

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Palo Alto Networks, Inc.
Fortinet, Inc. and
WatchGuard Technologies, Inc.
Petitioners

v.

Selective Signals, LLC,
Patent Owner

U.S. Patent No. 8,111,629
Issue Date: Feb. 7, 2012
Title: Media Session Identification Method for IP Networks

Inter Partes Review No.: IPR2018-00594

**SUPPLEMENTAL DECLARATION OF DR. SAMUEL H. RUSS *INTER*
PARTES REVIEW OF
U.S. PATENT NO. 8,111,629**

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SUPPLEMENTAL DECLARATION OF DR. SAMUEL RUSS

1. I am over the age of eighteen (18) and otherwise competent to make this declaration.

2. I have been retained by Palo Alto Networks (Petitioner) as an independent expert consultant in this proceeding before the United States Patent and Trademark Office. Although I am being compensated at my rate of \$445 per hour for the time I spend on this matter, no part of my compensation depends on the outcome of this proceeding, and I have no other interest in this proceeding. To the best of my knowledge, I have no financial interest in Palo Alto Networks.

3. In preparing this Declaration, I have reviewed the '629 Patent (PAN-1001), the file history of the '629 Patent (PAN-1002), and each of the documents cited herein, and I have considered these documents in light of the general knowledge in the art as of Nov. 6, 2006. In formulating my opinions, I have relied upon my experience in the relevant art. I have also considered the viewpoint of a person of ordinary skill in the art ("POSA") in the field, as of Nov. 6, 2006. I also have reviewed my previous Declaration (PAN-1003) and hereby incorporate my opinions expressed therein.

4. I have been asked to provide my technical expertise, analysis, insights and opinions regarding the '629 Patent and relevant references that form the basis of the grounds of rejection set forth in the accompanying Petition for *inter partes*

review of the ‘629 Patent. As described in detail below, I offer at least the following opinion in this Declaration:

- A POSA would have found Substitute Claim 25 to be obvious over U.S. Pat No. 8,085,775 to Pappu issued on Dec. 27, 2011 from an application filed on Jul 31, 2006 (“Pappu”) alone, or in view of U.S. Pat Pub. No. 2006/0262789 published on November 23, 2006 from an application filed May 19, 2006 (“Peleg”) or further in view of U.S. Pat. No. 7,660,248 to Duffield issued on Feb 9, 2010 from an application filed on Jun 23, 2004 (“Duffield”), Pappu alone, or in view of Peleg and Duffield teach each element of Substitute Claim 25 to a POSA and a POSA would have been motivated to combine the teachings of these references.

I. Pappu, Alone or in Combination with Peleg, Discloses “Traffic Packet Characteristics”

5. Pappu defines a flow to be “a set of packets that are *related in some manner.*” *PAN-10046*:16-17 (emphasis added). Furthermore, Pappu teaches that flows can be identified and classified based on observed behavioral characteristics, not just based on packet header information:

In one embodiment of the invention, flows are identified and classified based upon their observed behavior.

Because flows are identified and classified based upon

their observed behavior, and because their behavior cannot be hidden, the traffic type that a flow represents can be estimated with relatively high accuracy even if the contents of the packets that represent the traffic type are dissimilar.

PAN-1004 2:41-47.

6. Claim 1 of Pappu discloses an embodiment where the flow is not identified by header information alone:

1. A machine-implemented method for the identification and handling of a single application flow, the flow comprising a plurality of information packets, and the method comprising:

creating a flow block as the first packet of a flow is processed by a router;

said flow block being adapted to store payload-content agnostic behavioral statistics about said flow;

updating said flow block with the flow's payload-content agnostic behavioral statistics as packets belonging to said flow are processed by said router;

said flow being incapable of being identified by header information alone;

...

PAN-1004 Claim 1 (emphasis added)

7. Pappu also teaches that the described method does not need to rely only on information contained in the packets:

Routers which employ the techniques described herein may classify and handle packets in a manner that takes into account information beyond that which is contained in the packets themselves (some kinds of traffic cannot be identified only on the basis of the information contained in the packets that form that traffic).

