UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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Palo Alto Networks, Inc.,

Fortinet, Inc. and

WatchGuard Technologies, Inc.

Petitioner

v.

Selective Signals, LLC

Patent Owner

IPR2018-00594

PATENT 8,111,629

# DECLARATION OF DR. GABI NAKIBLY

MAY 17, 2018

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I, Dr. Gabi Nakibly, hereby declare and state as follows:

## A. Introduction

1. My name is Gabi Nakibly, and I have been retained by Selective Signals, LLC ("Selective Signals" or the "Patent Owner"). My client Selective Signals and its associated counsel, Toler Law Group PC, have asked me to study U.S. Patent No. 8,111,629 ("the '629 Patent"), the Petition for Inter Partes Review of U.S. Patent No. 8,111,629 ("Petition" or "Pet."), the proffered prior art in this case, and other relevant documents. I document my findings in this declaration.

2. I have concluded that U.S. Pat. No. 8,085,775 ("Pappu") [EX1004], either alone or combined with U.S. Pat. App. Pub. No. 2006/0262789 ("Peleg") [EX1006], does not render obvious any challenged claim of the patent at issue, the'629 patent, at least for the following reasons:

   a) Pappu fails to disclose or render obvious the "traffic packet characteristics" limitations of independent Claim 15, the only challenged independent claim.

   b) Pappu fails to disclose or render obvious the "session" limitations of independent Claim 15, the only challenged independent claim.

c) Pappu fails to disclose or render obvious dependent Claim 18.

d) Pappu fails to disclose or render obvious dependent Claim 19.

e) Pappu fails to disclose or render obvious dependent Claims 17 and 20–22.

f) The proposed combination of Pappu and Peleg is improper.

3. The limited scope of my opinions and analysis in this declaration do not imply that I may not later express other opinions or report other results from other investigations concerning other issues raised by the Petitioners or their experts in this IPR.

## B. Qualifications

4. I have 18 years of experience in IP networks and network security, as well as extensive experience in research leadership. My research deals with many networking technologies in all aspects.

5. I currently serve as the chief research scientist of a research laboratory at Rafael ltd. In this position and previous positions at the research lab I have led state-of-the-art research projects.

6. I am a senior adjunct lecturer and a research associate at the Computer Science Department at the Technion – Israel Institute of Technology. In the summers of 2012 and 2016 I was a visiting scholar at Stanford University's security lab.

7. I am a recipient of the Katzir Fellowship (2007-2012).

8. I am an active speaker at major industry conferences such as Black Hat USA, Black Hat Europe and RSA. I hold a B.Sc. in Information Systems Engineering and B.Sc. in Industrial Engineering and Management from the Technion (received in 1999, summa cum laude). In 2008 I finished the direct track to PhD in Computer Science at the Technion.

9. I am the author and co-author of around 30 research peer-reviewed papers published in top academic conferences and journals.

10. This and other information about my background is included in my CV, which is attached to this declaration as Attachment A.

## C. Compensation, Testimony, and Publications

11. I am being paid $5,000 for the time I spend working on this matter. My compensation is not contingent on my performance,

the outcome of this IPR, or any issues involved in or related to this IPR.

12. I have no prior experience in patent-related testimonies.

13. The following is a list of my publications:

- Restorable Logical Topology in the Face of No or Partial Traffic Demand Knowledge, IEEE/ACM Transactions on Networking, 24(4):2074-2085, 2016

  Gabi Nakibly and Reuven Cohen

- Website-Targeted False Content Injection by Network Operators

  USENIX Security Symposium, 2016

  Gabi Nakibly, Jaime Schcolnik, and Yossi Rubin

- Analyzing Internet Routing Security Using Model Checking

  LPAR, 2015

  Adi Sosnovich, Orna Grumberg and Gabi Nakibly

- Small Lies, Lots of Damage: a Partition Attack on Link-State Routing Protocols

  IEEE CNS, 2015

  Reuven Cohen, Raziel Hess-Green and Gabi Nakibly

- PowerSpy: Location Tracking using Mobile Device Power Analysis

  USENIX Security Symposium, 2015

Yan Michalevsky, Gabi Nakibly, Aaron Shulman, Gunaa Arumugam Veerapandian and Dan Boneh

- Hardware Fingerprinting Using HTML5

  arXiv:1503.01408 [cs.CR], 2015

  Gabi Nakibly, Gilad Shelef and Shiran Yudilevich

- Optimizing Data Plane Resources for Multi-Path Flows

  IEEE/ACM Transactions on Networking, 23(1):138-147, 2015

  Gabi Nakibly, Reuven Cohen and Liran Katzir

- OSPF Vulnerability to Persistent Poisoning Attacks: A Systematic Analysis

  ACSAC, 2014

  Gabi Nakibly, Adi Sosnovich, Eitan Menahem, Ariel Waizel and Yuval Elovici

- Gyrophone: Recognizing Speech from Gyroscope Signals

  USENIX Security Symposium, 2014

  Yan Michalevsky, Gabi Nakibly and Dan Boneh

- Mobile Device Identification via Sensor Fingerprinting

  arXiv:1408.1416 [cs.CR], 2014

  Hristo Bojinov, Yan Michalevsky, Gabi Nakibly and Dan Boneh

- Subverting BIND's SRTT Algorithm Derandomizing NS Selection

  Haki9 Magazine, June 2014

  Roee Hay, Jonathan Kalechstein and Gabi Nakibly

- Restorable Logical Topology in the Face of No or Partial Traffic Demand Knowledge

  IEEE Infocom, 2014

  Reuven Cohen and Gabi Nakibly

- ACTIDS: An Active Strategy for Detecting and Localizing Network Attacks

  ACM AISec, 2013

  Eitan Menahem, Gabi Nakibly, Nir Amar and Yuval Elovici

- Finding Security Vulnerabilities in a Network Protocol using Parameterized Systems

  CAV, 2013

  Adi Sosnovich, Orna Grumberg and Gabi Nakibly

- Subverting BIND's SRTT Algorithm Derandomizing NS Selection

  USENIX WOOT, 2013

  Roee Hay, Jonathan Kalechstein and Gabi Nakibly

- OSS: Using Online Scanning Services for Censorship Circumvention

  PETS, 2013

  David Fifield, Gabi Nakibly and Dan Boneh

- Poster: Network-based Intrusion Detection Systems Go Active!

