

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAP AMERICA, INC.,
Petitioner,

v.

CYANDIA, INC.,
Patent Owner.

Case IPR2024-01433
U.S. Patent No. 8,751,948

**DECLARATION OF MICHAEL T. GOODRICH, Ph.D. IN
SUPPORT OF PATENT OWNER'S RESPONSE**

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I. INTRODUCTION

I, Michael T. Goodrich, hereby declare as follows:

1. I have been retained as an expert witness by I have been retained as a technical expert on behalf of Cyandia, Inc. (“Cyandia”) in connection with the above-captioned *Inter Partes Review* (“IPR”) before the Patent Trial and Appeal Board (“PTAB” or “Board”) regarding U.S. Patent No. 8,751,948 (“’948 Patent”). I understand that Petitioner asserts the family member PCT publication No. WO 2009/140386 (Ex. 1104, the “PCT Publication”) as prior art because allegedly the parent application filed in 2009 (Ex. 1106, the “2009 Parent”) does not provide written description support for several claim terms, and therefore the earliest priority date is the actual filing date of the ’948 Patent. I disagree for the reasons set forth below. The opinions set forth below are true to the best of my knowledge, and if called to testify, I can testify competently to them.

2. I am being compensated for my work in this matter. My compensation does not depend on the outcome of this proceeding.

3. I have been asked to provide my technical opinions relating to the ’948 Patent in relation to arguments raised by Cyandia in its Petition.

4. My opinion is based on a person having ordinary skill in the art (which I understand is sometimes abbreviated “POSITA”) at the time of the earliest

potential claimed priority date, which I understand to be 2008. '948 Patent at 1. My opinion does not change with a later priority date.

II. MATERIALS CONSIDERED

5. My opinions in this declaration are based on my years of education, research, and experience, as well as my investigation and study of relevant materials.

6. I have reviewed both Petitioner's and Patent Owner's exhibits and the PTAB documents for the above captioned IPR. I have also reviewed the documents cited in the September 20, 2024, declaration by Mr. Christopher M. Schmandt, Ex. 1103 ("Schmandt Decl.").

III. QUALIFICATIONS

7. I summarize some of the relevant information regarding my CV (Appendix A) as follows. I received a Bachelor of Arts degree in Mathematics and Computer Science from Calvin University, in Grand Rapids, Michigan, in 1983, a Master of Science (M.S.) degree in Computer Science from Purdue University, in West Lafayette, Indiana, in 1985, and a Ph.D. in Computer Science from Purdue University in 1987.

8. I am a Distinguished Professor in the Department of Computer Science at the University of California, Irvine, where I have been a faculty member since 2001. The Distinguished Professor title is a campus-level distinction and is reserved for faculty who have achieved the highest levels of scholarship over the course of

their careers. I was a professor in the Department of Computer Science at Johns Hopkins University from 1987-2001.

9. I have authored or coauthored over 350 publications, including several widely adopted books, such as Data Structures and Algorithms in Java, Data Structures and Algorithms in C++, Data Structures and Algorithms in Python, Introduction to Computer Security, and Algorithm Design and Applications. My publications include contributions to data structures and algorithms, information visualization, networking, graph algorithms, computational geometry, distributed and parallel algorithms, cloud security, information security and privacy, and algorithm engineering. Also, several of my textbooks include entire chapters on software engineering, and several of my publications are on algorithm engineering. Altogether, my publications have, according to Google Scholar, been cited over 18,000 times. My research has been supported by grants from the Defense Advanced Research Projects Agency (“DARPA”), the National Security Agency (“NSA”), the Office of Naval Research (“ONR”), the Army Research Office (“ARO”), and the National Science Foundation (“NSF”).

10. In addition, I have consulting experience in matters involving algorithms, cryptography, machine learning, digital rights management, computer security, mobile devices (including power management), networking, software, video streaming, and storage technologies.

11. I am a Fellow of the American Association for the Advancement of Science (“AAAS”), a Fellow of the Institute of Electrical and Electronics Engineers (“IEEE”), and a Fellow of the Association for Computing Machinery (“ACM”), as well as being named as a Foreign Member of the Royal Danish Academy of Sciences and Letters. I am also a recipient of a Fulbright Scholarship (for senior specialist service to University of Aarhus, Denmark). In addition, I am a recipient of the IEEE Computer Society Technical Achievement Award (“for outstanding contributions to the design of parallel and distributed algorithms for fundamental combinatorial and geometric problems”) and the Pond Award for Excellence in Undergraduate Teaching. Also, I am an ACM Distinguished Scientist.

12. I have extensive experience studying technologies involved with distributed video streaming. For instance, in my journal article J-56, my coauthors and I study methods for partitioning data into push and pull regions so as to optimize communication costs between a server and several clients. I have also published numerous research articles on topics in cloud computing and storage, distributed algorithms, and network visualization. Using the indexing scheme of my CV, examples of such publications include P-3, P-4, P-5, P-6, P-8, P-10, Ch-9, Ch-10, J-7, J-26, J-36, J-38, J-61, J-69, J-73, J-76, J-77, J-78, J-82, J-84, C-41, C-46, C-47, C-53, C-60, C-69, C-79, C-85, C-90, C-91, C-92, C-94, C-102, C-105, C-106, C-112, C-119, C-123, C-134, C-154, C-156, C-159, C-165, C-167, C-168, C-169, C-

171, C-172, C-182, C-196, C-200, C-203, C-228, C-230, and C-243. Further, I have published research articles on topics in audio and video creation, encoding, and distribution, as well as authoring research videos, including publications P-9, J-65, J-66, J-68, C-38, C-54, C-74, and C-124. I also have published research articles on technologies for streaming data, including publications J-56 (mentioned above), J-58, J-72, C-98, C-121, and C-179.

13. I am a co-inventor on several U.S. patents, including U.S. Patent No. 7,257,711, “Efficient Authenticated Dictionaries with Skip Lists and Commutative Hashing,” which discloses secure distributed data authentication schemes. I am also co-inventor of U.S. Patent No. 7,299,219, “High Refresh-Rate Retrieval of Freshly Published Content using Distributed Crawling,” which discloses a technology for quickly retrieving website data that can change frequently, so as to be stored in a search engine. I am also co-inventor of U.S. No. Patent 8,681,145, “Attribute Transfer Between Computer Models Including Identifying Isomorphic Regions in Polygonal Meshes,” which teaches how to map one mesh-based computer model to another. In addition, I am co-inventor of U.S. Patent No. 9,152,716, “Techniques for Verifying Search Results Over a Distributed Collection,” which discloses a system for searching the Internet so as to produce verifiable search results that can be produced by a search engine.

14. I have taught courses at Johns Hopkins University, Brown University, and University of California, Irvine, at both the undergraduate and graduate levels. Topics of my courses have included computer security, algorithms, data structures, information visualization, computer graphics, networking, algorithm engineering, computational geometry, and parallel processing. In addition, I have mentored twenty-six (26) PhD students over the years, who have written their PhD theses on topics in algorithms, data structures, information visualizations, networking, parallel processing, and computer security and privacy.

15. I have served as an editor on several technical journals, including Computational Geometry: Theory and Applications, Journal of Computer & System Sciences, Journal of Graph Algorithms and Applications, Int. Journal of Computational Geometry & Applications, and Information Processing Letters. I have also served on many program committees (PCs) for top conferences and workshops in Computer Science, including serving as PC chair in several instances. Examples include ACM Symposium on Computational Geometry (“SoCG”), ACM Symposium on Theory of Computing (“STOC”), Workshop/Symposium on Algorithms and Data Structures (“WADS”), Algorithm Engineering and Experimentation (“ALENEX”), which I cofounded with Dr. Catherine McGeoch in 1999), IEEE Symposium on Foundations of Computer Science (“FOCS”), ACM-SIAM Symposium on Discrete Algorithms (SODA), International Symposium on

Graph Drawing (“GD”), International Colloquium on Automata, Languages, and Programming (“ICALP”), ACM Conference on Computer and Communications Security (“CCS”), European Symposium on Algorithms (“ESA”), IEEE International Parallel and Distributed Processing Symposium (“IPDPS”), ACM Symposium on Parallel Algorithms and Architectures (“SPAA”), ACM Symposium on Advances in Geographic Information Systems (“GIS”), IEEE Symposium on Security and Privacy (“S&P”), IEEE International Conference on Big Data, IEEE International Conference on Data Engineering (“ICDE”), and International Symposium on Algorithms and Computation (“ISAAC”), and DAGS Conference on Electronic Publishing and the Information Superhighway.

IV. PERSON OF ORDINARY SKILL IN THE ART

16. I understand that the factors to be considered in determining the level of ordinary skill in the art to be: (1) the educational level of active workers in the field, including the named inventors of the patent; (2) the type of problems encountered in the art; (3) prior art solutions to those problems; (4) the rapidity with which innovations are made; and (5) the sophistication of the technology in the art. I further understand that in a given case, every factor may not be present, and one or more factors may predominate.

17. Based on my review of the ’948 Patent and my consideration of the abovementioned factors, it is my opinion that a person of ordinary skill in the art

(“POSITA”) as of May 2008 would have had a Bachelor’s degree in electrical engineering, computer science, or the like, and/or four or more years of experience in server-based applications. This description is approximate, and more work experience could compensate for less education or more education could compensate for less work experience. I have used the earliest priority date as the date of invention for the ’948 Patent, for which I provide an analysis elsewhere herein. However, if the ’948 Patent are found to have another date of invention within that general timeframe, up to and including the filing date for the ’948 Patent, it would not materially impact my opinions in this Declaration.

18. Based on my training and experience, I believe that I am a person of greater-than-ordinary skill in the relevant art, and have been since at least the priority date of the ’948 Patent, which I understand permits me to give an opinion about the qualifications of one of ordinary skill at the time of the invention.

19. I note that Mr. Christopher M. Schmandt applies a similar but different definition in his Declaration. See, e.g., Schmandt Decl. at ¶¶ 34-38. For example, the definition of a POSITA offered by Mr. Schmandt can have fewer years of industry experience than the definition of POSITA as I have opined above. Nevertheless, the opinions contained in this Declaration would not change were I to use the definition of a POSITA offered by Mr. Schmandt. For example, I agree with Mr. Schmandt that a POSITA would be familiar with user interfaces used in

smartphones as of the priority date of the '948 Patent. See, e.g., Schmandt Decl. at ¶ 36, Ex. 1126.

V. APPLICABLE STANDARDS AND CONTROLLING PRINCIPLES

A. Claim Construction

20. I have been informed through counsel that during this inter partes review proceeding (because this petition for inter partes review was filed after November 13, 2018), claims terms should be given their “ordinary and customary meaning as would be understood by a person of ordinary skill in the art in question at the time of the invention.” I have further been informed that for determining the meaning of a disputed claim term, it is appropriate to “look principally to the intrinsic evidence of the record, examining the claim language itself, the written description, and the prosecution history.” I understand that a term is introduced with an indefinite “an” article and subsequently referred to with the definite “the” article. I further understand that extrinsic evidence can be helpful in demonstrating how a term is used in the art, and how the plain meaning is applied in the context of the intrinsic record.

21. I understand that the Patent Office will look to the specification and prosecution history in construing a given claim term. I understand the Patent Office will also sometimes look to other evidence, which I am informed is called “extrinsic”

evidence, including dictionary definitions, for how a person of ordinary skill in the art would have understood a claim term.

22. I understand that a patent's "specification" includes all of the figures, discussion, and claims within the patent, including those that are incorporated by reference. I understand that the "prosecution history" includes the statements made to and dialogue with the patent office in the course of obtaining the patent, and that the prosecution history of any parent application can contain relevant information.

B. Obviousness

23. I understand that an issued patent claim is invalid as obvious if it can be shown that the differences between the patented subject matter 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. Relevant considerations include the level of ordinary skill in the art; the scope and content of the prior art; differences between the prior art and the claims at issue; and the so called objective indicia, or secondary considerations, of nonobviousness.

24. I understand that in order to evaluate the obviousness of any claim of the '343 Patent over a given prior art combination, I should analyze whether the prior art references, included collectively in the combination, disclose each and every element of the allegedly invalid claim as those references are read by the person of ordinary skill in the art at the time of the invention. Then I am to determine whether

that combination makes the claims of the '948 Patent obvious to the person of ordinary skill in the art by a preponderance of the evidence, at the time of the inventions. I understand that such preponderance of the evidence is satisfied if the proposition is likely to be true than not true.

25. I understand that the obviousness inquiry requires that the prior art be considered in its entirety.

26. I understand that even where all of the claim limitations are expressly disclosed in the prior art references, there must be some showing that a person of ordinary skill in the art would have been motivated to combine such prior art references and that there would have been a reasonable expectation of successfully achieving the claimed invention from such combination.

27. I understand in considering the obviousness of a claimed invention, one should not view the invention and the prior art with the benefit of hindsight. It is for that reason, I understand that obviousness is assessed by the person of ordinary skill in the art at the time the invention was made. In this regard, I am informed and I understand that the invention cannot be used as a guide to selecting and understanding the prior art. I understand that the appropriate standard is to determine whether a person of skill in the art would be motivated to combine references, not whether they could.

28. I understand that obviousness cannot be predicated on what was unknown at the time of the invention, even if the inherency of a certain feature is later established. I understand that unknown properties of the prior art may not be relied upon to provide the rationale for modifying or combining the prior art to reach the claimed subject matter.

29. I understand that a reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.

30. 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.

C. Written Description

31. I have been informed that a claim is valid under the written description requirement of 35 U.S.C. §112 when the descriptions in the patent show that the applicant invented what is claimed. The patent applicant does not have to use any particular form of disclosure to describe the subject matter claimed. Rather, the test is whether the disclosure in the patent reasonably conveys to one skilled in the art

that the applicant had possession of the claimed subject matter as of the filing date of the application. This test requires an objective inquiry into the specification from the perspective of a person of ordinary skill in the art. I also have been informed that the adequacy of the description of an invention depends on the nature of the claims and the complexity of the technology. Given this perspective, in some instances, a patent owner can rely on information that is well-known in the art to satisfy written description.

32. I 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 that these statements were made with 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.

