Ma, FIG. 4 (annotated).

- i. [19h]: “sending a message reporting the depth of the queue to the upstream device to thereby enable the upstream device to determine whether to reduce or increase the rate at which the upstream device sends packets to the integrated device; and”

127. *Ma* discloses or renders obvious [19h] as explained for [1f] (Section VII.A.1.g).

- j. [19i]: “sending the message from the upstream device to an upstream network device to thereby control a

rate at which the upstream device receives packets from the upstream network device.”

128. *Ma* discloses or renders obvious [19i] as explained for [1g] (Section VII.A.1.h).

4. Claim 26

a. [26Preamble]: “A queuing device for incorporation as a lossless processing stage in a network device in a communications network between an upstream device and a downstream device in the network device, the queuing device comprising:”

129. *Ma* discloses or renders obvious [26Preamble] as explained for [9Preamble] (Section VII.A.2.a).

b. [26a]: “a processor coupled to a queue, wherein the queue receives packets from the upstream device within the network device; and”

130. *Ma* alone (Ground 1a) or in combination with *Kim* (Ground 1b) renders obvious [26a] as explained for [9a] (Section IV.A.2.b) and [9d] (Section IV.A.2.e).

c. [26b]: “modules executed by the processor, the modules including:”

131. *Ma* alone (Ground 1a) or in combination with *Kim* (Ground 1b) renders obvious [26b] as explained for [9b] (Section VII.A.2.c).

d. [26c]: “a module for monitoring a depth of the queue,”

132. *Ma* alone (Ground 1a) or in combination with *Kim* (Ground 1b) renders obvious [26c] as explained for [1a] (Section VII.A.1.b) and 9[c] (Section VII.A.2.d).

e. [26d]: “the queuing device acting as a discard point by discarding packets when the queue is full;”

133. *Ma* alone (Ground 1a) or in combination with *Kim* (Ground 1b) renders obvious [26d] as explained for [1c] (Section VII.A.1.d).

f. [26e]: “a module for, if the depth of the queue passes a predetermined threshold, sending a message to the upstream device to reduce a rate at which packets are sent to the queuing device to prevent the queue from filling and thereby preventing packet discarding and loss by the queuing device, wherein the upstream device is a traffic manager;”

134. *Ma* alone (Ground 1a) or in combination with *Kim* (Ground 1b) renders obvious [26e] as explained for [1d] (Section IV.A.1.e), [1e] (Section IV.A.1.f), [9f] (Section IV.A.2.g), and [9g] (Section IV.A.2.h).

g. [26f]: “a module for sending a message reporting the depth of the queue to the upstream device to thereby enable the upstream device to determine whether to

reduce or increase the rate at which the upstream device sends packets to the queuing device; and”

135. *Ma* alone (Ground 1a) or in combination with *Kim* (Ground 1b) renders obvious [26f] as explained for [1f] (Section VII.A.1.g) and [9h] (Section VII.A.2.i).

h. [26g]: “a module for sending the message from the upstream device to an upstream network device to thereby control a rate at which the upstream device receives packets from the upstream network device.”

136. *Ma* alone (Ground 1a) or in combination with *Kim* (Ground 1b) renders obvious renders obvious [26g] as explained for [1g] (Section VII.A.1.h) and [9i] (Section VII.A.2.j).

5. Claims 2, 10, 20, 27: “if the depth drops below the predetermined threshold: sending a message to the upstream device to increase the rate at which packets are sent to the queuing device.”

137. Claims 2, 10, 20, and 27 are identical aside from the independent claim from which they depend. *Ma* discloses or renders obvious these claims because *Ma* discloses that “if the depth drops below the predetermined threshold: sending a message to the upstream device to increase the rate at which packets are sent to the queuing device,” as claimed.