  ACM CCS, 2013

  Eitan Menahem, Gabi Nakibly and Yuval Elovici

- Persistent OSPF Attacks

NDSS, 2012

Gabi Nakibly, Dima Gonikman, Alex Kirshon and Dan Boneh

- On the Trade-Off between Control Plane Load and Data Plane Efficiency in SDNs

  Technion CS Dept. - Tehnical Report CS-2012-04, 2012

  Gabi Nakibly, Reuven Cohen and Liran Katzir

- Security Vulnerabilities in IPv6 Tunnels

  Haki9 Magazine, February 2011

  Gabi Nakibly

- Maximizing Restorable Throughput in MPLS Networks

  IEEE/ACM Transactions on Networking, 18(2):568-581, 2010

  Reuven Cohen and Gabi Nakibly

- Routing Loop Attacks using IPv6 Tunnels

  USENIX WOOT, 2009

  Gabi Nakibly and Michael Arov

- A Traffic Engineering Approach for Placement and Selection of Network Services

  IEEE/ACM Transactions on Networking, 17(2):487-500, 2009

  Reuven Cohen and Gabi Nakibly

- Maximizing Restorable Throughput in MPLS networks

  IEEE Infocom, 2008

  Reuven Cohen and Gabi Nakibly

- On the Computational Complexity and Effectiveness of N-hub Shortest Path Routing

  IEEE/ACM Transactions on Networking,16(3): 691-704, 2008

  Reuven Cohen and Gabi Nakibly

- A Traffic Engineering Approach for Placement and Selection of Network Services

  IEEE Infocom, 2007

  Reuven Cohen and Gabi Nakibly

- On the Computational Complexity and Effectiveness of N-hub Shortest Path Routing

  IEEE Infocom, 2004

Reuven Cohen and Gabi Nakibly

## D. Information Considered

14. In order to arrive at my opinions, I have reviewed and considered the materials listed below:

- Petition for Inter Partes Review of U.S. Patent No. 8,111,629, and exhibits, Case No. IPR2018-00594, February 7, 2018 [Pet.]
- U.S. Patent No. 8,111,629 ("the '629 Patent") [EX1001], and its prosecution history [EX2003, 1002]
- Declaration of Samuel H. Russ, February 7, 2018 [EX1003]
- U.S. Pat. No. 8,085,775 ("Pappu") [EX1004]
- U.S. Pat. App. Pub. No. 2006/0262789 ("Peleg") [EX1006]

- Excerpts from "Palo Alto Networks Firewall Session Overview," available at https://live.paloaltonetworks.com/t5/Learning-Articles/Palo-Alto-Networks-Firewall-Session-Overview/ta-p/55633 (last visited May 16, 2018) [EX2002]

## E. Legal Standards

15. I understand there are certain legal rules, standards, or requirements that I accept for the purpose of my analysis of the opinions and conclusions set forth in this declaration.

16. I understand a patent is obvious "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." 35 U.S.C. § 103(a). An obviousness determination must be based on four factual inquiries: (1) the scope and content of the prior art; (2) the differences between the claims and the prior art; (3) the level of ordinary skill in the art; and (4) objective indicia of nonobviousness.

17. I have been informed that if a single limitation of a claim is absent from the prior art, the claim cannot be considered obvious.

18. I further understand that it is improper to combine references where the references teach away from a claimed invention. A prior art reference teaches away from the claimed invention when a person of ordinary skill, upon reading the reference would be led in a direction divergent from the path that was taken by the applicant. Prior art also teaches away when it criticize[s], discredit[s], or otherwise discourage[s] investigation into the claimed invention. Additionally, a combination is improper when using that combination would produce an inoperative result. A combination is also improper when using that combination would render the invention described in the combination unsatisfactory for its intended purpose.

19. In addition, I understand that if a proposed modification or combination of the prior art would change the principle of operation of the prior art device being modified, then the

teachings of the references are not sufficient to render the claims *prima facie* obvious.

## F. The '629 Patent

20. I have reviewed U.S. Patent No. 8,111,629 ("the '629 Patent"), as well as the file history of the '629 Patent. The '629 Patent is titled *Media Session Identification Method for IP Networks,* was issued on February 7, 2012. The application 12/513,510 ("the '510 Application"), by inventor Avi Oron, was filed on November 1, 2007. The '510 Application claims priority to provisional application No. 60/856,795, filed on November 6, 2006. EX1001.

21. The '629 patent "relates to a media session identification method for IP networks and, more particularly, but not exclusively, to a media session identification method that identifies media sessions from the flow of packets and assigns specific packets to the media sessions." *Id.* at 1:17–22.

22. The Abstract of the '629 patent provides an overview as follows:

> A method of allocating, restricting or refusing communication resources to media sessions in

> accordance with individual **session or session type**, comprises: categorizing passing packets using **packet traffic characteristics** such as packet length or inter-arrival period; grouping together those packets having similar traffic characteristics, and analyzing the grouped packets for session characteristics, thereby to identify a session type and allocate resources to the session or provisioning or like actions or services. (EX1001 at Abstract) (Emphasis added.)

23. The '629 Patent recognized the need for better methods of managing IP sessions: "It is desirable to identify packets as belonging to a session to group the succession of IP packets and also to identify a particular application or type that the session belongs to in order to apply provisioning, quality of service, and control actions to the session . . . ." EX1001, 1:46–50.