PAN-1004 8:33-38.

8. A POSA understood Pappu to group packets into flows and to use the observed behavioral statistics disclosed by Pappu to group the packets in a meaningful way. For example, the flow rate statistics shown in Fig. 4 of Pappu describe the data rate of the flow. Data rate is a direct way of grouping packets in a meaningful way – for example, a POSA understood that a flow with a data rate on the order of 50 kbit/s is much more likely to be a VOIP session than a flow with a data rate on the order of 1 Mbit/s. Thus, the teachings of Pappu provide examples of non-header parameters that are relatively easily gathered and that help inform the system as to grouping and classification.

9. Additionally, Peleg describes the use of several characteristics other than header information, including time interval between packets and throughput

per second. PAN-1006 Claim 3. In one embodiment, Peleg describes grouping packets into the same session based on inter arrival time: “In accordance with the present invention, an exemplary classifier classifies the packets based on their length and/or the time intervals between successive packets belonging to the same session.” PAN-1006 [0022]. A POSA would be motivated to combine the teaching of Peleg (PAN-1006 [0008]) (“To one of ordinary skill in the art, there is thus a need, and it would be highly desirable to have a method and corresponding device for classifying sessions based on the pattern and/or characteristics of traffic rather than traffic contents) with the teachings of Pappu (PAN 1004 6:29-32) (“by grouping packets into flows, it is possible to aggregate individual packets in a meaningful way to allow the traffic flowing through router 102 to be understood at a higher level”) to use a traffic characteristic other than header information, e.g., inter-arrival time, to group packets into common sessions. Such a combination would be useful in an embodiment disclosed in Pappu of a flow that is “incapable of being identified by header information alone.” PAN-1004 Claim 1.

A. “Session” and “Flow”

10. The ’629 Specification teaches:

a media session identification method that identifies
media sessions from the flow of packets and assigns
specific packets to the media sessions.

PAN-1001 1:18-21.

This suggests that multiple media sessions can be identified *from* the flow of packets, where the '629 Patent uses the term “flow of packets” generically to mean IP based media traffic over networks. *Id.* 1:16-28.

11. The Specification does not require that a session be bi-directional, as the Specification expressly includes “video streams” as a “session,” which are well-known to be unidirectional:

It is noted that the term “session” includes streaming of data, such as in for example a video stream.

PAN-1001 1:20-23.

12. Each of the '629 Patent, Pappu, and Peleg, provide VOIP and video streaming over IP as an example of a session or flow, thus confirming they are all referring to the same concept. *PAN-1001* 1:20-23; *PAN-1004* Abstract, 6:34-37; *PAN-1005* ¶[0020].

13. In the '629 Patent, a “session” is a set of packets that are grouped into a common session type:

Packet identification or grouping, are terms used to refer to an identification of packets that belong together to a session type in a common session.

PAN-1001 3:40-42.

14. Pappu describes that “a flow is a set of packets that are related in some manner” (*PAN-1004* 6:16-17) and can be grouped according to traffic type

such as VOIP. PAN-1004 6:33-42. Pappu teaches that using observed behavior allows the traffic type of the flow to be determined with high accuracy: “Because flows are identified and classified based upon their observed behavior, and because their behavior cannot be hidden, the traffic type that a flow represents can be estimated with relatively high accuracy even if the contents of the packets that represent the traffic type are dissimilar.” *PAN-1004* 2:23-53

15. A POSA would have understood that “flows” described in Pappu correspond to the “sessions” described in the ’629 Patent, with both their goals being to group packets into common traffic types in order to make best use of resources to control the packets. Compare Pappu PAN-1004 6:38-42 (“To make the best use of available resources, and to best control the traffic that passes through router 102, router 102 would benefit from an ability to identify different types of traffic, and to take specified appropriate actions relative to those types of traffic.”) with the ’629 Patent PAN-1001 6:19-22 (“The traffic characteristics may also be used to identify the session type so that appropriate resources can be made available or not for the session, or other provisioning and control actions may be applied to the session.”).