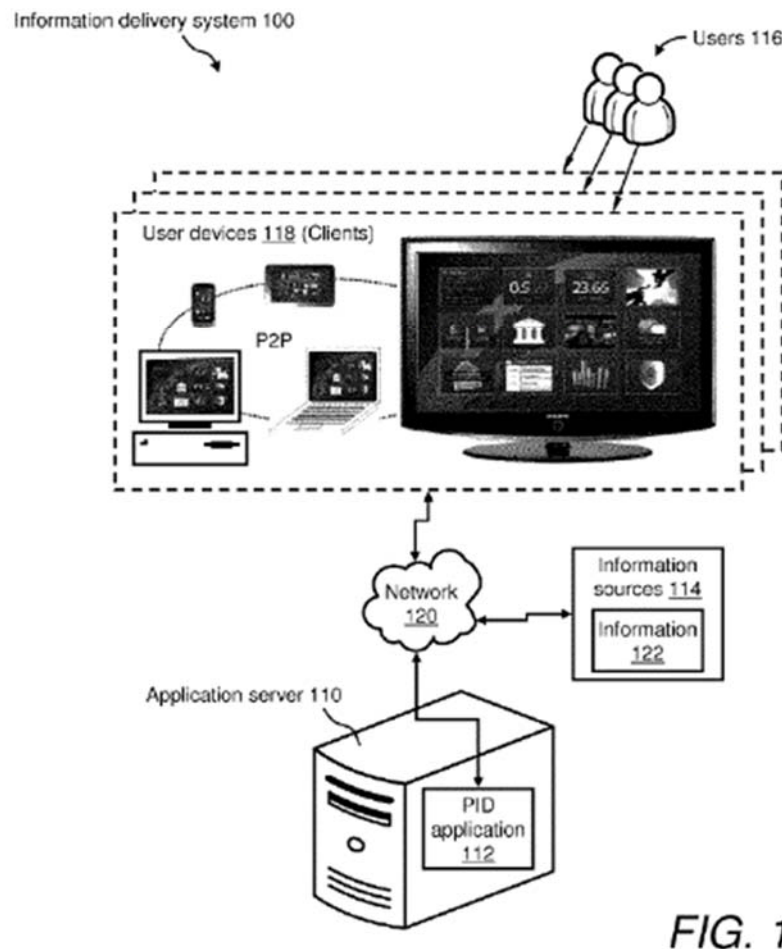
VI. OVERVIEW OF THE '948 PATENT

A. The '948 Patent

33. The '948 Patent describes technology for presenting, managing, and interacting with different types of information from multiple information sources across multiple computer devices. '948 Patent at 1:66-2:13. Further, the '948 Patent incorporates by reference the 2009 Parent, (Ser. No. 12/465,331) that led to the '948 Patent. '948 Patent, 1:22-34. In one embodiment, the '948 Patent describes the “channel grid framework” with a matrix of channels authorized for the user, with

these channels allowing for the user to receive or interact with secure user-centric information. '948 Patent at Abstract and 2:4-18.

34. Figure 1 of the '948 Patent provides an overview of an information delivery system that provides for the display of and access to secure user-centric information via the construction of a channel grid framework.

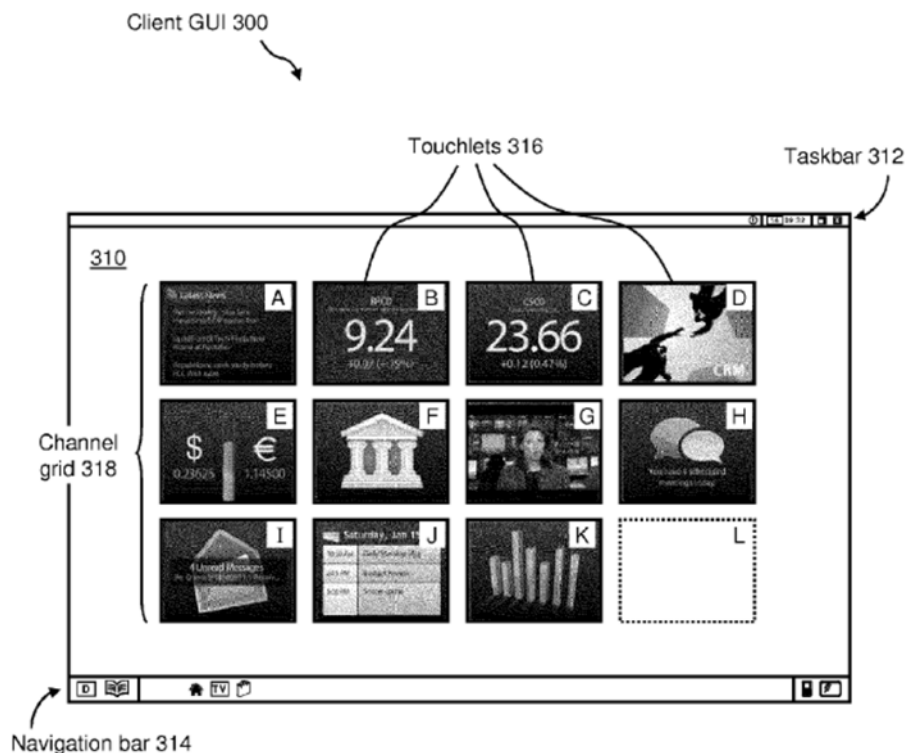


'948 Patent at Fig. 1.

35. Figure 1 shows how the user's device will be managed by an application service to display information from different applications into the

channels. The channel grid framework includes multiple user-selectable items that provide access to corresponding “channels” by which respective portions of user-centric information are delivered to the user. In this example, the user and the user device are first authenticated to receive the secure user-centric information, and the user-selectable items included in the channel grid framework on the desktop for the user device are based on information access rights and security protocols defined for the corresponding channels, as well as the user and the user device. Each channel in the “channel grid framework” displays and enables a user to interact with secure user-centric information. ’948 Patent at 5:33-36, 6:65-7:59.

36. Figure 12 of the ’948 Patent, reproduced below, shows an exemplary channel grid framework, including a channel grid 318:



'948 Patent at Fig. 12.

37. As demonstrated, information can be displayed directly to the users through these different channels while they are shown within a matrix. '948 Patent, 24:4-17. The '948 Patent describes “the channel is a conduit for delivering information to a user (e.g., providing access to and interaction with information),” including a “visualization piece that is presented on the client device (e.g., user devices 118)” and an “integration piece residing at the server (e.g., application server 110).” '948 Patent at 8:63-9:3; Fig. 2. The “visualization piece” of a channel is also referred to as a “touchlet.” 948 Patent at 9:25-27 (“Each channel 200 may include a visual component 210 that is formed of a touchlet 212 and a channel application 214.”).

38. Unlike standard icons and windows that are static and have little or no built-in intelligence, touchlets 212 have both static and dynamic behaviors, as well as intelligence.” '948 Patent at 12:24-26. The '948 Patent further explains, “the context presented in each touchlet is designed to present only what is important to the user without saturating the user with content he/she does not want or need.” '948 Patent at 12:41-44.

39. The '948 Patent also discloses accessing and interacting with “secure user centric information.” '948 Patent at 5:50-59. Examples of secure user-centric information include “one or more secure email services, one or more secure banking

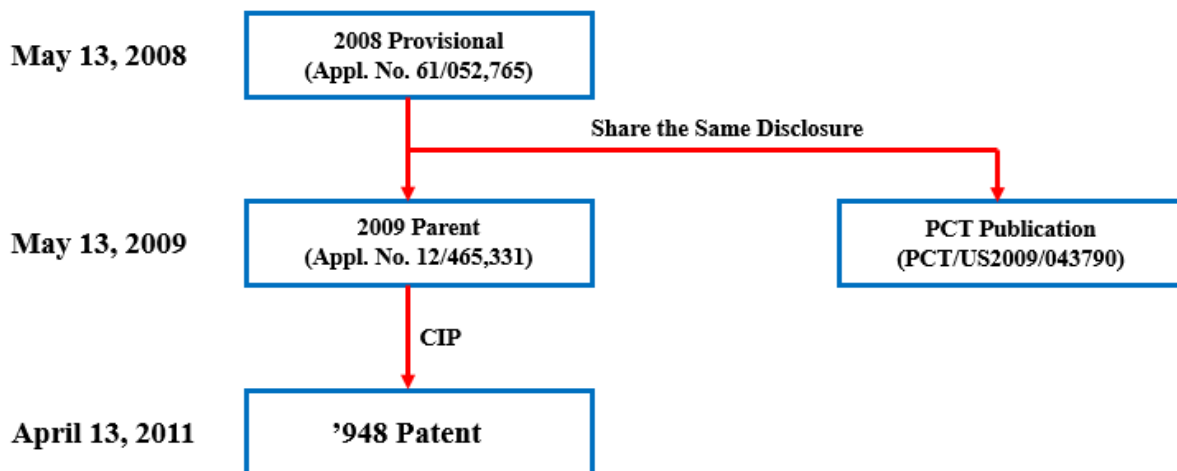
and/or financial accounts, one or more secure web-services accounts, and the like.” ’948 Patent at 15:65-16:1. The ’948 Patent describes improving the operation of a user’s system by managing the access rights and user authorization for the different channels, thereby allowing information from different applications, including secure information, to go directly to the user. ’948 Patent at Abstract. The ’948 Patent further describes authorizing the channels so that the necessary secure information can be displayed directly to the user through the channel, rather than through a separate application. In particular, the specification describes a channel grid framework that “[i]mplement[s] authorized channels through which the user receives and/or interacts with secure user-centric information.” ’948 Patent at Fig. 7A, 18:21-62.

40. The ’948 Patent, and the parent application it claims priority to, also include descriptions of alerts that can be used to notify a user of changes in response to secure user-centric information in the channels. ’948 Patent at Abstract. These alerts are an additional way that the systems were improved to give the user the information they need in a timely manner. *See, e.g.*, ’948 Patent, Fig. 25, 2:14-41, 5:60-6:64, 14:58-15:25, 19:45-20:59, 21:6-42, 22:23-51.

B. The ’948 Patent’s Family Relationships

41. The ’948 Patent is a continuation-in-part (“CIP”) of the 2009 Parent, which was filed on May 13, 2009, and claims priority to a provisional application

filed in May 2008 (Ex. 1108, the “2008 provisional”). See ’948 Patent at Cover. The PCT Publication likewise claims priority to the 2008 provisional and shares the same disclosure as the 2009 Parent. See Ex. 1104 at ¶ [0001]; Pet. at 32 (asserting that the PCT Publication is identical to the 2009 Parent, “containing the same drawings and specification.”). Reproduced below is a visual diagram of the family relationship between these applications below:



42. In my opinion, the 2009 Parent, which the ’948 Patent incorporates by reference and claims priority to, provides written description support for *all* Challenged Claims

C. The ’948 Patent and its Family Member Disclosures

43. The ’948 Patent describes instantiating a channel grid framework, which is an interactive matrix of channels that enables a user to receive and interact with secure user-centric information and providing alerts to the user’s device(s) upon

detected changes to secure user-centric information. '948 Patent at Abstract. Both the '948 Patent and the 2009 Parent disclose (1) examples of alerts provided on user devices, (2) how to determine a notification method for providing alerts on the user devices, and (3) determining which user devices receive the alerts.

44. **Alerts:** The '948 Patent and 2009 Parent describe alerts generically while also providing non-limiting alert examples. *See, e.g.,* '948 Patent at 2:42-44, 9:39-43; Ex. 1106 at ¶ [0023], Claim 9, ¶ [0039]. Specifically, the 2009 Parent's non-limiting examples include visual and auditory alerts:

If an established condition is met, the channel alert server 211 may notify the identity management server 208 to confirm the subscriber of the event, determine the active devices of the subscriber, and then pass through the web services gateway 207 and the channel grid framework 201 ***to provide a visual or auditory alert in the channel 202.***

Id. at ¶ [0039] (emphasis added).

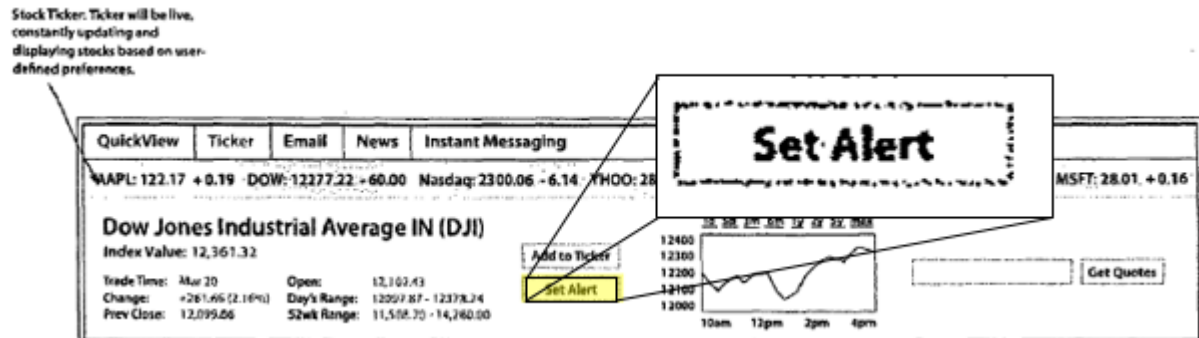
45. **Determining a Notification Method:** This method refers to determining the device(s) of the user to send the alert to and how to send the alert. *See* IV.C.1, *infra* (construing “determining a notification method”). For instance, the 2009 Parent discloses an identity management server that determines the user's active device(s) based on session data and the protocol (e.g., HTTP) to send the alert via the web services gateway:

If an established condition is met, the channel alert server 211 may notify the ***identity management server 208*** to confirm the subscriber of the event, ***determine the active devices of the subscriber***, and then pass ***through the web services gateway 207*** and the channel grid framework 201 to provide a visual or auditory alert in the channel 202 . . . The alert can appear as defined on other platforms such as a mobile device, a television (set top box), a Blu-ray player, or other devices.