24. The '629 Patent identified specific flaws in other approaches to IP traffic management. Specifically, the '629 Patent identified "traditional technologies" in two categories: (1) approaches using header-only information, and (2) approaches using packet-content inspection. *Id.* at 2:4–20. The former is deemed "simplistic" and insufficient; the latter cumbersome and resource-intensive. *Id.* at 2:8–36.

25. In response to these deficiencies, the '629 Patent describes systems and methods for analyzing IP traffic sessions that are more thorough (and thus more useful) than header-only analysis yet less cumbersome and resource-intensive than packet content analysis. The challenged claims refer to "traffic pattern characteristics"—information that includes more than header-only data—for efficient, robust session management.

## G. Ordinary Skill in the Art

26. The Petitioner's expert, Dr. Russ, defines a person of ordinary skill in the art as a person who "would have gained knowledge of [identifying, classifying, and controlling media sessions, including those based on the IP protocol, inspection techniques, and provisioning] through a mixture of training and work experience, such as by having a Bachelor's degree in computer science, computer communications, electrical engineering, or equivalent degree, coupled with two years of experience; or by obtaining a Master's degree in computer science, computer communications, or electrical engineering, but having no experience; or by having no formal education but experience in

computer science or computer communications of at least four years." EX1003 at ¶¶ 23–24; Pet. at 21.

27. I have no reason to disagree with Dr. Russ's description of a person of ordinary skill in the art. Moreover, based on my degrees in computer science, which included extensive training in communication networks, and 18-plus years of experience, I had, as of November 6, 2006, considerably more experience and expertise than the POSITA. I base my opinions regarding the level of ordinary skill in the art upon this understanding and my own experience in the field. I have considered the way in which a POSITA would have understood the '629 patent on its priority date,[1] and I offer my opinions on that basis.

## H. Claim Construction

28. Petitioner offers no explicit claim constructions, Pet. at 20–21.

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[1] The apparent priority date of November 6, 2006, is published on the face of the '629 patent. EX1001. I am not aware of any dispute in this IPR concerning the priority date.

29. Petitioner alleges that disclosure of only packet header information is sufficient to disclose the claimed "traffic packet characteristics." Pet. at 40–41. Specifically, the Petition alleges that Pappu's disclosure of "certain header information" discloses "traffic packet characteristics." Id. at 40. The explicit language of the '629 Patent contradicts this position.

30. My interpretation of the claims, including my analysis of the term "traffic packet characteristics" below, is based on the broadest reasonable interpretation standard that is consistent with the plain meaning of the term in light of the specification.

31. The limited scope of my opinions and analysis concerning claim construction in this declaration does not imply that I may not later express other opinions, express more analysis, construe other terms, or report other results from other investigations concerning other issues raised by the Petitioner or its experts in this IPR.

32. The '629 Patent explicitly discounts the use of only packet header information in analyzing IP traffic: "The traditional technologies for analyzing and identifying IP traffic (including IP media sessions) include packet header analysis. Packets

whose headers indicate the same destination may be assumed to belong to the same session. Packet header analysis is however simplistic. The same user may be running several different sessions simultaneously and mere packet header analysis may not be able to distinguish between them." EX1001, 2:4–11 (emphasis added).

33. The '629 Patent teaches the use of traffic packet characteristics rather than use of only packet header information. Specifically, the '629 Patent describes traffic packet characteristics as "parameters inherent to packet[] traffic" that include "features such as packet length, inter-arrival period, bandwidth and statistical and other derivations thereof as well as certain header characteristics such as source and destination address." EX1001, 6:12–19.

34. The '629 Patent teaches a "packet characteristic extraction unit" that obtains "readily available packet traffic characteristics such as packet length or inter-arrival period, or source or destination addresses or other traffic characteristics of the packets." Id. at 6:45–55.

35. The "session analyzer may use the packet's traffic characteristics, such as packet length and/or inter-arrival period to indicate the session type." Id. at 7:26–28.

36. A packet's total length and inter-arrival period are not found in the packet header. A packet's total length is the number of bytes that compose the entirety of the packet. Although there is a field in the packet's IP header that denotes the packet's length, this field only refers to the length of the IP header and its payload. It does not include the sum of lengths of other headers and trailers of layer 2 the packet may have. A packet's inter-arrival time is the time difference between the arrival of the packets that arrival of the previous packet. No indication of such time difference exists in the packet's headers.

37. The '629 Patent teaches an "algorithm [that] expects the two parameters of packet length and packet inter-arrival period to meet certain thresholds if indeed the packets belong to the same session." Id. at 7:58–60. Further, thresholding "of the packet length and packet inter-arrival period, or of a derivative such as statistical variations, sets a basic acceptance criterion for a

packet to be considered as part of a media stream, against which each consecutive incoming IP packet is examined." Id. at 8:1–9.

38. The '629 Patent also states: "In an embodiment, the traffic characteristics comprise at least one member of the group consisting of packet length, inter-arrival period, and average bandwidth." EX1001, 4:6–9. Similarly, the "session analyzer may use the packet's traffic characteristics, such as packet length and/or inter-arrival period to indicate the session type." Id. at 7:26–28.

39. The parameters considered by the session analyzer include statistics that cannot come from a packet header, such as variance of inter-arrival period, variance of length, etc. Id. at 4:22–55.

40. In the March 7, 2011 Response to Office Action for the '510 Application (that resulted in the '629 Patent), Applicant stated: "Tayyar [the Examiner's cited art] does not have extracted packet traffic characteristics since there is no evidence that the classifier ever extracts such data . . . ." EXYYYY4 at p. 10 (emphasis in original). The "data" Tayyar uses is the

"trivial[] . . . identification in the packet header (usually port number)." Id. at p. 9.

41. The '629 Patent states: "Traffic characteristics . . . include[] features such as packet length, inter-arrival period, bandwidth and statistical and other derivations thereof as well as certain header characteristics such as source address and destination address but excludes packet payload content whose inspection is common in deep packet inspection (packet content inspection) techniques." EX1001, 6:8–19.