B. “Behavioral Characteristics”

16. Pappu groups packets into flows having a common traffic type, and then applies a policy for that specific type of traffic to all the packets that have the

same traffic type. PAN-1004 3:4-21. Rather than treating all packets the same, Pappu expressly describes that packets grouped together as a VOIP traffic would be treated differently than packets grouped together as P2P traffic or online gaming traffic:

For example, multiple flows that exhibit behaviors that are characteristic of P2P traffic all may be handled in one way that is appropriate for P2P traffic. Multiple flows that exhibit characteristics of VOIP traffic all may be handled in another way that is appropriate for VOIP traffic. Multiple flows that exhibit characteristics of online gaming traffic all may be handled in yet another way that is appropriate for online gaming traffic.

PAN-1004 3:23-30.

17. The '629 Patent and Pappu thus describe treating sessions and flows in an identical manner, and neither teaches that all packets are treated the same way.

18. Pappu describes that the behavioral characteristics are not limited to “aggregate packet data”, but rather also **expressly** include “packet specific information” such as packet size and inter-arrival gap between two packets:

an instantaneous flow rate (derived by dividing (a) the *size of the most recently arrived packet* of the flow by (b)

the *inter-arrival time gap* between the two most recently arrived packets of that flow).

PAN-1004 7:42-46 (emphasis added). See also *PAN-1004* 2:59-3:3 and *PAN-1004* Fig. 4.

II. The Substitute Claims Are Obvious In View Of Pappu, Peleg, And Duffield

1. Duffield Discloses Grouping Packets Using More Than Packet Header Information

19. Duffield discloses grouping packets into preselected classes of service based on traffic features. *PAN-1005* 2:63-67. In one embodiment, the preselected classes of service include interactive traffic, bulk data transfer traffic, streaming traffic, and transactional traffic. *Id.* The traffic features include packet-level features such as packet size, flow-level statistics such as the 5-tuple, and intra-flow/connection features including the inter-arrival times between packets. *PAN-1005* 6:28-7:24. Duffield discloses assigning packets to the preselected classes based on the traffic features, including features in the packet header such as 5-tuple information, and features that are “more than packet header information” such as inter-arrival times. *PAN-1005* 5:7-14; FIG. 1.

20. Duffield disparages port analysis and content analysis, stating that methods that relied solely on port analysis or content analysis were not reliable due to the dynamic nature of ports and/or the use of encryption. *PAN-1005* 3:41-5:5.

2. Detailed Application Of Pappu, Peleg And Duffield To The Substitute Claims

a. Substitute Claim 25

i. *A method of identifying session type, comprising:*

21. Pappu discloses a method of “identifying, classifying, and controlling information packet flows in a network”. *PAN-1004* Abstract, 2:34-44; *PAN-1003* ¶91; Pet. p. 38-39.

ii. *obtaining passing packets of respectively unknown sessions and unknown session types;*

22. Pappu discloses receiving and processing of packets (*obtaining passing packets*) including packets that “do[] not match any previously established flow”. (*unknown sessions and unknown session types*). *PAN-1004* 7:4-6; *PAN-1003* ¶93; Pet. p. 39-40.

iii. *obtaining traffic packet characteristics of said passing packets of respectively unknown session types;*

23. Pappu discloses obtaining certain header information including the 5-tuple. *PAN-1004* 6:17-26; *PAN-1003* ¶94; Pet. 40. Pappu also discloses obtaining non-packet header information. Specifically, Pappu discloses that as the packets of a flow are processed, a set of behavioral statistics are maintained for the flow. *PAN-1004* Fig. 3 and Fig. 4; *PAN-1003* ¶78; Pet. 31-32. These behavioral statistics reflect the empirical behavior of the flow and are stored in the flow block for that flow. *PAN-1004* 7:21-24; *PAN-1003* ¶79; FIG. 4. These behavioral

statistics which are obtained include non-header information such as average inter-packet gap (inter-arrival period), flow rate, and instantaneous flow rate, each of which are packet characteristics that are more than packet header information.