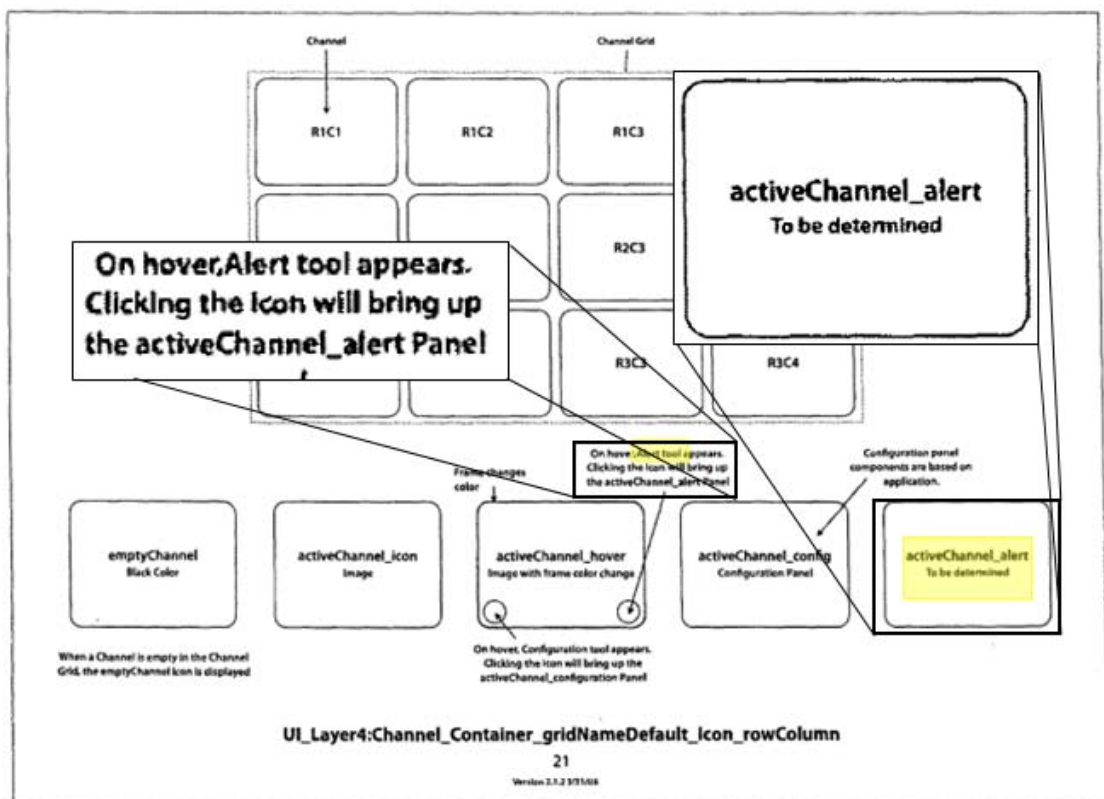
Ex. 1106 at ¶ [0039] (emphasis added); *id.* at ¶ [0021] (“Information may be delivered to a user based on the user’s identity as established by the system when the user’s session is established”). In some instances, the system may employ user preferences when determining, for example, whether a user wants a visual or auditory alert presented in their channel application on the device. *See id.* at ¶ [0034] (“[A] user profile may be established which may identify user preferences, platform identifies, and services support instructions as to how the user wishes information to behave on the selected platform.”).

46. The 2008 provisional provides details on the system’s user-defined preferences that can enable the system’s determination. For example, the “generalPreferences” tab provides “the ability to monitor select data and send alerts to [] email, SMS, RSS.” Ex. 1108, pg. 23 (emphasis added). As shown below, the alert is set “based on user-defined preferences” and can appear through a

“programming interface” or “media presentation devices” via the presentation determination.



Id. at pg. 45 (annotated).



Id., pg. 50 (annotated); see also *id.* pg. 12 at ¶ [0010] (“These alerts can also be made to appear, through a programming interface, through other media presentation

devices such as digital high definition television or audio signals.”). Accordingly, as was well-known in the art at the time, the 2009 Parent and 2008 provisional disclose storing user preferences that are used by the system.

47. **Providing Alerts on User Devices:** Both the ’948 Patent and 2009 Parent describe alerts provided to **active** devices as indicated by session data. See, e.g., ’948 Patent at 20:65-21:2, 21:8-11; Ex. 1106 at ¶ [0039]. For instance, the 2009 Parent discloses determining **the active devices** based on session information and providing alerts on those devices:

If an established condition is met, the channel alert server 211 may notify the **identity management server 208** to confirm the subscriber of the event, **determine the active devices of the subscriber** The alert can appear as defined on other platforms such as a mobile device

Ex. 1106 at ¶ [0039] (emphasis added).

VII. IN MY OPINION, THE PCT PUBLICATION IS NOT PRIOR ART BECAUSE THE CHALLENGED CLAIMS FIND SUPPORT IN THE 2009 PARENT

A. The 2009 Parent Provides Written Description Support for the Term “Provide [An] Alert”

48. I understand that at institution the Board found that alerts may include “tactile, auditory, and visual information as possibilities but do not require any one type of information.” Paper 13 at 15-16. I agree for the reasons discussed below.

49. As I discuss in Section VI.C above, the 2009 Parent discloses providing an alert to an external device. For example, “the channel alert server 211 may notify the identity management server 208 to confirm the subscriber of the event, determine the active devices of the subscriber, and then pass through the web services gateway 207 and the channel grid framework 201 to provide a visual or auditory alert in the channel 202.” Ex. 1106 at ¶ [0039]. Also, at the time of filing, tactile alerts were well known in the art and were presented on mobile devices as disclosed.

1. Claim Construction: “Provide [an] Alert” *Encompasses* but Does Not Require Any One Type of Alert

50. At institution, I understand that the Board determined that providing an alert *encompasses* various alerts but does not require any one type of alert. Paper 13 at 15-16 (finding that the term “include[s] tactile, auditory, and visual information as possibilities, but do not require any one type of information.”). I agree with this finding.

51. A POSITA would also read the term in this way based on the specification, which describes “alerts” generically and without limitation to particular alert types. See, e.g., ’948 Patent at 2:42-44 (“[A]ctionable and/or non-actionable **alerts** may be generated (e.g., in response to one or more triggers) on one or more authenticated user devices and/or other devices.”) (emphasis added); 5:32-36 (“[B]elow are more detailed descriptions of various concepts related to, and embodiments of, inventive methods, apparatus and systems for providing and

monitoring secure information via multiple authorized channels and generating **alerts** relating to same.”) (emphases added). Consistent with this disclosure, the 2009 Parent similarly describes alerts generically, including any type of alert that may be “defined on other platforms such as a mobile device, a television (set top box), a Blu-ray player, or other devices.” Ex. 1106 at ¶¶ [0023], [0039], Claim 9.

52. In view of the above, I agree with the Board’s findings and in my opinion these findings should be maintained during trial.

2. The 2009 Parent Discloses Alert Examples with Tactile Alerts Being Well-Known in 2009

53. Mr. Schmandt opines that there is no written description support from the 2009 Parent for alerts that may include tactile alerts. Schmandt Decl. at ¶¶ 43-55. I disagree, because, as I explain below, a POSITA would understand that it was common by 2009 to send vibration alerts to mobile device.

54. In my opinion, a POSITA would know that tactile alerts (e.g., vibrations) were widely used in mobile phones as of 2009. For example, the 2007 book, iPhone: The Missing Manual, Ex. 2018 lists “Silent Vibrate, Ring Vibrate” under “Sounds” and states, “Like any self-respecting cellphone, the iPhone has a Vibrate mode—a little shudder in your pocket that might get your attention when you can’t hear the ringing. As you can see on this screen, there are two On/Off controls for the vibrator: one for when the phone is in Silent mode (page 12), and one for when the ringer’s on.” Ex. 2018 at 245. Petitioner excerpts from this book as

Ex. 1126, and Mr. Schmandt opines in his declaration that a POSITA would be familiar with this book's teachings. Schmandt Decl. at ¶ 36. See also, e.g., Ex. 2003 at Abstract; Ex. 2004 at 354 (listing a number of articles describing the use of tactile alerts in mobile applications); Ex. 2005 at 401 ("When the recipient's mobile phone receives the SMS message, he is notified by his mobile phone with a sound or vibrating.").

55. Further, Mr. Schmandt apparently agrees with me that a POSITA would know that tactile alerts were widely used in mobile phones as of 2009. For example, Mr. Schmandt's declaration also states, "POSITAs in 2009 were familiar with visual, auditory, and tactile information, and their differences. These three are properly referred to as different sensory modalities as they rely on a human's different senses of sight, hearing, and touch." Schmandt Decl. at ¶ 47. Further, at his deposition, when asked, "Were tactile alerts known to persons of ordinary skill in the art at the time the 2009 priority application was filed?," Mr. Schmandt concluded his answer by saying, "So vibration tactile was certainly used as notification for various kinds of events, yes." Ex. 2022 ("Schmandt Dep. Tr.") at 15:17-19.

56. At his deposition, Mr. Schmandt also testified as follows, which agrees with my conclusion that in 2009 a POSITA would be aware of smartphones using vibration alerts:

Q. Was it common for smartphones in the 2009 time frame to alert users with tactile information?

. . .

A: Okay. So certainly in 2009 some smartphones had vibration, yes. I can't off the top of my head tell you what percentage of them did. But some of them certainly did. The system architecture employed by these devices was such that the phone would get a notification from the system, from the base station, about an event, and the phone would decide after consulting user preferences in the form of settings, how to notify the user, which could include visual, auditory, and in a phone so equipped, tactile. That was a closed eco system and it was not available to an application that was not running on the phone.

So the system, the mobile telephone system, could not tell the phone to vibrate. It could tell the phone, here's an event such as a text or a phone call, and the phone could decide, if it was so equipped, to vibrate.

Schmandt Dep. Tr. at 16:25-17:22.

57. As an initial matter, by 2009, virtually all smartphones had vibration alerts. In fact, this was already true for mobile phones by the beginning of 2003. For example, the research article, "Innovation and Dominant Design in Mobile Telephony," by Heli Koski and Tobias Kretschmer, *Industry and Innovation*, Vol.

14, No. 3, 305-324, July 2007, Ex. 2019, reports that vibration alerts were available in all sampled models in 2002. Ex. 2019 at 12. Further, this research article also reports, “Certain horizontal innovations such as clocks, games, SMS, speed dialing and vibration alert have become so common in mobile handsets that they constitute a dominant design at the level of additional features.” *Id.* at 15. This article concludes, “The dominant design handset model in the beginning of 2003 was a compact communications device that included at least SMS, speed dialing and vibration alert options, clock and games.” *Id.* at 19.

58. In the above excerpted portion, Mr. Schmandt testified that in 2009 a system “could not tell the phone to vibrate.” Further, Mr. Schmandt also testified as follows:

Q. And why is that relevant?

A. Because the -- like I said, the 2009 application, the logic here that was posed in the preliminary response was that because the 2009 application mentions mobile devices, that that is sufficient written description for tactile alerts. And the part of that like was that the claim that it was common for mobile phones to have the ability to vibrate. I'm not disputing that last sentence. I'm not verifying it, but I'm not disputing it. But the point is that an alert in the context of -- well, there are a number of issues. One issue is that that sentence is only about visual alerts. It doesn't have anything to do with tactile alerts. So everything else

is -- everything else that I'm going to say is irrelevant. But if we arguendo say that it did, then the fact that the phone could decide to vibrate does not mean that an application that runs server based off the phone, such as described in the '948 could on its own decide that some event has happened which should trigger a notification and that that notification could be tactile. Phones at that time simply didn't have a way of doing that. It was supported in the operating system. There was no API, application program interface to allow that.

Schmandt Dep. Tr. at 20:6-19:25.

59. I disagree with Mr. Schmandt's testimony here, as well as his follow-up testimony at *id.*, 18:25-20:23. By 2009, there were a number of well-known application programming interfaces (APIs) for mobile smartphones that supported distributed applications, including clients and servers, for sending vibration alerts to mobile devices. For example, a research article, "PeopleTones: A System for the Detection and Notification of Buddy Proximity on Mobile Phones," by Kevin A. Li, Timothy Sohn, Steven Huang, and William G. Griswold, which was published in the proceedings of MobiSys'08, June 17-20, 2008 ("PeopleTones," Ex. 2021), states, "The playVibrate function represents the standard function for turning the actuator on, supplied by almost all mobile phone APIs." Ex. 2021 at 8. The PeopleTones article describes a system in which mobile phones periodically upload their locations

to a server and get alert notifications, including sound and/or vibration alerts, from the server when a “buddy” is near them. *Id.* at 6-7.

60. Further supporting my conclusion that sending vibration alerts from a server using an API was known in 2009, PeopleTones states, “Motivated by haptics research suggestions to use vibrotactile cues for ambient information delivery [35], we explored using vibrotactile patterns to convey ambient information on mobile phones with the actuator that commonly ships with these devices.” *Id.* at 7. Further, PeopleTones states, “PeopleTones is implemented as a client-server application using standard SOAP web services. The client-side application is written in C#.NET on the Windows Mobile Smartphone platform.” *Id.* at 9.

61. In addition, Mr. Schmandt testified that a mobile phone in 2009 could support an HTML alert (which I agree with), and he further confirmed this testimony, e.g., at Schmandt Dep. Tr. at 26:5-27:1. However, Mr. Schmandt stated at the end of an earlier answer, “But there’s nothing in HTML that says vibrate.” Schmandt Dep. Tr. at 22:25-23:1. I disagree with this latter statement regarding HTML on a smartphone in 2009. For example, the book, *Developing Hybrid Applications for the iPhone Using HTML, CSS, and JavaScript to Build Dynamic Apps for the iPhone*, by Lee S. Barney, (“Barney”) Ex. 2020, describes how to create “hybrid” iPhone applications, which are written in HTML, CSS, and JavaScript, and the “book covers the two most commonly used open-source JavaScript software

packages for writing applications for the iPhone and iPod touch devices: QuickConnectiPhone and PhoneGap.” Ex. 2020 at xiii (Preface). For example, Barney discloses, “To notify users of important pieces of information, insert them into an HTML div or another element regardless of which tool you use.” *Id.* at 3. With respect to the PhoneGap API, Barney discloses, “If you choose to use PhoneGap, your application can be run only when the user has access to the Internet from his device.” *Id.* at 9. For instance, Barney discloses the startup process for using the PhoneGap API in the following illustration:

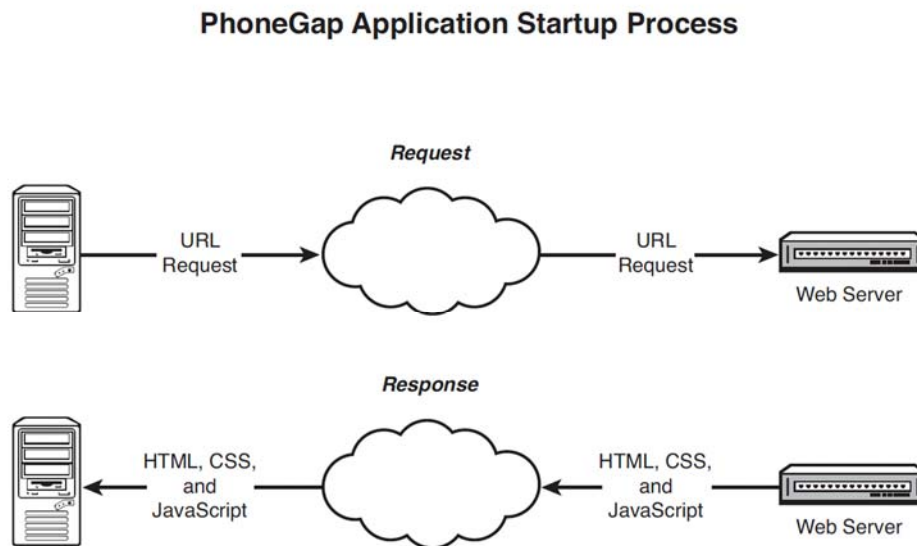


Figure 5.1 The startup request and response for PhoneGap applications used to obtain the HTML, CSS, and JavaScript that define the application

Id. at 96.