42. The '629 Patent, therefore, explicitly contemplates traffic packet characteristics that include more than packet header information and exclude packet payload content.

43. The term "packet traffic characteristics" in the context of the '629 Patent should be construed as "parameters associated with a traffic packet, the parameters including more than packet header information and excluding packet payload content whose inspection is common in deep packet inspection techniques."

# I. U.S. Patent No. 8,085,775 ("Pappu")

44. U.S. Pat. No. 8,085,775 to Pappu et al. ("Pappu"), titled *Identifying Flows Based on Behavior Characteristics and Applying User-Defined Actions*, was filed on July 31, 2006, and issued on December 27, 2011. See EX1004.[2]

45. Pappu relates to "a mechanism for effectively identifying, classifying, and controlling information packet flows in a network is provided." EX1004 at 2:34–36.

46. Pappu explains "the header portion comprises the following sets of information: (1) a source address (i.e., the network address (e.g., Internet Protocol (IP) address) of the entity sending the packet); (2) a source port number (e.g., a Transport Control Protocol (TCP) or User Datagram Protocol (UDP) port number); (3) a destination address (i.e., the network address (e.g., IP address) of the entity that is to receive the packet); (4) a destination port number (e.g., a TCP or UDP port number); and

[2] Pappu is presented as prior art to the '629 Patent. I offer no opinion on whether Pappu is, in fact, prior art to the '629 Patent.

(5) an indication of the transport layer protocol (e.g., TCP or UDP) that is to be used. These sets of information may be referred to as the 'five tuple'." Id. at 5:57–67.

47. According to Pappu, "one or more packets are grouped into a **flow**. Multiple different flows, each comprising different packets, may exist concurrently. According to one embodiment of the invention, a flow is a set of packets that are related in some manner. In one embodiment of the invention, **packets are grouped into a flow if those packets share a sufficient amount of header information**. More specifically, in one embodiment of the invention, **packets are deemed to belong to the same flow if they have the five tuple in common**. Thus, if two or more packets have the same source address, the same source port number, the same destination address, the same destination port number, and the same transport layer protocol, then those packets are deemed to belong to the same flow. Usually, barring some failure that requires rerouting, all of the packets belonging to a flow are received by the same ingress line card 202 and forwarded to the same egress line card 202. 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." Id. at 6:13–32 (emphasis added).

48. Pappu premises a packet's inclusion in a flow on the commonality of the "five tuple." For example, Pappu teaches when "FM 210 creates a new flow block, FM 210 stores, in that flow block, criteria (e.g., a "five tuple") that information in a packet (e.g., header information) needs to satisfy in order to be deemed to belong to that flow." Id. at 16–20.

49. Pappu analyzes its grouped flows based on "behavioral characteristics." *E.g.*, id. at 8:26–38.

50. These "behavioral characteristics" are based on pre-determined "policies." *E.g.*, id. at 8:43–53.

51. These "policies" are groups threshold-bounded values of flow characteristics. Id. at 8:43–10:51. For example, "a particular policy might comprise a set of criteria that a flow satisfies only if (a) the flow's total byte count is greater than a first threshold value, (b) the flow's total byte count is less than a second threshold value, (c) the flow's life duration is either less than a

third threshold value or greater than a fourth threshold value, (d) either the flow's average flow rate over the last ten seconds is greater than a fifth threshold value or the flow's average packet size is less than a sixth threshold value, (e) the flow's average packet rate is greater than a seventh threshold value, (f) the flow's average packet rate is less than an eighth specified threshold value, and (g) the flow's average inter-packet gap is either less than a ninth specified threshold value or greater than a tenth specified threshold value." Id. at 9:1–17.

52. None of the exemplary "behavior characteristics" mentioned in Pappu involve comparing one packet or a set of packets with another. Rather, it compares a flow's characteristic with a predefined set of characteristics.

## J. U.S. Patent Application Publication No. 2006/0262789 ("Peleg")

53. U.S. Pat. App. Pub. No. 2006/0262789 to Peleg et al. ("Peleg"), titled *Method and Corresponding Device for Packets*

*Classification*, was filed on May 19, 2006, and published on November 23, 2006. See EX1006.[3]

54. Peleg "relates to packets classification and, more particularly, to methods and corresponding devices for packets classification featuring pattern recognition, and not content recognition or port matching." EX1006 at [0001].

55. Peleg describes "methods and corresponding devices for packets classification of the present invention involves performing or completing selected tasks or steps manually, semi-automatically, fully automatically, and/or, a combination thereof. Moreover, according to actual instrumentation and/or equipment used for implementing a particular preferred embodiment of the disclosed methods and corresponding devices, several selected steps of the present invention could be performed by hardware, by software on any operating system of any firmware, or a combination thereof. In particular, regarding

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[3] Peleg is presented as prior art to the '629 Patent. I offer no opinion on whether Peleg is, in fact, prior art to the '629 Patent.

hardware, selected steps of the invention could be performed by a computerized network, a computer, a computer chip, an electronic circuit, hard-wired circuitry, or a combination thereof, involving a plurality of digital and/or analog, electrical and/or electronic, components, operations, and protocols. Additionally, or alternatively, regarding software, selected steps of the invention could be performed by a data processor, such as a computing platform, executing a plurality of computer program types of software instructions or protocols using any suitable computer operating system." Id. at [0013].

56. Although Peleg uses the term "session," the disclosure of Peleg describes flows, not sessions. For example, *Peleg* explicitly states: "As known in the art, sessions, by definition, are unidirectional, and therefore each packet should belong to one unidirectional session." EX1006, [0065].

57. A session, as per the '629 patent, is the entire media exchange between two end entities. Such an exchange by definition can not be unidirectional. On the other hand, a flow that is defined by a tuple must be unidirectional.

58. Additionally, Peleg describes, in Para. [0069], "each table entry contains the following: Source IP address, Destination IP address, Source Port number, and Destination Port number." This teaches that Peleg identifies a "session" in the session table by a single 5-tuple. Hence Peleg's session is nothing more than a mere flow.