PAN-1004 Fig. 4; *PAN-1003* ¶79; Pet. 32-33. Although Fig. 4 discloses “average inter-packet gap”, Pappu describes that the inter-packet gap can be used to derive an “average” inter-packet gap (*PAN-1004* 7:34-42) and that “the inter-packet time gap between the two most recently arrived packets” can be used to derive an instantaneous flow rate. *PAN-1004* 14:57-15.4. Thus, a POSA understood that Pappu discloses determining the inter-packet gap between successive packets to derive the average inter-packet gap and to derive flow rate

iv. comparing said obtained packets with each other using respectively obtained traffic packet characteristics

24. Pappu discloses comparing parameters associated with traffic packets with parameters of other packets to determine if they share sufficient information.

PAN-1004 6:17-26; *PAN-1003* ¶¶97,98; Pet. 41-42

25. Pappu teaches that flows can be identified and classified based on behavioral statistics¹, not just based on packet header information. *PAN-1004* 2:37-53; *PAN-1003* ¶72; Pet. 28-29. These behavioral statistics include characteristics

¹ Pappu uses the words behavioral statistics and behavioral characteristics

interchangeably. See *PAN-1004* Title vs Abstract.

of traffic packets such as inter-packet gap (inter-arrival period), flow rate, and instantaneous flow rate. *PAN-1004* Fig. 4; *PAN-1003* ¶79; Pet. 32-33. Using these characteristics and others, Pappu creates a flow block for each previously identified flow. A flow block is a data structure containing behavioral statistics of the flow. When a packet arrives at a router it is checked to see if it “matches” an existing “flow block”: “If the packet matches an existing flow block, then the packet is deemed to belong to the flow that corresponds to that flow block.” *PAN-1004* 7:9-16; *PAN-1003* ¶78. When Pappu matches based on “flow blocks” in which the behavioral statistics for that flow are stored, it is comparing packets based on traffic packet characteristics that includes more than packet header information.

26. To the extent Patent Owner argues that Pappu only discloses comparing packets based upon header information, it would have been obvious to a POSA, in view of knowledge in the art, to modify Pappu to include in the comparison of non-header information.

27. As described in Pappu, the type or classification of a flow may be determined by individual and/or aggregate characteristics of the packets within the flows. *PAN-1004* 13:20-38; *PAN-1003* ¶¶76-81. Inter-packet gaps and instantaneous data rate are examples of packet characteristics that discriminate different flow types. Individual packets having characteristics associated with the

type/classification of a flow are more likely to belong to that particular flow than are packets having characteristics that do not match. For example, packets exhibiting characteristics of a VoIP packet are an indication that the packets are part of a VoIP flow. The more characteristics in common, the more likely it is that the packets belong to the same flow or session. Thus, a POSA understood that the behavioral statistics used to identify the type of traffic could also be used to group the packets, and identifying commonality in packets facilitates grouping. Thus a POSA would be motivated to compare packets based on the behavioral statistics of inter-arrival gap and instantaneous flow rate as well as header information in order to more effectively group the packets into flows (*sessions*).

28. Pappu expressly provides the motivation to compare more than just packet header information: “by grouping packets into flows, it is possible to aggregate individual packets in a meaningful way to allow the traffic flowing through router 102 to be understood at a higher level.” *PAN 1004* 6:29-3.

Moreover, these non-header parameters are relatively easily gathered and that helps inform the system with regard to grouping and classification. Thus, Pappu expressly provides a motivation for a POSA to group packets into flows, and therefore a POSA would be motivated to compare packets using the behavior statistics disclosed by Pappu in order to group the packets in a meaningful way. A

POSA would also be confident in success of the modification, given the established use of identifying flows based upon these behavioral statistics.

v. grouping together those packets having similar values of said traffic packet characteristics into a presumed session

29. Pappu discloses grouping packets together that match an existing flow block data structure in an existing flow. *PAN-1004* 6:63-66, 7:4-6; *PAN-1003* ¶93. Pet. 39-40.