62. Barney also includes the following API call for causing a phone to vibrate for the standard amount of time:

Table 5.1 PhoneGap JavaScript API

Element	Parameters	Behavior
<code>gotAcceleration()</code>	x—The acceleration value along the x-axis. y—The acceleration value along the y-axis. z—The acceleration value along the z-axis.	This function is not predefined. To receive accelerometer information, create this function somewhere in your application. When created, the Objective-C library can then call it and pass it the parameter values.
<code>Device.init()</code>	None	Gathers up the device information from global variables that were set when the application started. This information is placed in the Device object and includes: Device type (iPhone/iPodTouch) Device OS version Device UniqueID PhoneGap version
<code>Device.vibrate()</code>	None	Causes the phone to vibrate for the standard amount of time.

Id. at 97 (annotated).

63. Further, Barney discloses that the PhoneGap API had confirmed vibration functionality for both iPhones and Android smartphones on February 23, 2009. *Id.* at 183 (Appendix C). Moreover, Barney also discloses that PhoneGap supports alerts to users. *Id.* at 3.

64. Confusingly, Mr. Schmandt’s declaration cites his own research, which contradicts his position regarding sending vibration alerts to mobile devices before 2009. For example, at ¶ 12 in his declaration, Mr. Schmandt cites his paper with Stefan Marti, “Giving the Caller the Finger: Collaborative Responsibility for Cellphone Interruptions,” Proc. of ACM (CHI 2005), 1633-1636 (2005), Ex. 2027 (Finger), describing construction of a vibration enabled wearable ring for alerting

users of possible incoming group calls. Mr. Schmandt and his coauthor presented a system in which a cell phone decides whether to ring by accepting votes from the others in a conversation with the called party. When a call comes in, the phone first determines who is in the conversation by using a decentralized network of autonomous body-worn sensor nodes. It then vibrates all participants' wireless finger rings. Although the alerted people do not know if it is their own cellphones that are about to interrupt, each of them has the possibility to veto the call anonymously by touching his/her finger ring. If no one vetoes, the phone rings. Ex. 2027 at Abstract.

65. Accordingly, because tactile alerts would be well-known to a POSITA as features of mobile phones in 2009, the 2009 Parent's disclosure of alerts "defined on other platforms such as a mobile device" (Ex. 1106 at ¶ [0039]) provides disclosure of tactile alerts. Therefore, it is my opinion that the 2009 Parent provides written description support in the Challenged Claims for alerts that may include tactile alerts (as well as visual or auditory alerts) because tactile alerts were well-known in the art in 2009 and their use in the claimed invention is implicitly disclosed in the 2009 Parent.

B. The 2009 Parent Provides Written Description Support For the "Information" Terms

66. In my opinion the 2009 Parent also provides written description support for the "information" terms. For disclosure of "information" terms listed below,

Petitioner cites the PCT publication, which corresponds to the exact paragraphs and disclosure in the 2009 Parent.¹ Thus, these terms are disclosed in the 2009 Parent.

Term	Petitioner’s PCT Publication (2009 Parent) Citations
“user-centric information”	Ex. 1104 at ¶¶ [0022] [0036] (“user-centric information”). Pet. at 43-44.
“channel information”	Ex. 1104 at ¶ [0022] (“channel information”). Pet. at 49.
“discrete information”	Ex. 1104 at ¶ [0039], Claim 9 (“discrete information”). Pet. at 52.
“information access rights”	Ex. 1104 at ¶¶ [0024],[0036] (“information access rights”). Pet. at 48-49.

67. It is also my opinion that the “information” terms find support for the same reasons as those discussed in the section above.

¹While I understand Petitioner’s written description challenge to be predicated only on “secure, user-centric information,” I provide disclosure support for the other “information” claim terms as well. See Pet. at 25.

C. The 2009 Parent Provides Written Description Support for Elements [1.10] F (“Determining a Notification Method”) and [1.11] G (“Generating Notification Data”)

68. In my opinion, the 2009 Parent provides written description support for “determining a notification method” under the proper construction, which only requires determining which device(s) should receive the alert and how to send the alert.

69. I understand that at institution the Board considered the written description question by assuming that this limitation requires all three aspects of relied on Petitioner’s implicit construction of “determining a notification method” that “can include,” *i.e.* “(1) the user device(s) to send the notification to . . . (2) the communication protocol to use to send the notification . . . ; and (3) how to present the alert. Pet. at 53; Paper 13 at 20-21. However, the third aspect (“how to present an alert”), a POSITA would understand is not always needed to determine the notification method.

70. But even if all three aspects were required, it is my opinion that the 2009 Parent still provides written description support because the third aspect is based on ***user preferences*** that (1) the 2009 Parent discloses, (2) includes alert information on the presentation of an alert; and (3) was well-known in the art to be used by systems in determining how to present an alert.

71. Also, it is my opinion that the 2009 Parent also discloses “generating notification data” for the reasons discussed below.

1. Claim Construction: “Determining a Notification Method”

72. In my opinion, a POSITA would understand “determining a notification method” to include *determining the device(s) to send the alert to and how to send the alert*. I understand that this construction differs from the tacit construction applied in the Petition in that how to present an alert (aspect 3) is not required. However, as I explain herein this aspect is not always necessary.

73. The construction including only aspects one and two is consistent with the '948 Patent specification, which discloses a “Home Security” embodiment that provides an alert on the user’s device(s) if motion is detected. In this embodiment, the system determines (1) that there is an active session on the user’s laptop computer and (2) the protocol (e.g., HTTP) for sending the alert to the user’s laptop computer. '948 Patent at 20:49-21:36 (disclosing that the system “determine[s] whether user 116 has an active session . . . [I]n one example, it is determined that user 116 as an active session on his/her laptop computer” and the system “dispatches the event notification (i.e., alert) through user’s logical event queue. For example, the client gateway 418 . . . transmits (via AMF) the alert”). In this manner, a POSITA would know that the notification method for the alert is determined as the

alert is delivered to the user's active laptop computer by the protocol via the client gateway. *Id.* at 21:23-36.

74. Determining how to present the alert (aspect 3), however, is not a necessary part of determining a notification method. For example, the 2009 Parent discloses an embodiment in which “[t]he alert can appear as defined on other platforms such as a mobile device.” Ex. 1106, ¶ [0039]. In that embodiment, the mobile device, not the processor, determines how to present the alert.

75. Moreover, Mr. Schmandt testified that second and third aspects are implicitly tied. Schmandt Dep. Tr. at 26:9-27:1. For example, Mr. Schmandt testified that SMTP is for email. Schmandt Dep. Tr. at 63:17-18. I agree. For example, as acknowledged by Mr. Schmandt, a POSITA would understand that SMS is for text messages. Thus, if a system chooses to send an alert using SMS, then implicitly it has also decided to send that alert as a text message alert, say to a mobile smartphone. Likewise, if a system chooses to send an alert using SMTP, then implicitly it has also decided to send that alert as an email message alert, say to a mobile smartphone. I understand that in the co-pending District Court proceeding, Petitioner's, expert, Dr. Clark, accounted for these instances when interpreting “determining a notification method” as requiring only the determination of the devices to send the alert to and how to provide the alert, for example, SMTP (email) or SMS (text). Ex. 2023 (“Clark Rpt.”) at ¶¶ 534-535.

76. Thus, for at least the foregoing reasons, it is my opinion that “determining a notification method” includes *determining the device(s) to send the alert to and how to send the alert*.

**2. The 2009 Parent Provides Written Description Support For
“Determining a Notification Method” Under the Proper
Construction or Petitioner’s Construction**

**(a) The 2009 Parent Discloses Determining the Devices to
Send the Alert to and How to Send the Alert**

77. In my opinion, the 2009 Parent provides written description support for “determining a notification method” under the proper construction because it discloses how the system determines the user device(s) to send the alert to and how to send the alert.

78. The 2009 Parent discloses an identity management server that determines which of the subscriber’s devices are active and which protocol (e.g., HTTP) should be used to send the alert to the active device(s) via web services gateway 207:

If an established condition is met, the channel alert server 211 may notify the identity management server 208 to confirm the subscriber of the event, **determine the active devices of the subscriber**, and then **pass through the web services gateway 207** and the channel grid framework 201 to provide a visual or auditory alert in the channel 202.

Ex. 1106 at ¶ [0039] (emphasis added); *see also id.* at ¶¶ [0020]-[0021], [0023].
[0026]-[0027], [0031], [0033].

79. A POSITA would know from the 2009 Parent disclosure how active devices are determined and how alerts are sent via the gateway. For instance, session information indicates the active user devices and is what the system uses to “determine the active devices of the subscriber” to send the alert to. *See* Ex. 1106 at ¶ [0039], ¶ [0021] (disclosing that “[i]nformation may be delivered to a user based on the user’s identity as established by the system when the user’s session is established); Pet. at 51 (describing “session data” as meaning “data indicating whether and which of the **user’s device(s) is/are active**”) (citing **paragraph 39**), 54 (explaining that “a channel alert server [] **determines the active devices** of the user and delivers an alert to the user’s device(s)”) (quoting **paragraph 39**) (emphases added). Also “web service gateway[s]” use protocols, such as HTTP, to send information to client devices. *See id.* at ¶ [0039]; Ex. 2006 at 1-2 (describing that an application gateway uses HTTP to send information to clients).

80. Thus, it is my opinion that under the proper construction the term “determining a notification method” finds support in the 2009 Parent’s disclosure of determining the user device(s) to send the alert to (active device(s)) and how to send the alert (HTTP via the web services gateway).

(b) The 2009 Parent Also Discloses How to Present an Alert Which is Included in Petitioner's Construction

81. Even if determining a notification method *also* requires how to present an alert (the third aspect), it is my opinion that this aspect is also disclosed in the 2009 Parent because it discloses user preferences that instruct the system of how information should be presented on various platforms.

82. Mr. Schmandt agreed that this third aspect is satisfied if the system consulted user preferences to determine how to present the alert (visually or auditory, for example). Schmandt Dep. Tr. at 52:7-20 (Q: “So long as the information is defined in the user preferences, alert goes out? A. That’s the third aspect of it.”). Mr. Schmandt further agreed that the 2009 Parent’s disclosed “user preferences” and that it includes alert information as to how a user wants the alert to be presented:

Q. So you agree that the PCT Publication teaches a user profile that identifies user preferences . . . as to how the user wishes information to behave on the selected platform?

A. Yes.

Q. Is an alert information?

A. [M]y answer to your question is yes.

Schmandt Dep. Tr. at 101:18-102:13.² I agree with Mr. Schmandt.

83. Mr. Schmandt also admitted that it was well known in the art for a user to set user preferences and a system to reference the user preferences (*i.e.* alert information) to determine how to present an alert:

And it seems pretty clear you would want to respect user preferences. Users were already use to the idea of setting preferences on their devices. So the only reasonable way for such a system to work would be to allow the user . . . to set those preferences.

Schmandt Dep. Tr. at 53:13-19; *see also id.* at 50:3-52:16. I agree with Mr. Schmandt. Based on express disclosure in the 2009 Parent and what was well-known in the art, a POSITA would know that the disclosed user preferences (including alert information) are used by “the system [to] determine[] how an alert is presented” (the third aspect). Paper 13 at 21.

84. In this respect, it is my opinion that the 2009 Parent contains the same disclosure as Austin-Lane for “determining a notification method” under Petitioner’s construction including all three aspects. When contending that Austin-Lane

² As established in Section II.A *supra*, the PCT Publication and the 2009 Parent share the same specification and therefore provide the same disclosure support.

discloses the term, Petitioner points to Austin-Lane’s disclosure of determining “***the user device(s)***” to send the alert to, “***the communications protocols***” used to send the alert, and “***how to present***” the alert. Pet. at 53 (emphasis added). Petitioner itself admits that the PTC Publication—and thereby the 2009 Parent—is equivalent to Austin-Lane because:

[T]he PCT Publication’s system already includes a channel alert server that determines the active devices of the user and delivers an alert to the user’s device(s)

* * * *

the PCT Publication discloses setting the same type of alert (stock alert) and presenting it in the same way (visually) as Austin-Lane.

Pet. at 54 (citing Ex. 1104 at ¶¶ [0023], [0039]) (emphasis added); Ex. 1106 at ¶¶ [0023], [0039]. To present the alert “visually,” a POSITA would know that user preferences may be used in that presentation determination, just as in Austin Lane. See, e.g., Ex. 1105 at ¶¶ [0019], [0038]. In this manner, the notification method for the alert is determined as the “active device(s)” are identified and the alert “deliver[ed]” to these device(s) and “present[ed] [] in the same way as in Austin-Lane.” Pet. at 54.

85. The 2009 Parent’s passages describing equivalent disclosure in Austine-Lane I list as follows:

(1) the user device(s) to send the notification to (e.g., phone, PDA, notebook, computer, desktop computer). Ex. 1106 at ¶ [0039] (describing determining the active devices to send the alert to); *see also* ¶¶ [0020], [0023], [0027], [0033];

(2) the communication protocol to use to send the notification, i.e., how to send the notification (e.g., SMTP, SMS, HTTP). *Id.* at ¶¶ [0026], [0031], [0039] (describing a web services gateway that the alert is passed through³); and

(3) the type of alert to provide, i.e., how to present the notification. *Id.* at ¶¶ [0022], [0023], [0034], [0039] (describing user preferences, alert types, and alerts appearing on the user's devices).