59. In contrast to the challenged claims of the '629 Patent, which requires "unknown sessions and unknown session types," Peleg explicitly contemplates flow types that are already known: "In an embodiment of the present invention, the sessions are VoIP session, and/or Multimedia over IP sessions." EX1006, [0020].

## K. Pappu Does Not Disclose Any Challenged Claim of the '629 Patent

60. The Petitioner challenges Claims 15 and 17–22 as rendered obvious by Pappu [EX1004]. Pet. at 26–27.

61. Claim 15 is the only independent claim challenged.

62. In the following sections, I show that Petitioner fails to make a prima facie case of obviousness over the challenged claims based on Pappu for at least the following reasons:

- Pappu fails to disclose "traffic packet characteristics" as properly construed.
- Pappu fails to disclose "session."
- Pappu fails to disclose the limitation "obtaining traffic packet characteristics of said passing packets of respectively unknown session types" recited in independent Claim 15. The element of Claim 15 is completely missing from Pappu.
- Pappu fails to disclose the limitation "comparing said obtained packets with each other using respectively obtained traffic packet characteristics" recited in independent Claim 15. The element of Claim 15 is completely missing from Pappu.
- Pappu fails to disclose the limitation "grouping together those packets having similar values of said traffic packet characteristics into a presumed session" recited in independent Claim 15. The element of Claim 15 is completely missing from Pappu.
- Pappu fails to disclose the limitation "analyzing said grouped packets of said presumed session for session characteristics" recited in independent Claim 15. The element of Claim 15 is completely missing from Pappu.
- Pappu fails to disclose the limitation "using said session characteristics to identify a session type of said presumed session" recited in independent Claim 15. The element of Claim 15 is completely missing from Pappu.
- Pappu fails to disclose the limitation "further comprising thresholding said traffic characteristics, and identifying those

packets whose characteristics are mutually within said threshold for said grouping" recited in dependent Claim 18. The element of Claim 18 is completely missing from Pappu.

- Pappu fails to disclose the limitation "wherein said characteristics comprise at least one member of the group consisting of packet length, inter-arrival period, and average bandwidth" recited in dependent Claim 19. The element of Claim 19 is completely missing from Pappu.
- The combination of Pappu and Peleg is improper at least because:
    - Pappu teaches away from a combination with Peleg
    - Under Petitioner's characterization, Peleg and Pappu address different problems
- The combination of Pappu and Peleg does not disclose every element of Claim 15 at least because:
    - Peleg does not disclose or suggest a "presumed session"
    - The proposed combination of Pappu and Peleg does not disclose the "session" or "traffic packet characteristics" limiations

### K.1 Pappu fails to disclose or suggest "traffic packet characteristics" as properly construed

63. Petitioner argues Pappu alone discloses "traffic packet characteristics." Pet. at 40–41, 41–42, 42–43.

64. Petitioner's support for its assertion that Pappu discloses the recited "traffic packet characteristics" is Pappu's use of a "five tuple" in routing IP packets. See e.g., Pet. at 40 (citing EX1004, 6:17–26).

65. The term "packet traffic characteristics" in the context of the '629 Patent should be construed as "parameters associated with a traffic packet, the parameters including more than packet header information and excluding packet payload content whose inspection is common in deep packet inspection techniques." See ¶¶ 30–43 *supra*.

66. As detailed in paragraphs 32–42 above, the recited "traffic packet characteristics" must include more than header information.

67. Pappu groups packets into flows based solely on the "five tuple." The five tuple is a group of header-only data that consists of: source address, source port number, destination address, destination port number, and an indication of the transport layer protocol to be used. EX1004, 5:48–66. Pappu groups packets into flows "if they have the five tuple in common." Id. at 6:13–22. Pappu makes its decision on how to

group packets based on that five tuple alone. See id. at 7:16–19 ("When FM 210 creates a new flow block, FM 210 stores, in that flow block, criteria (e.g., a "five tuple" that information in a packet (e.g., header information) needs to satisfy in order to be deemed to belong to that flow)").

68. Because Pappu only teaches using *header-only* information (i.e., the five tuple), Pappu does not disclose parameters associated with a traffic packet, the parameters including *more than packet header information*.

69. Based on my analysis above in this section and elsewhere in this declaration, in my opinion, the "obtaining traffic packet characteristics of said passing packets of respectively unknown session types" limitation of independent Claim 15 is completely missing from Pappu.

### K.2 Pappu fails to disclose the limitation "obtaining traffic packet characteristics of said passing packets of respectively unknown session types" as recited in independent Claim 15

70. Among other limitations, independent Claim 15 recites "obtaining traffic packet characteristics of said passing packets of respectively unknown session types." EX1001, 13:29–30.

71. Petitioner relies on Pappu obtaining only the five tuple (i.e., only packet header data) from passing packets. Pet. at 40–41.

72. "Traffic packet characteristics" is properly construed as "parameters associated with a traffic packet, the parameters including more than packet header information."

73. Pappu fails to disclose obtaining parameters associated with a traffic packet, the parameters including more than packet header information of passing packets.

74. Based on my analysis above in this section and elsewhere in this declaration, in my opinion, the "obtaining traffic packet characteristics of said passing packets of respectively unknown session types" limitation of independent Claim 15 is completely missing from Pappu.

### K.3 Pappu fails to disclose the limitation "comparing said obtained packets with each other using respectively obtained traffic packet characteristics" as recited in independent Claim 15

75. Among other limitations, independent Claim 15 recites "comparing said obtained packets with each other using respectively obtained traffic packet characteristics." EX1001, 31–32.

76. "Traffic packet characteristics" is properly construed as "parameters associated with a traffic packet, the parameters including more than packet header information."

77. Petitioner relies on Pappu's comparison of packets with each other using only the five tuple (i.e., only packet header data). Pet. at 41–42.