138. *Ma* discloses that “[w]hen the average queue length drops below the BFCN threshold, a release of the congestion in this intermediate node is determined.” Ex. 1005, 7:61-63. *Ma* further discloses that “an FBCN packet with

an FBCN bit turned off is generated if the queue length drops below the FBCN threshold. When the queue length remains below the threshold, no additional FBCN packet is generated and no filter mechanism is employed. Since the FBCN packet with a set FBCN bit is produced once per round-trip time, if buffer congestion still exists, the generation of the FBCN packet with a FBCN bit turned off will not exceed once per round-trip time. For example, if the congestion lasts longer than a round-trip time, the FBCN packet with FBCN bit '0' will not be generated until the length of the queue returns back to the lower threshold level. Thereafter, no additional FBCN packet with reset FBCN bit is generated, since the queue remains lower than the threshold, such that the total number of FBCN packets with reset FBCN bit is less than the number of packets with set FBCN bit. On the other hand, if the node congestion is released before a round-trip time has passed, the number of FBCN packets with FBCN bit of '0' (reset) is equal to those with FBCN of '1' (set) in this node." *Id.* at 8:24-43.

139. *Ma* also discloses that "[w]ith the above two different kinds of FBCN messages, the access node in which the adaptive congestion control is implemented will increase the acknowledgment rate if a FBCN packet with reset FBCN bit has been received, since this indicates that the congestion in the notifying network node has been released." *Id.*, 8:58-63.

6. Claims 4, 12, 22, and 29: “wherein the network device is a router, switch, or gateway.”

140. Claims 4, 12, 22, and 29 are identical aside from the independent claim from which they depend. *Ma* discloses or renders obvious these claims because *Ma* discloses that “the network device is a router switch or gateway.”

141. *Ma* discloses that “FIG. 1 shows a network configuration, wherein TCP sources S1 and S2 are connected via respective local area networks LAN1 and LAN2 to an IP subnetwork comprising **network nodes such as an intermediate router R and gateways G1 and G2**, through which data packets are transmitted in the IP subnetwork. Each of the local area networks LAN1 and LAN2 is connected to the subnetwork via a respective edge device, e.g. access node (not shown).” Ex. 1005, 6:50-57 (emphasis added).

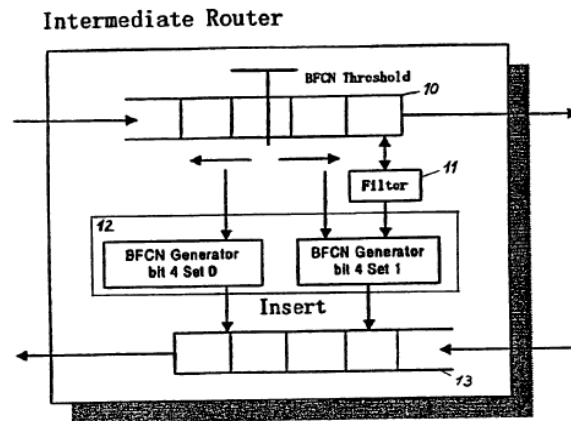
7. Claims 5, 13, 24, and 30: “wherein the queuing device is a network processor or traffic manager.”

142. Claims 5, 13, 24, and 30 are identical aside from the independent claim from which they depend. *Ma* discloses or renders obvious these claims because *Ma* discloses that “the queuing device is a network processor or traffic manager.”

143. As discussed above, a person of skill would have understood intermediate router R to be a queuing device. *Ma* discloses that “FIG. 2 shows a functional block diagram of the intermediate router R, which comprises a forward

buffer 10, a backward buffer 13, a filter 11 and a congestion notification unit 12.

The congestion notification unit 12 comprises a mechanism for active queue Management to detect incipient congestion in the forward buffer 10. For simplicity, only one FBCN threshold is set before the queue in the forward buffer 10 overflows. The congestion notification unit 12 determines an average queue length and compares this average queue length with the predetermined BFCN threshold. When the average queue length exceeds the BFCN threshold, an incipient network congestion is determined. When the average queue length drops below the BFCN threshold, a release of the congestion in this intermediate node is determined. Whenever the buffer length in the network node exceeds or remains higher than the FBCN threshold, one FBCN packet is generated by the congestion notification unit 12 for each forward incoming packet or, alternatively, only for one FBCN packet upon the reach of the FBCN threshold, wherein an FBCN bit is set in the FBCN packet.” Ex. 1005, 7:48-8:2. Thus, the intermediate router R is at least a traffic manager.