3. The 2009 Parent Provides Written Description Support For “Generating Notification Data”

86. With respect to “generating notification data,” I understand that Petitioner contends that “notification data” is “data transmitted to the user’s device that is responsible for causing the alert to be displayed on the user’s device” because “it ‘provide[s] the notification to the user.’” Pet. at 41, 55.

³ Passing the alert through a gateway requires protocols such as HTTP. *See* Ex. 2006.

87. I also understand that at institution, the Board agreed that “if the May 2009 application discloses determining a notification method,” it then “discloses generating a notification alert. See Paper 13 at 21. Accordingly, the 2009 Parent discloses “generating a notification alert” for the reasons I discussed directly above.

88. Further it is my opinion that notification data is inherently disclosed in the 2009 Parent because for the alert to be displayed on the user’s device, there necessarily exists notification data responsible for the display. Pet. at 41, 55 (interpreting “notification data” as “data transmitted to the user’s device that is responsible for causing the alert to be displayed on the user’s device” because “it ‘provide[s] the notification to the user’”). Petitioner acknowledges that the PCT Publication—and therefore the 2009 Parent—discloses setting and presenting the alert on the device:

[T]he PCT publication’s system already includes a channel alert server that determines the active devices of the user and delivers an alert to the user’s device(s) . . . [and] discloses ***setting the same type of alert*** (stock alert) and ***presenting it*** in the same way (visually).

Pet. at 54 (emphasis added) (citing Ex. 1104 at ¶¶ [0023], [0039], Claim 9); see also Ex. 1106 at ¶¶ [0023], [0039]. Because notification data is what causes the alert to be displayed on the user’s device, it is inherent in the 2009 Parent disclosure. *Id.* at 29, 41.

89. Further, I understand that Petitioner confirms that “a POSITA would have been familiar with communication protocols and markup languages commonly used for transmitting information (including notification data) between a server and a user’s device(s).” Pet. at 4. I agree. As I explain above, and for which Mr. Schmandt apparently agrees, a POSITA would, for example, be familiar with the SMS protocol used for text messages, the SMTP protocol used for email messages, and the HTTP protocol used for web communications. Furthermore, a POSITA would also be aware that notifications sent using any of these protocols would include both the content of the notification (e.g., that the price of a stock of interest has gone past a set threshold) as well as metadata that is responsible for causing the alert to be displayed on the user’s device.

D. The 2009 Parent Provides Written Description Support For “the at Least One External Device” (Elements [1.10] F, [1.11] G), and [1.12] H)

1. Session Data” Indicates That “the at Least One External Device” Provided the Alert Is/Are the User’s Active Device(s)

90. The Challenged Claims require providing an alert to external device(s) based on the current state as indicated by “session data” which indicates the *active* device(s). Therefore, providing an alert on “at least one external device” refers to user’s external device(s) that are *active*, which is disclosed in the 2009 Parent.

91. A POSITA would understand that in the context of distributed computing a “session” is an active communication connection, e.g., between a client and a server. See, e.g., Ex. 2007 at 616 (session data: “Data about a session . . .”); *id.* at 615 (Session: (1) “all the activities which take place during the establishment, maintenance, and release of a connection.” (3) “The period of time during which a user of a terminal can communicate with an interactive system . . .”); *see also* Ex. 2002 at 475 (session: “1. The time during which a program is running. In the most interactive programs, a session is the time during which the program accepts input and processes information. 2. In communications, the time during which two computers maintain a connection.”); Ex. 2026 at 434 (session: “a period of time during which a person is using a particular computer service, such as a connection to the Internet.”).

92. The “session data” recited in this element is further limited as “session data indicating a current state of at least one external device of the user.” This is reflected, for example, in Mr. Schmandt’s declaration, where he states, “Sending the alert to the device the user is currently using (as indicated by session data) ensures the user receives the alert promptly and generating the notification data such that it conforms to the requirements/specifications of the determined notification method ensures that the user actually/successfully receives the alert.” Schmandt Decl. at ¶ 71. I agree with this statement by Mr. Schmandt, because it accurately reflects the

fact that the “session data” in this element is limited to session data indicating a current state of at least one external device of the user.

93. The 2009 Parent discloses gathering data regarding an active session of a user and acting upon that data:

Information may be delivered to a user based on the user's identity as established by the system when the user's session is established. Because the user is known and authenticated, preferences and rights to certain information types can be defined and managed for the user.

Ex. 1006 at ¶ [0021].

94. The 2009 Parent also discloses acting on session data about the active devices of a user to send a notification alert to one or more such devices based on their current state:

If an established condition is met, the channel alert server 211 may notify the identity management server 208 to confirm the subscriber of the event, determine the **active devices of the subscriber**, and then pass through the web services gateway 207 and the channel grid framework 201 to provide a visual or auditory alert in the channel 202. Likewise, the alert may trigger additional actions affecting the channel 202 and the underlying computer application. For example, a channel may be established to monitor an alarm condition of a business or residence. If a condition

at the business or residence triggers an alarm, an additional alert action such as notifying a law enforcement agency or a protective services group may be triggered. The alert can appear as defined on other platforms such as **a mobile device**, a television (set top box), a Blu-ray player, or **other devices**.

Ex. 1006 at ¶ [0039] (emphasis added).

95. Accordingly, a POSITA would understand that session data indicating a current state of at least one external device of the user consists of data about active sessions for at least one external device of the user, and this has written description support from the 2009 Parent. Moreover, in addition to the above-cited portions, the Parent document also describes how a user ends a current session, which a POSITA would understand to end the session data indicating the current state of the device. Ex. 1106 at Fig. 4, ¶ [0058].

96. In addition, this understanding is apparently also shared by Dr. Clark in his opening report in the related District Court case, in that he opines in his analysis of the “session data” elements in the ’948 Patent that the alleged prior references he relies on disclose sending notification to the “user’s device where the session is active,” (Clark Rpt., ¶ 535), not to a device that is currently inactive:

To the extent the Cyandia contends that SAP EP 6.0 or IBM WebSphere Portal lacked any of the claimed features related to identifying, storing, and/or utilizing information

about the user and the user's device(s) in a user profile, it remains the case that skilled artisans would have been motivated, with a reasonable expectation of success, to leverage SAP EP 6.0 and WebSphere's existing session-tracking functionality at least as of 2005 to send the alert to the specific device associated with the user on which the user has an active session to ensure the user receives the alert promptly, to improve the usability and security of the system.

Clark Rpt., ¶ 266.

A skilled artisan would have been motivated to modify the SAP EP+IBM WebSphere combination that were already collecting and logging session events to select the notification method based on session data and severity (e.g., the user's online generated events), as taught by Austin-Lane, to ensure the user receives the alert promptly.

Clark Rpt., ¶ 543.

Specifically, a skilled artisan would have been motivated to modify the WebSphere system to select the notification method based on session data (e.g., the user's online presence), as taught by Austin-Lane, to ensure the user receives the alert promptly.

Clark Rpt., ¶ 579.

97. Petitioner also correctly interprets session data as indicating only **active devices** in its obviousness analysis. See Pet. at 51. There, Petitioner relies on paragraph 39 (copied above) in asserting that the PCT Publication’s disclosed system “receives the session data indicating a current state of the at least one external device of the user (i.e., data indicating whether and which of the user’s device(s) is/are active)” . . . to “determine the active devices of the subscriber” to send the alert to. See Pet. at 51-52 (citing Ex. 1104 at ¶ [0039]) (emphases added); see also Ex. 1106 at ¶ [0039] (same). Through this reliance, Petitioner admits that (1) session data indicates “active device(s) of the subscriber” that are provided the alert, and that (2) the 2009 Parent provides written description support for “the at least one external device” because the user’s active device(s) are determined and provided the alert.

2. At Least One or More External Devices” Means One or More Devices, Not Each Device

98. Although Petitioner contends that the claims require providing an alert on **each** of “the at least one external device” (active and inactive), a POSITA understands that the plain language of the claims only require “provid[ing] **at least one alert on the at least one external device** based on the current state of the at least one external device indicated by the session data”:

D) receiving session data indicating a current state of at
least one external device of the user

* * * *

F) determining a notification method by which to provide
at least one alert on the at least one external device
based on the current state of the at least one external device
indicated by the session data;

'948 Patent at Claim 1 (emphasis added).

99. I agree with Cyandia's contention that there is not a one-to-one correspondence between the "at least one alert" and the "at least one external device," as Petitioner's interpretation suggests. Pet. at 29-30. Instead, the plain language of the claims contemplates providing:

- (1) one alert on the user's only external device,
- (2) multiple alerts on the user's only external device,
- (3) one alert on a subset of the user's multiple external devices,
- (4) multiple alerts on each device of a subset of the user's external devices,
- (5) one alert on each of the user's external devices, and
- (6) multiple alerts on each of the user's external devices.

E. All Other Limitations in the Challenged Claims Find Written Description Support in the 2009 Parent

100. While Petitioner's written description challenge only identifies the four limitations discussed above, it is also my opinion that all other limitations of the Challenged Claims enjoy written description at least as far back as the 2009 Parent.

101. *First*, I understand that during examination of the '948 patent application, the Examiner accorded the 2009 Parent priority date to several limitations made before amendments.⁴ Particularly, in its priority date findings, the Examiner determined that the pre-amendment limitations were disclosed in the 2009 Parent. *See* Ex. 1102 at 272-73 (“[T]he claimed invention gets priority date of 05/13/2009 as claimed feature is disclosed in application”).

102. Accordingly, the issue of written description for the pre-amendment limitations has been considered by the Office, and Petitioner does not allege any error, let alone material error, made by the examiner in its priority finding. *See* Pet. at 2-4 (alleging only that amendments made after the examiner’s priority finding lack written description support, asserting no error in the examiner’s priority finding for the pre-amendment limitations).

103. *Second*, it is my opinion that the limitations amended after the examiner’s priority date findings, and which are not identified in Petitioner’s written

⁴ The limitations include Element [1.1], Element [1.2], Element [1.3], Element [1.4], Element [1.5] (also recited in Independent Claims 35 and 36), Claims 2, 4-7, 10-11, 13, 18-19, 23, and 29 (collectively, the “pre-amendment limitations”). *See* Ex. 1102 at 75-85.

description, are also supported by the 2009 Parent. The table reproduced below represents the passages that support these limitations:

Claim Limitations/Claim	2009 Parent Support
Limitation [1.6] (Step B) establishing a user profile to identify user preferences, platform identities, and service support instructions that determine how the secure user-centric information behaves on the at least one user platform.	Paragraph [0034] Transfer icon #1 mobile device 204, transfer icon # 2 television 205, and transfer icon # 3 other device type may each be a hardware device or software application. If a selected channel 202 exists in the application host transfer tool 203, the channel 202 may be moved to a transfer icon through a drag and drop instruction. During a drag and drop function, the channel 202 may be transformed to become available on a selected platform (e.g., a mobile device). During an initial configuration of channels 202, a user profile may be established which may identify user preferences, platform identities, and service support instructions as to how the user wishes information to behave on the selected platform. The selected platform may need to be electronically connectable such as through the Internet, close over-the-air mechanism (e.g., Bluetooth®), or through a wired connection. When the channel 202 appears on the selected platform, it may retain all of its original native functionality from the channel grid framework 201 if it has been configured or programmed to do so. The application host and transfer tool 203 transfer icons 204, 205, 206 may serve as trigger mechanisms, each to activate a channel download to a specific, registered device or platform. The download may be activated by a drag and drop of an application host and transfer tool 203 in which channel 202 application resides onto a transfer icon 204, 205, 206, which, in turn, may send the download request to a remote server application where the appropriate and device or

Claim Limitations/Claim	2009 Parent Support
	platform specific application may be downloaded to the requesting device or platform. Ex. 1106 at ¶ [0034].
Limitation [1.7] (Step C) receiving configuration data indicating one or more user preferences regarding alerts transmitted via the first channel based on the user profile.	Paragraph [0023] The assignment of information priority, event alerts or triggers, and complex actions that can result from the user's interaction with a channel may be built upon and exploited by developers. A development tool or facility may be provided to a developer to create many forms of customization. Triggers may be parameterized against information behavior. Non-limiting examples of triggers may include exceeding a quantified numerical limit and multiple similar events trending in a certain direction. The trigger may cause the information channel to change its appearance or to take other actions that may be implemented by the developer. By way of non-limiting example, one action that may be implemented is to provide a notification to the user. <i>Id.</i> at ¶ [0023]. Paragraph [0039] The channel alert server 211 may be a hardware device or software application that may continually monitor application and information activities defined by a channel. By way of non-limiting example, a user or developer may define threshold conditions with definitive values assigned to events, conditions, logical workflows, discrete information values or signal data. If an established condition is met, the channel alert server 211 may notify the identity management server 208 to confirm the subscriber of the event, determine the active devices of the subscriber, and then pass through the web services gateway 207 and the channel grid framework 201 to provide a

Claim Limitations/Claim	2009 Parent Support
	visual or auditory alert in the channel 202. Likewise, the alert may trigger additional actions affecting the channel 202 and the underlying computer application. For example, a channel may be established to monitor an alarm condition of a business or residence. If a condition at the business or residence triggers an alarm, an additional alert action such as notifying a law enforcement agency or a protective services group may be triggered. The alert can appear as defined on other platforms such as a mobile device, a television (set top box), a Blu-ray player, or other devices. <i>Id.</i> at ¶ [0039].
Limitation [1.8] (Step D) receiving session data indicating a current state of at least one external device of the user.	See Step C, Paragraph 39. Paragraph [0021] Information may be delivered to a user based on the user's identity as established by the system when the user's session is established. Because the user is known and authenticated, preferences and rights to certain information types can be defined and managed for the user. <i>Id.</i> at ¶ [0021].
Limitation [1.9] (Step E) monitoring at least the first channel information so as to determine one or more events, conditions, logical workflows, discrete information values or signal data, based on at least one threshold condition or parameter relating to the first channel	See Step C, Paragraph 39. Claim 9. The computer-readable storage media of claim 8 further comprising computer-readable instructions configured to cause one or more computer processors to execute the operations comprising: configuring the channel grid framework to provide an intelligent alert object; comparing the evaluated content provided by the first computer application to a predetermined intelligent alert threshold condition; and displaying an alert condition on the

Claim Limitations/Claim	2009 Parent Support
information and determined based on the user preferences indicated by the configuration data; and if the one or more events, conditions, logical workflows, discrete information values or signal data is/are determined in E).	first and second platforms when the evaluated content meets the predetermined threshold condition. <i>Id.</i> at Claim 9
Claim 3. The apparatus of claim 1, wherein if the one or more events, conditions, logical workflows, discrete information values or signal data is/are determined in E), the at least one processor controls the at least one memory so as to store trigger information relating to the one or more determined events, conditions, logical workflows, discrete information values or signal data.	See Step C, Paragraph 39.