78. Pappu fails to disclose comparing obtained packets with each other using respectively obtained parameters associated with a traffic packet, the parameters including more than packet header information.

79. Based on my analysis above in this section and elsewhere in this declaration, in my opinion, the "comparing said obtained packets with each other using respectively obtained traffic packet characteristics" limitation of independent Claim 15 is completely missing from Pappu.

### K.4 Pappu fails to disclose the limitation "grouping together those packets having similar values of said traffic packet characteristics into a presumed session" as recited in independent Claim 15

80. Among other limitations, independent Claim 15 recites "grouping together those packets having similar values of said

traffic packet characteristics into a presumed session." EX1001, 33–35.

81. "Traffic packet characteristics" is properly construed as "parameters associated with a traffic packet, the parameters including more than packet header information."

82. Petitioner argues Pappu discloses this limitation, relying on Pappu's grouping of packets into a flow using only the five tuple (i.e., only packet header data). Pet. at 42–43.

83. Pappu fails to disclose grouping together packets having similar values of parameters associated with a traffic packet, the parameters including more than packet header information into a presumed session.

84. Based on my analysis above in this section and elsewhere in this declaration, in my opinion, the "grouping together those packets having similar values of said traffic packet characteristics into a presumed session" limitation of independent Claim 15 is completely missing from Pappu.

## K.5 Pappu fails to disclose "sessions"

85. Pappu does not disclose managing sessions; Pappu discloses managing flows.

86. A flow is a set of packets that have the same 5-tuple (i.e., IP source address, IP destination address, source port, destination port and the layer 4 protocol).

87. A session is a set of packets the belong to a layer 7 media exchange (a conversation) between two end entities. A packet's session may belong to multiple flows. A packet's flow may belong to multiple sessions.

88. Packet flows are trivially grouped by layer 3/4 header information (5-tuple).

89. Packet sessions are not obvious to group together. Specifically, they cannot be identified by mere observation of header information. It demands the use of packets' characteristics that may change of the life time of the session. Hence the management of sessions is completely different technical task than management of flows.

90. Flows have layer 3/4 semantics, whereas sessions have layer 7 semantics. Flow-based management treats all packets in a flow the same.

91. For example, once a router establishes a media flow for a plurality of video streams, the router that employs flow-based management will treat all packets within that flow the same. Session-based networking allows packets within the flow to be treated differently for the purposes of priority and bandwidth-shaping assuming the packets belong to different sessions.

92. A session—as opposed to a flow—is: (1) end-to-end as opposed to ending at network address translation boundaries; (2) stateful in that it necessitates a stateful management; (3) bi-directional; and (4) multiple in that multiple sessions can be in a single flow.

93. The preamble of challenged independent Claim 15 recites a "method of identifying session type." EX1001, 13:26 (emphasis added).

94. Among other limitations, independent Claim 15 recites "grouping together those packets having similar values of said

traffic packet characteristics into a presumed session," "analyzing said grouped packets of said presumed session for session characteristic[s]," and "using said session characteristics to identify a session type of said presumed session." Id. at 13:33–40.

95. Pappu only discloses dealing with flows. Pappu explicitly uses the term "flow" throughout its disclosure. E.g., EX1004, Title, Abstract, 2:34–3:30, 5:48–6:57.

96. Pappu's solution using the "five tuple" does not address the problem initially stated by the '629 Patent: that header-only information is insufficient and "simplistic" for managing sessions. EX1001, 2:8–9.

### K.6 Pappu fails to disclose or render obvious the limitation "grouping together those packets having similar values of said traffic packet characteristics into a presumed session" as recited in independent Claim 15

97. As detailed in ¶¶ 63–69 and 85–96, Pappu does not disclose "traffic packet characteristics" or a "session."

98. Petitioner argues that Pappu alone discloses this limitation, relying on Pappu's use of header-only data to group packets

into "previously unknown flows." Pet. at 42 (citing EX1004, 6:17–26).

99. Petitioner then contradicts this argument in recognizing that "treating all flows interchangeably," which is endemic to managing flows, is a problem to overcome.

100. Petitioner relies on Pappu's teaching of "previously unknown flows" as disclosing the claimed "presumed session." Pet. at 42.

101. The '629 Patent explicitly describes a presumed session: "Thus packets believed to belong to the same session can be grouped together so that the session itself can be analyzed." EX1001, 7:3–7.

102. Because Pappu does not disclose traffic packet characteristics, Pappu does not disclose sessions, Pappu does not disclose the claimed "presumed session."

103. For at least these reasons, Pappu fails to disclose "grouping together those packets having similar values of said traffic packet characteristics into a presumed session."

104. Petitioner asserts Peleg cures this deficiency. Pet. at 43–44. However, as noted in ¶¶ 153–54, Peleg also does not disclose

the claimed "presumed session" because Peleg also does not teach a session as described in the '629 Patent.

### K.7 Pappu fails to disclose the limitation "analyzing said grouped packets of said presumed session for session characteristics" as recited in independent Claim 15

105. Petitioner relies on Pappu as disclosing "analyzing said grouped packets of said presumed session for session characteristics," as recited in independent Claim 15.

106. As noted above, Pappu does not disclose a "presumed session." Pappu also does not disclose "session characteristics."

107. Petitioner argues "obtaining behavioral statistics (session characteristics) of passing packets of the previously unknown flow (presumed session)" discloses this limitation. Pet. at 46 (emphasis in original).

108. Petitioner states "grouped packets are analyzed by the flow manager to determine what behaviors those flows are exhibiting." Pet. at 48.

109. However, Pappu is devoted only to flow characteristics rather than session characteristics. Specifically, Pappu teaches only characteristics that may be useful in managing flows where

every packet is treated the same (e.g., averages of behavioral statistics across packets in a flow) rather than characteristics that are packet-specific and therefore useful in managing sessions in which packets may be treated differently.

110. Petitioner relies on Pappu's "behavioral statistics" that are of little to no use in managing sessions because they strip out all packet-specific information.