As is described in greater detail below, in one embodiment of the invention, when FM 210 receives a packet, FM 210 determines whether that packet matches any existing “flow block” data structure.

If the packet matches an existing flow block, then the packet is deemed to belong to the flow that corresponds to that flow block.

Alternatively, if the packet does not match an existing flow block, then FM 210 creates a new flow block for a new flow to which the packet is deemed to belong.

PAN-1005 7:7-16; *PAN-1003* ¶93; Pet. 39-40.

30. Pappu, as modified by the knowledge of one skilled in the art, teaches comparing packets using non-header traffic characteristics as well as packet header information to determine if the packets match one another, and based on the match the packets are grouped. As noted above, a POSA would have been motivated to use these characteristics to group packets “to allow the traffic flowing through router 102 to be understood at a higher level.” *PAN 1004* 6:29-32.

31. Pappu teaches that flows can be both identified and classified based on observed behavioral characteristics, not just based on packet header information:

In one embodiment of the invention, flows are identified and classified based upon their observed behavior.

Because flows are identified and classified based upon their observed behavior, and because their behavior cannot be hidden, the traffic type that a flow represents can be estimated with relatively high accuracy even if the contents of the packets that represent the traffic type are dissimilar.

PAN-1004 2:41-47.

32. Pappu expressly discloses and claims an embodiment where the flow is not identified by header information alone:

1. A machine-implemented method for the identification and handling of a single application flow, the flow comprising a plurality of information packets, and the method comprising:

creating a flow block as the first packet of a flow is processed by a router;

said flow block being adapted to store payload-content agnostic behavioral statistics about said flow;

updating said flow block with the flow's payload-content
agnostic behavioral statistics as packets belonging to said
flow are processed by said router;
*said flow being incapable of being identified by header
information alone;*
...

PAN-1004 Claim 1 (emphasis added)

33. Pappu also teaches that the described method does not need to rely
only on information contained in the packets:

Routers which employ the techniques described herein
may classify and handle packets in a manner that takes
into account information beyond that which is contained
in the packets themselves (some kinds of traffic cannot
be identified only on the basis of the information
contained in the packets that form that traffic).

PAN-1004 8:33-38

34. Pappu teaches that information that is not contained in the packets
includes the observed statistics identified in FIG. 4. (See also *PAN 1004* 14:50-
15:5) Thus, a POSA understood that the same statistics that could be used to
identify the type of traffic could also be used to group the packets. For example,
Pappu discloses that “by grouping packets into flows, it is possible to aggregate
individual packets in a meaningful way to allow the traffic flowing through router
102 to be understood at a higher level.” *PAN 1004* 6:29-32.

35. To the extent that Patent Owner asserts that Pappu does not disclose grouping packets in a presumed session, it would have been obvious in view of Peleg. *PAN-1004* 6:38-42; *PAN 1006* [0041,47]; *PAN-1003* ¶¶103-104; Pet. 43-45. In one embodiment, Peleg describes using a classifier to group packets into the same session based on inter arrival time: “In accordance with the present invention, an exemplary classifier classifies the packets based on their length and/or the time intervals between successive packets belonging to the same session.” *PAN-1006* [0022]. A POSA would be motivated to combine the teaching of Peleg (*PAN-1006* [0008]) (“To one of ordinary skill in the art, there is thus a need, and it would be highly desirable to have a method and corresponding device for classifying sessions based on the pattern and/or characteristics of traffic rather than traffic contents) with the teachings of Pappu (*PAN 1004* 6:29-32) (“by grouping packets into flows, it is possible to aggregate individual packets in a meaningful way to allow the traffic flowing through router 102 to be understood at a higher level”) to use a traffic characteristic other than header information, *e.g.*, inter-arrival time, to group packets into common sessions. Such a combination would be useful in an embodiment disclosed in Pappu for a flow that is “incapable of being identified by header information alone.” *PAN-1004* Claim 1. Additionally, such a combination would arise naturally to a POSA inasmuch as the two references solve the same

issues (classifying traffic in order to understand how to process it) and so a POSA would be highly motivated to add the teaching of Peleg to that of Pappu.