'948 Patent at Claims 1 and 3; *see also* Pet. at 13-14.

104. *Third*, I understand that Petitioner's obviousness analysis also affirms written description support because Petitioner relies on the PCT Publication's disclosure for these limitations—which is “***substantively identical to the May 2009***

Parent application, containing the same drawings and specification.” Pet. at 32 (emphasis added); *see also id.* at 43 (Element [1.1] (relying on the PCT Publication’s disclosure), 44 (Element [1.2] (same)), 45 (Element [1.3] (same)), 45-46 (Element [1.4] (same)), 47-49 (Element [1.5] A) (same)), 49-50 (Element [1.6] B) (same)), 50 (Element [1.7] C) (same)), 50-52 (Element [1.8] D) (same)), 52-53 (Element [1.9] E) (same)), 58 (Claim 2 (same)), 58-59 (Claim 3 (same)), 59-60 (Claim 4 (same)), 60 (Claim 5 (same)), 60-61 (Claim 6 (same)), 61 (Claim 7 (same)), 61-62 (Claim 10 (same)), 62 (Claim 11 (same)), 62-63 (Claim 13 (same)), 63 (Claim 18 (same)), 64 (Claim 19 (same)), 64 (Claim 23 (same)), 64-65 (Claim 29 (same))).

VIII. CONCLUSION

105. In view of the foregoing, it is my opinion that the 2009 Parent provides written description support for each limitation of the Challenged Claims.

106. I 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 that these statements were made with 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.

Declaration of Michael T. Goodrich, Ph.D.
IPR2024-01433 (U.S. Patent No. 8,751,948)

Executed on June 30, 2025, in Honolulu, Hawaii.



Michael T. Goodrich, Ph.D.

APPENDIX A

CURRICULUM VITAE

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EDUCATION

Ph.D.	1987	<i>Efficient Parallel Techniques for Computational Geometry</i> Computer Science, Purdue Univ. (M.J. Atallah, advisor)
M.S.	1985	Computer Science, Purdue Univ.
B.A.	1983	Mathematics and Computer Science, Calvin Univ.

PROFESSIONAL EXPERIENCE

July '19 to present	Distinguished Professor, Dept. of Computer Science Univ. of California, Irvine
March '10 to present	Technical Director, Center for Algorithms and Theory of Computation Univ. of California, Irvine
April '07 to June '19	Chancellor's Professor, Dept. of Computer Science Univ. of California, Irvine
July '12 to June '13	Chair, Dept. of Computer Science Univ. of California, Irvine
October '06 to June '12	Assoc. Dean for Faculty Dev., Bren School of Info. and Comp. Sci. Univ. of California, Irvine
July '01 to March '07	Professor, Dept. of Computer Science Univ. of California, Irvine
Fall '00	Visiting Professor of Computer Science Brown Univ.
July '96 to June '02	Professor of Computer Science (on leave, from July '01) Johns Hopkins Univ.
July '92 to June '96	Associate Professor of Computer Science Johns Hopkins Univ.
Spring '94	Visiting Associate Professor of Computer Science Univ. of Illinois, Urbana-Champaign
July '87 to June '92	Assistant Professor of Computer Science Johns Hopkins Univ.
Aug. '83 to June '87	Teaching Assistant, Research Assistant Purdue Univ.
Summer '83	Summer intern Argonne National Laboratory

RESEARCH INTERESTS

Algorithm and data structure design
Networking and parallel and distributed computing
Computer security and information assurance and privacy
Machine learning and computer vision
Databases and high-performance data management
Information visualization and graph drawing
Computational geometry and computer graphics

PRIZES, HONORS, AND AWARDS

- *Compere Loveless Fellowship in Computer Sciences*, Purdue Univ., 1985
- *Research Initiation Award*, National Science Foundation, 1988
- *Oraculum Award for Excellence in Teaching*, Johns Hopkins, 1993, 1994, 1995
- *ACM Recognition of Service Award*, 1996
- *Robert B. Pond, Sr. Award for Excellence in Undergraduate Teaching*, Johns Hopkins, 1998
- *Elected Senior Member*, the Institute of Electrical and Electronics Engineers (IEEE), 1999
- *Spirit of Technology Transition Award*, DARPA Dynamic Coalitions Program, 2002
- *Brown Univ. Award for Technological Innovation* (with R. Tamassia, N. Triandopoulos, D. Yao, and D. Ellis), 2006
- *ACM Distinguished Scientist*, 2006
- *Edward J. McCluskey Technical Achievement Award*, IEEE Computer Society, “for outstanding contributions to the design of parallel and distributed algorithms for fundamental combinatorial and geometric problems,” 2006
- *Fulbright Scholar*, for senior specialist service to University of Aarhus, Denmark, 2007
- *Fellow of the San Diego Supercomputer Center*, 2007
- *Fellow of the American Association for the Advancement of Science (AAAS)*, “for distinguished contributions to parallel and distributed algorithms for combinatorial and geometric problems, and excellence in teaching, academic and professional service, and textbook writing,” 2007
- *Named as Chancellor’s Professor*, for “demonstrated unusual academic merit and whose continued promise for scholarly achievement is unusually high,” Univ. of California, Irvine, 2007
- *Fellow of the Institute of Electrical and Electronics Engineers (IEEE)*, “for contributions to parallel and distributed algorithms for combinatorial and geometric problems,” 2009
- *Fellow of the ACM*, “for contributions to data structures and algorithms for combinatorial and geometric problems,” 2009
- *ICS Dean’s Award for Research*, “for contributions in the area of parallel and distributed algorithms,” 2014
- *Chancellor’s Award for Excellence in Fostering Undergraduate Research*, Univ. of California, Irvine, 2016
- *Faculty Mentor of the Month*, Undergraduate Research Opportunities Program (UROP), Univ. of California, Irvine, April 2016
- *Elected as a foreign member*, Royal Danish Academy of Sciences and Letters, April 2018
- *Named as Distinguished Professor*, for achieving “the highest levels of scholarship” over the course of a career and having “earned national and international level distinctions and honors of the highest level,” Univ. of California, Irvine, 2019
- *Recipient, Alejandro López-Ortiz Best Paper Award*, for “Zip-zip Trees: Making Zip Trees More Balanced, Biased, Compact, or Persistent,” 18th Algorithms and Data Structures Symposium, 2023.
- *Recipient, SIGMOD Research Highlight Award*, for “History-Independent Dynamic Partitioning: Operation-Order Privacy in Ordered Data Structures,” 2024. This award recognizes research projects that exemplify core database research and that address an important problem, represent a definitive milestone in solving the problem, and have the potential of significant impact.
- *Distinguished Science Alumni Award*, Purdue University, 2025.

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- O-9. M.T. Goodrich, M. Shin, C.D. Straub, and R. Tamassia, “Distributed Data Authentication (System Demonstration),” *DARPA Information Survivability Conf. and Exposition*, IEEE Press, Volume 2, 58–59, 2003.
- O-10. M.T. Goodrich and R. Tamassia, “Efficient and Scalable Infrastructure Support for Dynamic Coalitions,” *DARPA Information Survivability Conf. and Exposition*, IEEE Press, Volume 2, 246–251, 2003.
- O-11. M.T. Goodrich, “Simulating Parallel Algorithms in the MapReduce Framework with Applications to Parallel Computational Geometry,” Second Workshop on Massive Data Algorithmics (MASSIVE), 2010. Available as *arXiv* preprint, 1004.4708, 2010.
- O-12. D. Eppstein, M.T. Goodrich, and P. Baldi, “Privacy-Enhanced Methods for Comparing Compressed DNA Sequences,” *arXiv* preprint, 1107.3593, 2011.
- O-13. E. Ghosh, M.T. Goodrich, O. Ohrimenko, and R. Tamassia, “Poster: Zero-Knowledge Authenticated Order Queries and Applications,” *IEEE Symp. on Security and Privacy*, 2015. (See also <https://eprint.iacr.org/2015/283>.)
- O-14. F. Bayatbabolghani, M. Blanton, M. Aliasgari, and M.T. Goodrich, “Poster: Secure Computations of Trigonometric and Inverse Trigonometric Functions,” *IEEE Symp. on Security and Privacy*, 2017. (See also <https://fattaneh88.github.io/fbayatba/Proposal-sine-arctangent.pdf>.)
- O-15. F. Bayatbabolghani, M. Blanton, M. Aliasgari, and M.T. Goodrich, “Secure Fingerprint Alignment and Matching Protocols,” *arXiv* preprint, 1702.03379, 2017.
- O-16. M.Z. Liang, M.T. Goodrich, and S. Zhao, “On the Optical Accuracy of the Salvator Mundi,” *arXiv* preprint, 1912.03416, 2019.
- O-17. A. Chiu, M. Ghosh, R. Ahmed, K.-S. Jun, S. Kobourov, and M.T. Goodrich, “Graph Sparsifications using Neural Network Assisted Monte Carlo Tree Search,” *arXiv* preprint, 2311.10316, 2023.

News Releases, Reviews, Interviews, and Media Mentions:

- N-1. H. Masum, "Review of *Data Structures and Algorithms in Java* (2nd ed)," *ACM SIGACT News*, **32**(1), 3–5, 2001.
- N-2. H. Masum, "Book Review: *Algorithm Design: Foundations, Analysis, and Examples*," *ACM SIGACT News*, **35**(2), 14–16, 2004.
- N-3. "Domain Integrity: Brown Licenses Internet ID Verification Technology to Startup Firm," *Brown Univ. News Service*, https://www.brown.edu/Administration/News_Bureau/2005-06/05-031.html, September 20, 2005.
- N-4. "Computer scientist elected to Royal Danish Academy of Sciences & Letters," *UCI News*, <https://news.uci.edu/2018/04/24/uci-computer-scientist-elected-to-royal-danish-academy-of-sciences-letters/>, April 24, 2018.
- N-5. J. Yang, "Invertible Bloom Lookup Table," *CodeChain*, <https://medium.com/codechain/invertible-bloom-lookup-table-37600927cfbe>, May 6, 2018.
- N-6. D. Trapp, "What Are Invertible Bloom Lookup Tables?," *Dash News*, <https://dashnews.org/what-are-invertible-bloom-lookup-tables/>, February 26, 2019.
- N-7. "A virtual version of da Vinci's mystery glass orb has helped explain its weirdness," *MIT Technology Review*, <https://www.technologyreview.com/2020/01/02/102309/a-virtual-version-of-da-vincis-mystery-glass-orb-has-helped-explain-its-weirdness/>, January 2, 2020.
- N-8. C. Kuesel, "Scientists may have solved the mystery behind the glass orb in 'Salvator Mundi,'" *Artsy*, <https://www.artsy.net/article/artsy-editorial-scientists-solved-mystery-glass-orb-salvator-mundi>, January 3, 2020.
- N-9. S. Pappas, "Mystery of Orb in a Record-Breaking Leonardo Da Vinci Painting Deepens," *LiveScience*, <https://www.livescience.com/da-vinci-light-orb-mystery.html>, January 13, 2020.
- N-10. S. Murray, "Computer Scientists Make a Splash in Art World Analyzing the *Salvator Mundi*," *UCI ICS In The News*, https://www.ics.uci.edu/community/news/view_news?id=1706, February 11, 2020.
- N-11. A. Gorale, "Bitcoin in Bloom: How IBLTs Allow Bitcoin to Scale," *CCN*, <https://www.ccn.com/bitcoin-in-bloom-how-iblt-allow-bitcoin-scale/>, March 4, 2021.
- N-12. R. Miller, "Mike Goodrich's New zyVersion: Bringing Interactivity to Algorithm Design and Application Textbook," *zyBooks*, <https://www.zybooks.com/mike-goodrichs-new-zyversion-bringing-interactivity-to-algorithm-design-and-application-textbook/>, October 3, 2022.
- N-13. S. Murray, "ICS Researchers Receive Best Paper Award at Algorithms and Data Structures Symposium," *UCI ICS In The News*, https://www.ics.uci.edu/community/news/view_news?id=2351, July 18, 2023.

PROFESSIONAL SERVICE

Guest Editor:

Int. Journal of Computational Geometry & Applications, **2**(2), 1992
Journal of Computer & System Sciences, **52**(1), 1996
Computational Geometry: Theory and Applications, **12**(1–2), 1999.
Algorithmica, **33**(3), 2002.