Ex. 1005, FIG. 2

144. *Ma* also discloses that “[t]he FBCN mechanism guarantees that the congestion control is executed in a current round-trip time by quickly responding to previous FBCN messages in the same transmission window. Data transmission rate can be reduced and congestion can be alleviated before an amount of data corresponding to the transmission window has been received at the destination. This allows traffic to be kept under control using a limited number of FBCN messages. Moreover, since the FBCN mechanism requires only an IP indicator, an interface facility between IP and TCP can be avoided and there is no need for any changes in the response to the FBCN message at the receiver.” *Id.* at 9:48-59. Thus, a person of skill would have understood that by managing congestion, the intermediate router R is also managing traffic.

8. Claims 6, 14, 25, and 31: “wherein the packets are at least one of Internet Protocol (“IP”) packets, multiprotocol label switching (“MPLS”) packets, asynchronous transfer mode (“ATM”) packets, and frame relay packets.

145. Claims 6, 14, 25, and 31 are identical aside from the independent claim from which they depend. *Ma* discloses or renders obvious these claims because *Ma* discloses that “the packets are at least one of Internet Protocol (“IP”) packets, multiprotocol label switching (“MPLS”) packets, asynchronous transfer mode (“ATM”) packets, and frame relay packets.”

146. *Ma* discloses that “[w]hen the average queue length in the forward buffer 10 exceeds the FBCN threshold, the FBCN packet is generated by latching the source and destination **IP address** of the incoming packets, setting or resetting the FBCN bit in the **IP header**, exchanging source and destination addresses in the generated FBCN packet in which the IP header is replicated from the forward passing packet. Then, the FBCN packet is inserted into the reverse direction stream of the backward buffer 13. Since the new destination address is equal to the source address of the forward packet, the FBCN packet can be returned towards the TCP source and passed through the respective access node of the IP network.” Ex. 1005, 9:30-42 (emphasis added). Thus, a person of skill would have understood that the packets disclosed in *Ma* are at least IP packets.

9. Claim 7: “The method of claim 1, further comprising, after the queue has been drained: alerting the upstream device to resume sending traffic to the queue.”

147. *Ma* discloses or renders obvious claim 7 because *Ma* discloses that “after the queue has been drained: alerting the upstream device to resume sending traffic to the queue.”

148. For example, *Ma* discloses that “FIG. 2 shows a functional block diagram of the intermediate router R, which comprises a forward buffer 10, a backward buffer 13, a filter 11 and a congestion notification unit 12. The congestion notification unit 12 comprises a mechanism for active queue management to detect incipient congestion in the forward buffer 10. For simplicity, only one FBCN threshold is set before the queue in the forward buffer 10 overflows. The congestion notification unit 12 determines an average queue length and compares this average queue length with the predetermined BFCN threshold. When the average queue length exceeds the BFCN threshold, an incipient network congestion is determined. When the average queue length drops below the BFCN threshold, a release of the congestion in this intermediate node is determined.” Ex. 1005, 7:48-63. The ’973 patent recites that “[i]nstead of allowing the queuing device 140 to fill its queues and discard traffic packets, the queue depth monitoring system alerts an upstream device (e.g. 120 in FIG. 1) to slow down or stop sending traffic destined to the congested queue or queues in the queuing device 140. Once

the queue has been drained, the queue depth monitoring system can then alert the upstream device 120 to begin sending traffic to the queue again.” Ex. 1001, 5:55-62. In the context of the ’973 patent, a person of skill would have understood that the claimed “the queue has been drained” simply requires that the queue depth be low enough that it is ready to receive traffic once again.