36. To the extent Patent Owner argues that the combination of Pappu and Peleg does not disclose grouping packets having similar non-header traffic characteristics, it would have been obvious to in view of Duffield.

37. Duffield describes developing attributes based on traffic features and grouping arriving packets based on these attributes into different classes of service. PAN-1005 5:7-14.

Specifically, the disclosed method assigns traffic to classes based on selected attribute or attributes based on a mapping derived from a statistical analysis that forms a signature for traffic having particular values for those attributes.

PAN-1005 5:7-14; FIG. 1.

38. Duffield discloses assigning packets to the preselected classes based on the traffic features, including features in packet headers such as 5-tuple information, and features that are “more than packet header information” such as inter-arrival times. *PAN-1005* 5:7-14; FIG. 1.

39. It would have been obvious to a POSA to modify Pappu to group arriving packets using header information and non-header information such as inter-arrival period as disclosed in Duffield, because Pappu recognizes that “by grouping packets into flows, it is possible to aggregate individual packets in a

meaningful way to allow the traffic flowing through router 102 to be understood at a higher level.” *PAN 1004* 6:29-3. Thus, Pappu expressly provides a motivation for a POSA to aggregate/group packets and Duffield discloses the grouping of packets using non-header traffic features such as inter-arrival period. Therefore, a POSA would be motivated to use, among other attributes, inter-arrival period as taught by Duffield in order to group the packets in a meaningful way. A POSA would also be confident in success of the modification, as both Pappu and Duffield disclose the use of inter-arrival period (*PAN-1004* Fig. 4; *PAN-1005*, 5:15-24) and that packets may be grouped together by common features (*PAN-1004* 13:20-38; *PAN-1005* 6:22-7:41).

vi. and analyzing said grouped packets of said presumed session for session characteristic;

40. Pappu discloses obtaining behavioral statistics (*session characteristics*) of the passing packets of the previously unknown flow (*presumed session*). *PAN-1004* 7:21-50, 14:50--15:5, Figs. 3, 4; *PAN-1003* ¶¶105-108. Pet. 46-48.

vii. using said session characteristics to identify a session type of said presumed session.

41. Pappu discloses using behavioral statistics (*session characteristics*) to identify the type of traffic (*session type*) represented by the flow (*presumed session*). *PAN-1004* 8:26-27, 9:39-48, 10:17-27; *PAN-1003* ¶¶ 109-110; Pet. 48-49.

viii. wherein the traffic packet characteristics comprise parameters associated with a traffic packet, the parameters including more than packet header information; and

42. As explained in more detail *supra*, Pappu alone, or in view of Peleg, or in further view of Duffield discloses obtaining, comparing, and grouping using traffic characteristics having header information and “more than header information.”

ix. wherein said identifying a session type is followed by at least one of the group comprising: providing provisioning and providing control actions to the presumed session

43. Pappu describes applying user-specified actions (*control actions*) to the flow (*presumed session*) based on the prior step of identifying of flow type (*session type*). *PAN-1004* 3:4-30, 11:60-13:16; *PAN-1003* ¶¶ 111-112; Pet. 49-51.

b. Dependent Substitute Claims 26-29

44. Pappu, alone or in combination with Peleg and/or Duffield describe all the limitations of Substitute Claims 26-29 which correspond to Claims 18, 20, 21 and 22. Pet. 51-55.

Conclusion and Declaration

The findings and opinions set forth in this declaration are based on my work and examinations to date. I may continue my examinations. I may also receive additional documentation and other factual evidence over the course of this litigation that will allow me to supplement and/or refine my opinions. I reserve the right to add to, alter, or delete my opinions and my declaration upon discovery of any additional information. I reserve the right to make such changes as may be deemed necessary. 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 declare that all statements made herein on 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.

Dated: 2/21/2019

By: Samuel H. Russ

Samuel H. Russ