Editorial Board Membership:

Computational Geometry: Theory and Applications, 2006–2015
Journal of Computer & System Sciences, 1994–2011
Journal of Graph Algorithms and Applications, 1996–2011

Int. Journal of Computational Geometry & Applications, 1993–2010
Information Processing Letters, 1995–1997

Journal Advisory Board Membership:

Int. Journal of Computational Geometry & Applications, 2010–
Journal of Graph Algorithms and Applications, 2011–

Program Committee Service:

7th ACM Symp. on Computational Geometry (SoCG), 1991
1991 Workshop on Algorithms and Data Structures (WADS)
8th ACM Symp. on Computational Geometry (SoCG), 1992
25th ACM Symp. on Theory of Computing (STOC), 1993
Chair, 26th ACM Symp. on Theory of Computing (STOC), 1994
11th ACM Symp. on Computational Geometry (SoCG), 1995
DAGS '95 Conf. on Electronic Publishing and the Information Superhighway
1996 SIAM Discrete Mathematics Conference
1997 Workshop on Algorithms and Data Structures (WADS)
Int. Symp. on Graph Drawing (GD), 1997
1999 Workshop on Algorithms and Data Structures (WADS)
Co-chair, Workshop on Algorithm Engineering and Experimentation (ALENEX), 1999
Int. Symp. on Graph Drawing (GD), 2000
2000 Workshop on Algorithm Engineering (WAE)
41st IEEE Symp. on Foundations of Computer Science (FOCS), 2000
2001 Workshop on Algorithms and Data Structures (WADS)
Int. Symp. on Graph Drawing (GD), 2001
Workshop on Algorithm Engineering and Experimentation (ALENEX), 2002
18th ACM Symp. on Computational Geometry (SoCG), 2002
13th ACM-SIAM Symp. on Discrete Algorithms (SODA), 2002
Co-Chair, Graph Drawing 2002
Int. Symp. on Graph Drawing (GD), 2003
16th ACM-SIAM Symp. on Discrete Algorithms (SODA), 2005
32nd Int. Colloq. on Automata, Languages and Programming (ICALP), 2005
12th Int. Computing and Combinatorics Conference (COCOON), 2006
13th ACM Conf. on Computer and Communication Security (CCS), 2006
15th European Symp. on Algorithms (ESA), 2007
5th Int. Conference on Applied Cryptography and Network Security (ACNS), 2007
21st IEEE Int. Parallel & Distributed Processing Symp. (IPDPS), 2007
19th ACM Symp. on Parallelism in Algorithms and Architectures (SPAA), 2007
5th Workshop on Algorithms and Models for the Web-Graph (WAW), 2007
7th Int. Workshop on Experimental Algorithms (WEA), 2008
Second Int. Frontiers of Algorithmics Workshop (FAW), 2008
16th ACM SIGSPATIAL Int. Symp. on Adv. in Geographic Information Systems (GIS), 2008
17th ACM SIGSPATIAL Int. Symp. on Adv. in Geographic Information Systems (GIS), 2009
31st IEEE Symp. on Security and Privacy (S&P), 2010
18th Int. Symp. on Graph Drawing (GD), 2010
2011 Workshop on Analytic Algorithmics and Combinatorics (ANALCO)
8th Workshop on Algorithms and Models for the Web Graph (WAW), 2011
19th Int. Symp. on Graph Drawing (GD), 2011
24th ACM Symp. on Parallelism in Algorithms and Architectures (SPAA), 2012
20th European Symp. on Algorithms (ESA), 2012
2013 IEEE Int. Conf. on Big Data (BigData), 2013

30th IEEE Int. Conf. on Data Engineering (ICDE), 2014
 21st ACM Conf. on Computer and Communication Security (CCS), 2014
 Symp. on Algorithms and Data Structures (WADS), 2015
 ACM Cloud Computing Security Workshop (CCSW), 2015
 Int. Symp. on Graph Drawing (GD), 2015
co-chair, 2016 Workshop on Algorithm Engineering and Experiments (ALENEX)
 2016 Workshop on Massive Data Algorithmics (MASSIVE)
 2016 Int. Symp. on Algorithms and Computation (ISAAC)
 29th ACM Symp. on Parallelism in Algorithms and Architectures (SPAA), 2017
 25th ACM SIGSPATIAL Int. Conf. on Adv. in Geographic Information Systems (GIS), 2017
 26th European Symp. on Algorithms (ESA), 2018
 26th ACM SIGSPATIAL Int. Conf. on Adv. in Geographic Information Systems (GIS), 2018
 2nd SIAM Symp. on Simplicity in Algorithms (SOSA), 2019
 ACM SIGSPATIAL Int. Workshop on Spatial Gems, 2019
 2021 SIAM Symp. on Applied Computational & Discrete Algorithms (ACDA)
 2023 SIAM Symp. on Algorithm Engineering and Experimentation (ALENEX)
 35th ACM Symp. on Parallelism in Algorithms and Architectures (SPAA), 2023
 7th SIAM Symp. on Simplicity in Algorithms (SOSA), 2024
 37th ACM Symp. on Parallelism in Algorithms and Architectures (SPAA), 2025

Conference/Workshop Committee Service:

Conference chair, 12th ACM Symp. on Computational Geometry, 1996
 Organizer, 1st CGC Workshop on Computational Geometry, 1996
 Co-chair, 1999 Dagstuhl Workshop on Computational Geometry, 1999
 Conference chair, Graph Drawing, 2002
 Co-organizer, Hawaiian Workshop on Parallel Algorithms, 2017, 2019
 Member, Symp. on Theory of Computing (STOC) Test of Time Award Committee, 2024

Steering Committee and Executive Committee Service:

Member at large, ACM SIG on Algorithms & Comp. Theory (SIGACT) Exec. Comm., 1993–97
 Member, Exec. comm. for 1996 Federated Computing Research Conference (FCRC)
 co-Founder and member, Steering Comm. for Workshop on Algorithm Engineering
 and Experimentation (ALENEX), 1999–2017 (chair, 2014–16)
 co-Chair, Steering Comm. for ACM Symp. on Computational Geometry, 1999–2001
 Member, Steering Comm. for Graph Drawing Conference, 2000–03, 2014–16
 Conference Chair, ACM SIG on Algorithms & Comp. Theory (SIGACT), 2005–09

Center and Institute Affiliations:

Algorithms, Combinatorics and Optimization Center, UCI
 Center for Algorithms and Theory of Computation, UCI
 Center for Embedded and Cyber-physical Systems, UCI
 Center for Machine Learning and Intelligent Systems, UCI
 The Institute for Virtual Environments and Computer Games (IVECG), UCI
 Secure Computing & Networking Center, UCI

Postdoctoral Fellows:

1. Timothy Chan, Johns Hopkins, 1996. (Now at Univ. of Illinois)
2. Gill Barequet, Johns Hopkins, 1996-98. (Now at Technion)
3. Pawel Gajer, Johns Hopkins, 2000. (Now at Univ. of Maryland)
4. Amitabh Chaudhary, UC-Irvine, 2002-2004. (Now at U. Chicago)
5. Amitabha Bagchi, UC-Irvine, 2002-2004. (Now at IIT-Dehli)

6. Martin Nöllenburg, UC-Irvine, 2010, mentored jointly with David Eppstein. (Now at TU Wien)
7. Maarten Löffler, UC-Irvine, 2010-2011, mentored jointly with David Eppstein. (Now at Utrecht University)
8. Md. Jawaherul Alam, UC-Irvine, 2015-16. (Now at Amazon)
9. Giordano Da Lozzo, UC-Irvine, 2016-2017, mentored jointly with David Eppstein. (Now at "Roma Tre" University)

Ph.D. Students:

1. Mujtaba Ghouse, "Randomized Parallel Computational Geometry in Theory and Practice," Johns Hopkins Univ., May 1993.
2. Paul Tanenbaum, "On Geometric Representations of Partially Ordered Sets," Johns Hopkins Univ., May 1995 (co-advised with Edward Scheinerman).
3. Mark Orletsky, "Practical Methods for Geometric Searching Problems with Experimental Validation," Johns Hopkins Univ., May 1996.
4. Kumar Ramaiyer, "Geometric Data Structures and Applications," Johns Hopkins Univ., Aug. 1996.
5. Christian Duncan, "Balanced Aspect Ratio Trees," Johns Hopkins Univ., Aug. 1999.
6. Christopher Wagner, "Graph Visualization and Network Routing," Johns Hopkins Univ., Oct. 1999 (co-advised with Prof. Lenore Cowen).
7. Stephen Kobourov, "Algorithms for Drawing Large Graphs," Johns Hopkins Univ., May 2000.
8. Amitabha Bagchi, "Efficient Strategies for Topics in Internet Algorithmics," Johns Hopkins Univ., Oct. 2002.
9. Amitabh Chaudhary, "Applied Spatial Data Structures for Large Data Sets," Johns Hopkins Univ., Oct. 2002.
10. Breno De Medeiros, "New Cryptographic Primitives with Applications to Information Privacy and Corporate Confidentiality," Johns Hopkins Univ., May 2004 (co-advised with Giuseppe Ateniese).
11. "Jeremy" Yu Meng, "Confluent Graph Drawing," UC-Irvine, June 2006.
12. Jonathan Zheng Sun, "Algorithms for Hierarchical Structures, with Applications to Security and Geometry," UC-Irvine, Aug. 2006.
13. Nodari Sitchinava, "Parallel External Memory Model—A Parallel Model for Multi-core Architectures," UC-Irvine, Sep. 2009.
14. Darren Strash, "Algorithms for Sparse Geometric Graphs and Social Networks," UC-Irvine, May 2011 (co-advised with David Eppstein).
15. Lowell Trott, "Geometric Algorithms for Social Network Analysis," UC-Irvine, May 2013.
16. Joseph Simons, "New Dynamics in Geometric Data Structures," UC-Irvine, May 2014.
17. Pawel Pszona, "Practical Algorithms for Sparse Graphs," UC-Irvine, May 2014.
18. William E. Devanny, "An Assortment of Sorts: Three Modern Variations on the Classic Sorting Problem," UC-Irvine, July 2017 (co-advised with David Eppstein).
19. Siddharth Gupta, "Topological Algorithms for Geographic and Geometric Graphs," UC-Irvine, Aug. 2018 (co-advised with David Eppstein).
20. Timothy Johnson, "Graph Drawing Representations and Metrics with Applications," UC-Irvine, Aug. 2018.
21. Juan Besa, "Optimization Problems in Directed Graph Visualization," UC-Irvine, Aug. 2019.

22. Nil Mamano Grande, “New Applications of the Nearest-Neighbor Chain Algorithm,” UC-Irvine, Sep. 2019 (co-advised with David Eppstein).
23. Pedro Matias, “Exact Learning of Sequences from Queries and Trackers,” UC-Irvine, May 2021
24. Martha Osegueda, “Constructing, Counting and Matching Combinatorial and Geometric Shapes,” UC-Irvine, May 2022
25. Ramtin Afshar, “Exact Learning of Graphs Using Queries,” UC-Irvine, Feb. 2023
26. Evrim Ozel, “Efficient Algorithms for Road Networks and Noisy Sorting: an Experimental and Theoretical Perspective,” UC-Irvine, May 2024

Ph.D. Committee Service:

John Augustine	UC-Irvine	Advancement to candidacy, September 2003
Nikos Triandopoulos	Brown U.	Thesis prelim., February 2004
Einar Mykletun	UC-Irvine	Advancement to candidacy, March 2004
Kartic Subr	UC-Irvine	Advancement to candidacy, September 2004
S. Joshua Swamidass	UC-Irvine	Advancement to candidacy, April 2005
Jeong Hyun Yi	UC-Irvine	Thesis defense, August, 2005
Nodari Sitchinava	UC-Irvine	Advancement to candidacy, chair, December 2005
John Augustine	UC-Irvine	Thesis defense, July 2006
Maithili Narasimha	UC-Irvine	Thesis defense, August, 2006
Josiah Carlson	UC-Irvine	Advancement to candidacy, August 2006
Xiaomin Liu	UC-Irvine	Advancement to candidacy, September 2006
Gabor Madl	UC-Irvine	Advancement to candidacy, September 2006
Nikos Triandopoulos	Brown U.	Thesis defense, September 2006
Rabia Nuray-Turan	UC-Irvine	Advancement to candidacy, May 2007
S. Joshua Swamidass	UC-Irvine	Thesis defense, June 2007
Michael Sirivianos	UC-Irvine	Advancement to candidacy, June 2007
Kevin Wortman	UC-Irvine	Advancement to candidacy, August 2007
Di Ma	UC-Irvine	Advancement to candidacy, December 2007
Josiah Carlson	UC-Irvine	Thesis defense, December 2007
Michael Nelson	UC-Irvine	Advancement to candidacy, chair, March 2008
Minas Gjoka	UC-Irvine	Advancement to candidacy, June 2008
Sara Javanmardi	UC-Irvine	Advancement to candidacy, June 2008
Ali Zandi	UC-Irvine	Advancement to candidacy, September 2008
Jihye Kim	UC-Irvine	Thesis defense, September 2008
Darren Strash	UC-Irvine	Advancement to candidacy, December 2008
Kevin Wortman	UC-Irvine	Topic defense, January 2009
Nodari Sitchinava	UC-Irvine	Topic defense, chair, June 2009
Fabio Soldo	UC-Irvine	Advancement to candidacy, July 2009
Emil De Cristofaro	UC-Irvine	Advancement to candidacy, July 2009
Di Ma	UC-Irvine	Thesis defense, August 2009
Yanbin Lu	UC-Irvine	Advancement to candidacy, December 2009
Anh Le	UC-Irvine	Advancement to candidacy, April 2010
Lowell Trott	UC-Irvine	Advancement to candidacy, June 2010
Xiaomin Liu	UC-Irvine	Thesis defense, August 2010
Josh Olsen	UC-Irvine	Advancement to candidacy, September 2010
Yasser Altowim	UC-Irvine	Advancement to candidacy, December 2010
Angela Wong	UC-Irvine	Advancement to candidacy, May 2011