111. Specifically, Pappu's behavioral statistics aggregate packet data and then use that aggregated data to analyze packets. EX1004, 6:44–49.

112. Pappu uses this aggregated data to identify packets that might belong to a particular flow. Id.

113. Pappu's "flow" is a set of packets uniquely identified by their "five tuple" (i.e., layer-3 and -4 packet header information). A session is a set of packets that relates to an application-level (i.e., layer-7) conversation. A session's packets may belong to multiple flows. A flow may include packets from multiple sessions.

114. In Pappu, all packets in a flow are treated the same.

115. The '629 Patent, however, requires the ability to compare individual packets to one another. See, e.g., EX1001, 8:47–50.

116. Pappu's data aggregation loses the packet-specific data.

117. By losing the packet-specific data, Pappu is unable to compare individual packets to one another once it has identified a flow. EX1004, 6:44–49, 7:34–42.

118. Petitioner relies on Pappu's use of: (1) an average packet size, (2) an average "inter packet gap," and (2) a "moving average flow rate." Pet. at 47–48; EX1004 6:44–49, 7:34–42.

119. All of these "behavioral statistics" rely on averages of packets that have already been assigned to the same flow, thus losing packet-specific information.

120. Packet aggregate data cannot be used effectively to compare individual packets or subsets of packets. Thus, in analyzing packets for session characteristics, the use of these averages is of limited use.

121. For example, Pappu's calculated averages are only valid within the context of a single flow. There is no disclosure of comparing the parameters of multiple packets across flows, as

would be needed for managing a session that includes multiple flows.

122. In fact, Pappu's reliance on averages to determine further behavior purposefully loses those packet-specific statistics, thus rendering it impossible to compare packets across flows.

123. Since a session may include packets from multiple flows, and Pappu's behavioral characteristics cannot be used to compare packets across flows, Pappu's behavioral characteristics do not disclose "session" characteristics.

124. While the '629 Patent recognizes the use of packet length and inter-arrival period, it does so in the context of identifying characteristics of individual packets or subsets of packets within a presumed session. That is why the list of characteristics (e.g., in claim 22) recites packet length, inter-arrival period, variance of inter-arrival period, and variance of length—to analyze data associated with individual packets or subsets of packets that may then be analyzed across flows.

125. Based on my analysis above in this section and elsewhere in this declaration, in my opinion, Pappu does not disclose the

"analyzing said grouped packets of said presumed session for session characteristics" limitation of independent Claim 15.

### K.8 Pappu fails to disclose the limitation "using said session characteristics to identify a session type of said presumed session" as recited in independent Claim 15

126. Among other limitations, independent Claim 15 recites two separates steps: (1) grouping together those packets having similar values of said traffic packet characteristics into a presumed session, and (2) using said session characteristics to identify a session type of said presumed session. EX1001, 13:33–40.

127. Pappu does not disclose the claimed two-step process.

128. Petitioner argues Pappu discloses this limitation by using behavioral statistics to identify traffic type of a flow. Pet. at 48–49.

129. As detailed above, a flow type cannot be equated with the claimed "session type." Further, Pappu employs only a single-step process in which the behavioral statistics are already associated with a known flow type. For example, Pappu states: "In one embodiment of the invention, the VOIP policy [] is

applied to UDP flows[] to determine whether those UDP flows represent VOIP traffic . . . ." EX1004, 9:39–48.

130. There is no identification step in Pappu's process. Pappu simply takes a pre-established, pre-identified behavioral model and applies it to current data.

131. The '629 Patent describes a process whereby a specific service or application is identified after analyzing the session characteristics.

132. Identifying the session type is a key difference between managing flows and managing sessions.

133. It may be sufficient in a flow-based management process to identify a flow as "VOIP." In a session-based environment, however, session type is associated with the type of service or application required for the session. The difference is one between identifying a flow as "VOIP" and identifying a session as "using code type X, or voice session using Skype," as the '629 Patent teaches. See EX1001, 7:8–16.

134. Based on my analysis above in this section and elsewhere in this declaration, in my opinion, Pappu does not disclose the

"analyzing said grouped packets of said presumed session for session characteristics," limitation of independent Claim 15.

### K.9 Pappu fails to disclose the limitation "further comprising thresholding said traffic characteristics, and identifying those packets whose characteristics are mutually within said threshold for said grouping" as recited in dependent Claim 18

135. Challenged Claim 18 recites a method according to independent Claim 15, "further comprising thresholding said traffic characteristics, and identifying those packets whose characteristics are mutually within said threshold for said grouping." EX1001, 13:17–50.

136. Petitioner states Pappu discloses this limitation, arguing, "Pappu set the threshold that packets are deemed to belong to the same flow if they have the five tuple in common . . . ." Pet. at 51–52.

137. A binary choice of "everything either matches or it doesn't" does not constitute a "threshold."

138. Based on my analysis above in this section and elsewhere in this declaration, in my opinion, Pappu does not disclose the "further comprising thresholding said traffic characteristics, and identifying those packets whose characteristics are mutually

within said threshold for said grouping" limitation of dependent Claim 18.

### K.10 Pappu fails to disclose the limitation "wherein said characteristics comprise at least one member of the group consisting of packet length, inter-arrival period, and average bandwidth" as recited in dependent Claim 19

139. Challenged Claim 19 recites a method according to independent Claim 15, "wherein said characteristics comprise at least one member of the group consisting of packet length, inter-arrival period, and average bandwidth." EX1001, 14:1–3.

140. Petitioner states Pappu discloses this limitation, arguing, "Pappu discloses that behavioral statistics include average packet length, average inter-arrival period, and average bandwidth." Pet. at 52.

141. Pappu makes no mention of average bandwidth anywhere in its disclosure.

142. Disclosure of "average packet length" and "average inter-arrival period" does not disclose "packet length" or "inter-arrival period," particularly where, as in Pappu, the "average" is "derived by dividing the total byte count of the flow by the total

number of packets in the flow that have been processed." Pet. at 52–53; EX1004, 7:34–42.