149. *Ma* further discloses that “[w]ith the above two different kinds of FBCN messages, the access node in which the adaptive congestion control is implemented will increase the acknowledgment rate if a FBCN packet with reset FBCN bit has been received, since this indicates that the congestion in the notifying network node has been released.” Ex. 1005, 8:58-63. A person of skill would have understood that a message with the reset FBCN alerts the upstream device, access node, to resume sending traffic to the queue.

10. Claim 8: “The method of claim 1, further comprising: periodically reporting the depth of the queue to provide for error recovery.”

150. *Ma* discloses or renders obvious claim 8 because it discloses cyclically (“periodically”) reporting the congestion notification (“depth of the queue”) to provide for error recovery.

151. The ’973 patent only mentions “error recovery” in one place in the specification, stating, “the queue depth monitoring system provides for error recovery in the event that it makes a mistake or that a message is lost or corrupted.

The queue depth monitoring system provides for error recovery by periodically reporting queue depths rather than only reporting threshold crossing events.” Ex. 1001, 6:3-8. This description provides no enabling disclosure of how periodic reporting provides for error recovery but assumes that periodically reporting queue depths rather than reporting only threshold crossing events *per se* achieves the goal of providing for error recovery.

152. Although *Ma* does not expressly state that its cyclical reporting of congestion is for the purpose of error reporting, it meets this limitation because given the ’973 patent’s limited written description, for this claim to be valid as fully supported in the specification, a person of skill would have understood that periodic reporting rather than threshold reporting achieves the desired error recovery.

153. *Ma* discloses that “[t]he processing order of the above schemes should be implemented in such a manner that the FBCN mechanism is initiated at first. Then, if the buffer size has reached the comparatively highest ECN threshold, the ECN mechanism starts. The WECN mechanism is initiated if a packet loss due to congestion occurs before ECN messages have been received from a data window. If ECN bit and WECN bit are both set in the IP header of a received packet, a higher priority may be allocated to WECN, since WECN indicates a heavier network congestion, and the source window reduction is initiated by WECN in this

case. The cycle of these procedures is repeated in accordance with the buffer occupancies. Within such a cycle, the FBCN mechanism in the access node ends up when a WECN ACK or an ECN ACK has been detected, and the source congestion control will be invoked by any of them. However, different individual congestion notification messages may arrive at the source terminal during a round-trip time. To achieve a quick alleviation of congestion and avoid unnecessary waste of bandwidth, the TCP source may react only to the first congestion notification message, and the remaining ones are ignored if they arrive in the same congestion window.” Ex. 1005, 13:40-61.

154. *Ma* further provides filter 11 for “reducing the number of FBCN packets in order to achieve an effective control by avoiding the transmission of ineffective FBCN packets.” *Id.*, 8:10-12. Filter 11 “guarantees that a sufficient number of FBCN packets is transmitted in order to avoid an inadequate FBCN mechanism,” thus further preventing errors. *Id.*, 8:12-15.

155. Thus, *Ma* discloses cyclical (periodic) reporting, even more than is necessary to prevent errors, and not simply threshold reporting.

B. Ground 2: *Ma* in view of *Enomoto* (Ground 2A) and *Ma* in view of *Kim* and *Enomoto* (Ground 2B) Renders Obvious Claims 3, 11, 21, and 28

1. Claims 3, 11, 21, and 28: “wherein the monitoring further comprises: comparing a rate at which packets enter the queuing device to a rate at which packets exit the queuing device.”

156. Claims 3, 11, 21, and 28 are identical aside from the independent claim from which they depend.

157. *Ma* in combination with *Enomoto* (Ground 2a) or *Ma* in combination with *Kim* and *Enomoto* (Ground 2b) renders obvious claim 3.

158. *Ma* discloses that monitoring congestion was known in the art but is not specific about comparing the rates of packets entering and exiting the queuing device as the means for monitoring congestion. *See, e.g.*, Ex. 1005, 2:46-53.