143. Based on my analysis above in this section and elsewhere in this declaration, in my opinion, Pappu does not disclose the "wherein said characteristics comprise at least one member of the group consisting of packet length, inter-arrival period, and average bandwidth" limitation of dependent Claim 19.

## L. The Combination of Pappu and Pele is Improper

144. Among other limitations, independent Claim 15 recites "grouping together those packets having similar values of said traffic packet characteristics into a presumed session." EX1001, 13:33–35.

145. Petitioner argues that either Pappu discloses this limitation or, to "the extent that the Patent Owner asserts that Pappu does not disclose grouping packets in a presumed session, it would have been obvious in view of Peleg." Pet. at 42–43.

### L.1 Pappu teaches away from a combination with Peleg

146. Pappu stands in contrast to Peleg due to Pappu's reliance on header-only data in grouping packets together.

147. Peleg, like the '629 Patent recognizes the limitations of such an approach: "An additional significant limitation of prior-art devices operating on the bases of ports identification, is that port identification is not a robust mechanism. Moreover, port identification algorithms are easy to go around, and it is not necessarily possible to know through which ports the transmissions are taking place." EX1006 at [0005].

148. One of ordinary skill in the art would see Peleg's description of the limitations of Pappu and would therefore see no motivation to combine the two references.

### L.2 Under Petitioner's characterization, Peleg and Pappu address different problems

149. Petitioner states Peleg and Pappu "address the same problems (e.g., efficiently allocating resources network resources [sic] to packet flows)." Pet. at 45.

150. However, managing flows and managing sessions are different problems requiring different solutions.

151. Pappu and Peleg do address the same problem: *flow* classification.

# M. The Combination of Pappu and Pele Does Not Disclose Every Limitation of Independent Claim 15

## M.1 Peleg does not disclose or suggest a "presumed session"

152. As detailed above, although Peleg uses the term "session," the disclosure of Peleg describes flows. For example, Peleg explicitly states: "As known in the art, sessions, by definition, are unidirectional, and therefore each packet should belong to one unidirectional session." EX1006, [0065].

153. There is no disclosure in Peleg that would lead one of ordinary skill in the art to group packets into a "presumed session."

154. Independent Claim 15 requires that grouped packets are of "unknown session types." EX1001, 13:27–28 (emphasis added). Peleg explicitly states that its "session types" are already known: "In an embodiment of the present invention, the sessions are VoIP session, and/or Multimedia over IP sessions." EX1006, [0020]. Although Peleg also states that "there is no intent of limiting the scope of the present invention to" these types of sessions, id., there is no indication in Peleg that the session type is not already known at the beginning of the process.

## M.2 The proposed combination of Pappu and Peleg does not disclose the "session" or "traffic packet characteristics" limitations of Claim 15

155. Petitioner argues one of ordinary skill in the art would be motivated to combine Pappu and Peleg to "thereby allow treating the identified sessions differently from potential sessions in order to allocate resources more efficiently." Pet. at 44.

156. However, assuming that Pappu and Peleg were combined, the resultant combination would still not disclose the "session" or "traffic packet characteristics" of Claim 15.

157. *Peleg* teaches a packet and inter-arrival "range" that *Peleg* uses only if it's within same flow. EX1006 at [0032] ("If the length of the packet meets the length-range requirements, the appropriate IP source and IP destination, plus optional additional information (such as source and destination port number), are looked for in a sessions table. It is to be noted that the length can be a range, i.e. as long as the packet is in the length, it can be classified."); *see also* EX1006 at [0038]. This is the extent of *Peleg*'s discussion of the inter-arrival "range,"

and does not include any discussion of how such an arrangement would be applicable to multiple flows in a session.

158. *Peleg*'s vague language with respect to the inter-arrival "range" would not allow one of ordinary skill in the art to determine how *Peleg* would implement this "range" for **session** management.

159. Further, combining the teachings of Pappu and Peleg with respect to grouping packets does not disclose the "session" limitations of Claim 15. According to Petitioner, Peleg's "presumed session" would be used by Pappu to make "better use of available resources than treating all flows interchangeably." Pet. at 45. Nothing in Peleg indicates that incorporating Peleg into Pappu would result in anything other than all treating all flows interchangeably.

160. Grouping packets based on the combination of Peleg and Pappu will result in flows with similar packet-length and inter-arrival time, which will not handle a multi-session-based flow, nor a multi-flow-based session. This will only treat simple uni-directional flows (e.g. VoIP).

161. Petitioner's proposed combination would require Peleg to accept as inputs "those packets having similar values of said traffic packet characteristics."

162. Pappu only makes use of header-only information (i.e., the five tuple). If header-only information is the input to Peleg, then Peleg would simply group packets based on that header-only information.

163. Assuming Peleg sufficiently described how to group such packets into a "presumed session," these "sessions" would be based on header-only information.

164. Claim 15's "presumed session" is a result of "grouping together those packets having similar values of said traffic packet characteristics." Traffic packet characteristics require more than header-only information. Therefore, the combination of Pappu and Peleg would not result in a "presumed session" based on more than header-only information.

165. Thus, the proposed combination of Pappu and Peleg would not result in a method including "grouping together those packets

having similar values of said traffic packet characteristics into a presumed session."

166. Based on my analysis above in this section and elsewhere in this declaration, in my opinion, the Petition's asserted combination of Pappu and Peleg does not disclose and the Petitioners fail to make a prima facie case of obviousness for the "grouping together those packets having similar values of said traffic packet characteristics into a presumed session" limitation of independent Claim 15.

I declare that this declaration was executed in CITY, STATE on May 17, 2018, that all statements made are, to my knowledge, true, and all statements made on information and belief are believed to be true, and these statements were made knowing that willful false statements so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

DR. GABI NAKIBLY

May 18, 2018