159. *Enomoto* discloses comparing the incoming and outgoing flow rates of packets. For example, *Enomoto* discloses that “[w]hen the OUT side flow controller 6-1 receives a packet from the switch unit 8 (in the case of IN side flow controller 6-2, from the packet receiver 4), the flow control decider 653-1 of flow detector 65-1 extracts the header contained in the received packet (step 2001) and transfers the extracted header to the flow comparator 652-1 (step 2002).” Ex. 1007, [0085]. *Enomoto* further discloses that “[w]hen receiving the header from the flow control decider 653-1, the flow comparator 652-1 compares individual information pieces ... with pieces of information stored in the flow control condition memory

651-1 (information pieces registered in respective entries) in correspondence to the above information pieces, respectively, to determine coincidence of the former information pieces with the latter information pieces (step 2003). ... On the other hand, when any information piece registered in the flow control condition memory 651-1 coincides with each information piece, the flow comparator 652-1 further decides necessity or non-necessity of collection of flow statistic information by consulting information indicative of the contents of flow control registered in the flow control condition memory 651-1 in correspondence to the coincident information pieces (step 2004).” *Id.*, [0086].

160. *Ma* discloses a “congestion notification unit 12 [that] **determines an average queue length.**” Ex. 1005, 7:57-58; *see also id.*, 4:11-16, 5:3-6. But *Ma* does not provide additional details about how the queue length is determined. A person of skill would have understood that there were several known ways to monitor congestion that were known in the art, one of which, as taught by *Enomoto*, is comparing incoming and outgoing packet flows in the queueing device. A person of skill analyzing *Ma*’s system would have looked to other references to supply the methodology for determining the queue depth—like *Enomoto*. And a person of skill would have reasonably expected success in implementing *Enomoto*’s standard procedure using a conventional flow

comparator performing its routine function in *Ma* to achieve the expected flow comparison result.

C. Ground 3: *Ma* in view of *McCrosky* (Ground 3A) and *Ma* in view of *Kim* and *McCrosky* (Ground 3B) Renders Obvious Claim 17

1. Claim 17: “The system of claim 9, wherein the system is implemented with a field programmable gate array (‘FPGA’) within the network device.”

161. *Ma* in combination with *McCrosky* (Ground 3a) or *Ma* in combination with *Kim* and *Enomoto* (Ground 3b) renders obvious claim 17.

162. The ’973 patent acknowledges that implementing its claimed method using an FPGA was well within the purview of a person of skill. The ’973 patent mentions an FPGA at only two places of the specification. First, it states, “[t]he queuing device’s function may be replaced by a field programmable gate array (‘FPGA’) customized by the network device manufacturer.” Ex. 1001, 5:41-43. Second, it states, “[t]he queue depth monitoring system may be an external device (e.g., an FPGA, a data processing system 300, etc.).” *Id.*, 5:63-64. Neither of these limited disclosures provides any enablement for a specialized implementation beyond the use of a generic FPGA according to its routine function, and a person of skill would have understood this.

163. *Ma*’s network devices are generic network devices that a person of skill would have understood to include standard logic components—like an FPGA. *Ma* does not expressly disclose that its network device includes an FPGA, but

FPGAs were commonly used at the time and it would have been obvious that *Ma*'s network device includes or would be modified to include an FPGA, as disclosed in *McCrosky*.

164. *McCrosky* discloses a network device with a field programmable gate array. For example, *McCrosky* discloses that “[t]he logic of the ports and the switch core could be implemented in a great variety of ways, including but not limited to: a. custom hardware gates, b. gate arrays, c. **FPGAs**, d. software on microprocessors or microcontrollers, or e. any combination of the above.” Ex. 1008, 20:62-21:4 (emphasis added).

165. Given the limited disclosure of the '973 patent itself, a person of skill would have understood that an FPGA was a routine mechanism for implementing queuing systems in the art at the time, as taught by *McCrosky*. Therefore, a person of skill analyzing *Ma*'s system would have looked to other references for ways of implementing its methods, including those implementing a standard FPGS—like *McCrosky*. And a person of skill would have reasonably expected success in implementing *McCrosky*'s FPGA performing its routine function in *Ma* to achieve the expected result.

VIII. CONCLUSION

166. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of

the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Respectfully submitted,



Stephen Gray