Joshua Hill	UC-Irvine	Advancement to candidacy, September 2011
Alex Abatzoglou	UC-Irvine	Advancement to candidacy, September 2011
Michael Wolfe	UC-Irvine	Masters Thesis defense, October 2011
Olya Ohrimenko	Brown Univ.	PhD Thesis proposal, October 2011
Yanbin Lu	UC-Irvine	PhD Thesis defense, November 2011
Chun Meng	UC-Irvine	Advancement to candidacy, December 2011
Abinesh Ramakrishnan	UC-Irvine	Advancement to candidacy, March 2012
Pegah Sattari	UC-Irvine	PhD Thesis defense, April 2012
Michael Bannister	UC-Irvine	PhD Thesis defense, May 2015
Yingyi Bu	UC-Irvine	PhD Thesis defense, August 2015
Jenny Lam	UC-Irvine	PhD Thesis defense, November 2015
Timothy Johnson	UC-Irvine	Advancement to candidacy, chair, June 2016
Jiayu Xu	UC-Irvine	Advancement to candidacy, November 2016
Sky Faber	UC-Irvine	PhD Thesis defense, November 2016
Juan Jose Besa Vial	UC-Irvine	Advancement to candidacy, chair, March 2017
William Devanny	UC-Irvine	PhD Thesis defense, co-chair, July 2017
Ingo van Duijn	Aarhus Univ.	PhD Thesis defense, September 2017
Siddharth Gupta	UC-Irvine	Advancement to candidacy, January 2018
Boyang Wei	UC-Irvine	PhD Thesis defense, August 2018
Timothy Johnson	UC-Irvine	PhD Thesis defense, chair, August 2018
Siddharth Gupta	UC-Irvine	PhD Thesis defense, August 2018
Pedro Matias	UC-Irvine	Advancement to candidacy, chair, May 2019
Juan Jose Besa Vial	UC-Irvine	PhD Thesis defense, chair, August 2019
Sameera Chayyur	UC-Irvine	Advancement to candidacy, September 2019
Nil Mamano Grande	UC-Irvine	PhD Thesis defense, co-chair, September 2019
Yihan Sun	CMU	PhD Thesis defense, October 2019
Martha Osegueda	UC-Irvine	Advancement to candidacy, chair, June 2020
Tatiana Bradley	UC-Irvine	PhD Thesis defense, December 2020
Julius Ceasar Aguma	UC-Irvine	Advancement to candidacy, December 2020
Ramtin Afshar	UC-Irvine	Advancement to candidacy, chair, March 2021
Pedro Matias	UC-Irvine	PhD Thesis defense, chair, May 2021
Elham Havvaei	UC-Irvine	PhD Thesis defense, May 2021
Daniel Frishberg	UC-Irvine	Advancement to candidacy, May 2021
Hadi Khodabandeh	UC-Irvine	Advancement to candidacy, July 2021
Sameera Ghayyur	UC-Irvine	PhD topic defense, February 2022
Evrin Ozel	UC-Irvine	Advancement to candidacy, chair, May 2022
Rohith Gangam	UC-Irvine	Advancement to candidacy, May 2022
Martha Osegueda	UC-Irvine	PhD Thesis defense, chair, May 2022
Yanqi Gu	UC-Irvine	Advancement to candidacy, June 2022
Sameera Ghayyur	UC-Irvine	PhD Thesis defense, August 2022
Rasmus K. Petersen	Aarhus Univ.	PhD Thesis defense, Sept. 2022
Zihan Yu	UC-Irvine	Advancement to candidacy, Nov. 2022
Ramtin Afshar	UC-Irvine	PhD Thesis defense, chair, Feb. 2023
Shanshan Han	UC-Irvine	Advancement to candidacy, Feb. 2023
Zhanhang (Marco) Liang	UC-Irvine	Advancement to candidacy, Mar. 2023
Shion Fukuzawa	UC-Irvine	Advancement to candidacy, co-chair, Mar. 2023
Ryuto Kitagawa	UC-Irvine	Advancement to candidacy, chair, May 2024
Ofek Gila	UC-Irvine	Advancement to candidacy, chair, May 2024

Po-Chu Hsu	UC-Irvine	Advancement to candidacy, May 2024
Yanqi Gu	UC-Irvine	PhD Thesis defense, May 2024
Evrin Ozel	UC-Irvine	PhD Thesis defense, chair, May 2024
Hadi Khodabandeh	UC-Irvine	PhD Thesis defense, June 2024
Alfred (Songyu) Liu	UC-Irvine	Advancement to candidacy, chair, Nov. 2024
Parnian Shahkar	UC-Irvine	Advancement to candidacy, Nov. 2024
Stelios Stavroukakis	UC-Irvine	Advancement to candidacy, Nov. 2024
Zhiqian Zhou	UC-Irvine	Advancement to candidacy, Feb. 2025
Apurva Rai	UC-Irvine	Advancement to candidacy, Mar. 2025
Phillip Nazarian	UC-Irvine	Advancement to candidacy, June 2025

University Service:

Ph.D. Requirements Committee, Dept. of Computer Science, chair: 1987–89
Graduate Admissions Committee, Dept. of Computer Science, 1991–1993 (chair: 1992)
Faculty Recruiting Committee, Dept. of Computer Science, 1993,95,96 (chair: 1996)
Steering Committee, Whiting School of Engineering, 1990–93 (chair, 1993)
Johns Hopkins Homewood Academic Computing Oversight Committee, 1990–93
Curriculum Committee, Whiting School of Engineering, 1994–96
Strategic Planning Committee, Whiting School of Engineering, 1999–00
Graduate Policy Committee, UCI Dept. of Information & Computer Science (ICS), 2001–02
Faculty Search Committee in Cryptography, UCI Dept. of ICS, 2001–03
School of Info. and Computer Science Executive Committee, 2002–04
UCI Committee on Educational Policy (CEP), 2002–03, 2004–06
UCI Change of Major Criteria Committee, 2002–03
UCI CEP Policy Subcommittee, 2002–2003
Distinguished Faculty Search Committee, Bren School of ICS, 2004–11 (chair, 2007–08)
Equity Advisor, Bren School of ICS, 2005–09
Dean’s Advisory Council, Bren School of ICS, 2007–13
Associate Dean for Faculty Development, Bren School of ICS, 2006–12
Chair, Department of Computer Science, Bren School of ICS, 2012–13
Master of Computer Science Development Committee, Bren School of ICS, 2013–16
Stragic Planning Committee, Dept. of Computer Science, Bren School of ICS, 2015–16
Executive Committee, Bren School of ICS, 2017–18
UC-Irvine Senate Committee on Scholarly Honors & Awards, 2017–20
UC-Irvine Special Research Program Review Committee for CalIT2, 2018–19
UC-Irvine Year of Scholarly Values Advisory Committee, 2024–
Master of Computer Science Steering/Admissions Comm., Bren School of ICS, 2016–22, 2024–

Courses Taught and Developed:

Advanced Parallel Computing (developed and taught at Johns Hopkins)
Cyber-Puzzlers (designed and taught at UCI)
Computer Literacy (taught at Purdue, developed at Johns Hopkins)
Computer Programming for Scientists and Engineers (taught at Purdue)
Computer Security Algorithms (developed and taught at UCI)
Computational Models (revised and taught at Johns Hopkins)
Computational Geometry (revised and taught at Johns Hopkins and UCI)
Compiler Theory and Design (revised and taught at Johns Hopkins)
Computer Graphics (taught at Johns Hopkins)
Cyber-Fraud Detection and Prevention (designed and taught at UCI)

Data Structures (revised and taught at Johns Hopkins and UCI)
 Graph Algorithms (revised and taught at UCI)
 Formal Languages and Automata Theory (revised and taught at UCI)
 Fundamentals of Algorithms with Applications (revised and taught at UCI)
 Introduction to Algorithms (developed and taught at Johns Hopkins and UCI)
 Internet Algorithmics (developed and taught at Johns Hopkins, Brown, and UCI)
 Design and Analysis of Algorithms (revised and taught at Johns Hopkins and UCI)
 Parallel Algorithms (developed and taught at Johns Hopkins and Univ. of Illinois)
 Project in Algorithms and Data Structures (revised and taught at UCI)
 Text Processing and Pattern Matching (developed and taught at UCI)

Consulting:

Army Research Laboratory, Fort Belvoir, 1995
 Battelle Research Triangle, Columbus Division, 1996
 AT&T, 1998
 Univ. of Miami, 1999
 Algomagic Technologies, Inc., 2000–2005
 Brown University, 2000–2007
 Purdue University, 2002
 APAC Security, Inc., 2005
 Walt Disney Animation Studios, 2009
 Technical expert and expert witness, 2012–
 3M, 2015

GRANTS AND CONTRACTS

1. PI, “Research Initiation Award: Parallel and Sequential Computational Geometry,” National Science Foundation (NSF Grant CCR-8810568), \$32,914, 1988–90.
2. co-PI, “Paradigms for Parallel Algorithm Design,” NSF and DARPA (as NSF Grant CCR-8908092), \$523,837, 1989–93 (with S.R. Kosaraju (PI), S. Kasif, and G. Sullivan).
3. PI, “Parallel Computation and Computational Geometry,” NSF (Grant CCR-9003299), \$67,436, 1990–93.
4. co-PI, “A Facility for Experimental Validation,” NSF (Grant CDA-9015667), \$1,476,147, 1991–96 (with G. Masson (PI), J. Johnstone, S. Kasif, S.R. Kosaraju, S. Salzberg, S. Smith, G. Sullivan, L. Wolff, and A. Zwarico).
5. PI, “Parallel Network Algorithms for Cell Suppression,” The Bureau of the Census (JSA 91-23), \$14,998 1991–92.
6. PI, “A Geometric Framework for the Exploration & Analysis of Astrophysical Data,” NSF (Grant IRI-9116843), \$535,553, 1991–96 (with S. Salzberg and H. Ford (from Physics and Astronomy Dept.)).
7. PI, “Research Experiences for Undergraduates supplement to IRI-9116843,” NSF, \$4,000, 1993–94 (with S. Salzberg and H. Ford).
8. PI, “Constructing, Maintaining, and Searching Geometric Structures,” NSF (Grant CCR-9300079), \$134,976, 1993–96.
9. co-PI, “Robust and Applicable Geometric Computing,” Army Research Office (ARO MURI Grant DAAH04-96-1-0013), \$4,500,000, 1996–2000 (with F. Preparata (PI, Brown U.), R. Tamassia (Brown U.), S. Rao Kosaraju, J. Vitter (Duke U.), and P. Agarwal (Duke U.)). Subaward size: \$1,466,640.

10. PI, "Application-Motivated Geometric Algorithm Design," NSF (Grant CCR-9625289), \$107,389, 1996-98.
11. co-PI, "vBNS Connectivity for the Johns Hopkins University," NSF, \$350,000, 1997-99 (with T.O. Poehler (PI), D.J. Binko, J.G. Neal, and A.S. Szalay).
12. co-PI, "Product Donation, Technology for Education Program," Intel Corporation, \$480,071, 1997-2001 (with T.O. Poehler (PI), J.H. Anderson, A.S. Szalay, and M. Robbins).
13. co-PI, "A Networked Computing Environment for the Manipulation & Visualization of Geometric Data" (Research Infrastructure), NSF, \$1,638,785, 1997-2003 (with L.B. Wolff (PI), Y. Amir, S.R. Kosaraju, S. Kumar, R. Tamassia (Brown U.), R.H. Taylor, and D. Yarowsky).
14. PI, "Geometric Algorithm Design and Implementation," NSF, Grant CCR-9732300, \$224,982, 1998-2002.
15. PI, "Certification Management Infrastructure – Certificate Revocation," \$52,023, 1998, NSA LUCITE grant.
16. PI, "Software Engineering Data Loading, Analysis, and Reporting," \$41,614, 1998, NSA LUCITE grant.
17. PI, "Establishing a LUCITE Collaboration Environment," \$10,018, 1998, NSA LUCITE grant.
18. PI, "In Support of a Secure Multilingual Collaborative Computing Environment," \$51,471, 1999-2000, NSA LUCITE grant.
19. PI, "Accessing Large Distributed Archives in Astronomy and Particle Physics," \$199,981. subcontract to UCI from Johns Hopkins Univ. on NSF Grant PHY-9980044 (total budget, \$2,500,000), 1999-2004.
20. PI, "Efficient and Scalable Infrastructure Support for Dynamic Coalitions," \$1,495,000, DARPA Grant F30602-00-2-0509, 2000-2003 (with Robert Cohen and Roberto Tamassia), including \$227,893 subaward to UCI (with Gene Tsudik).
21. PI, "Graph Visualization and Geometric Algorithm Design," \$400,000, NSF Grant CCR-0098068, 2001-2004 (with Roberto Tamassia).
22. PI, "Collaborative Research: Teaching Data Structures to the Millennium Generation," \$125,00, NSF Grant DUE-0231467, 2003-2005.
23. PI, "Collaborative Research: An Algorithmic Approach to Cyber-Security," \$100,000, NSF Grant CCR-0311720, 2003-2006.
24. PI, "The OptIPuter," \$900,000, subcontract from UCSD on NSF ITR grant CCR-0225642 (total budget, \$13.5 million), 2002-2007 (with Padhraic Smyth and Kane Kim).
25. PI, "ITR: Algorithms for the Technology of Trust," \$300,000, NSF Grant CCR-0312760, 2003-2009.
26. co-PI, "SDCI Data New: Trust Management for Open Collaborative Information Repositories: The CalSWIM Cyberinfrastructure," NSF grant OCI-0724806, \$1,103,590, 2007-2012.
27. co-PI, "Support for Machine Learning Techniques for Cyber-Fraud Detection," Experian Corporation, \$200,000 gift, 2008.
28. PI, "IPS: Collaborative Research: Privacy Management, Measurement, and Visualization in Distributed Environments," NSF Grant IIS-0713046, \$224,851, 2007-2009.
29. PI, "Collaborative Research: Algorithms for Graphs on Surfaces," \$400,000, NSF Grant CCR-0830403, 2008-2011.
30. PI, "ROA Supplement: IPS: Collaborative Research: Privacy Management, Measurement, and Visualization in Distributed Environments," NSF Grant IIS-0847968, \$25,000, 2008-2009.

31. co-investigator, “Scalable Methods for the Analysis of Network-Based Data,” Office of Naval Research: Multidisciplinary University Research Initiative (MURI) Award, number N00014-08-1-1015, \$529,152, 2008–2014.
32. PI, “EAGER: Usable Location Privacy for Mobile Devices,” NSF Grant 0953071, \$300,000, 2009–2011.
33. PI, “TC:Large:Collaborative Research: Towards Trustworthy Interactions in the Cloud,” NSF Grant 1011840, \$500,000, 2010–2015.
34. PI, “TWC: Medium: Collaborative: Privacy-Preserving Distributed Storage and Computation,” NSF Grant 1228639, \$390,738, 2012–2018.
35. PI, “Support for Research on Geometric Motion Planning,” 3M Corporation, \$40,000 gift, 2014.
36. PI, “A4V: Automated Analysis of Algorithm Attack Vulnerabilities,” subcontract 10036982-UCI from University of Utah for DARPA agreement no. AFRL FA8750-15-2-0092, \$980,000, 2015–2019.
37. PI, “TWC: Small: Collaborative: Practical Security Protocols via Advanced Data Structures,” NSF Grant 1526631, \$166,638, 2015–2018.
38. PI, “NSF-BSF: AF: Small: Geometric Realizations and Evolving Data,” NSF Grant 1815073, \$474,392, 2018–2022.
39. PI, “Collaborative Research: AF: Medium: Algorithms for Geometric Graphs,” NSF Grant 2212129, \$799,800, 2022–2026.

SELECTED INVITED TALKS

- “Probabilistic Packet Marking for Large-Scale IP Traceback,” Purdue Univ., 2003
- “Algorithms for Data Authentication,” Harvey Mudd College, 2003
- “Efficient Tree-Based Revocation in Groups of Low-State Devices,” Univ. of Arizona, 2004
- “Leap-Frog Packet Linking and Diverse Key Distributions for Improved Integrity in Network Broadcasts,” Southern California Security and Cryptography Workshop, 2005
- “Is Your Business Privacy Protected?,” NEXT Connections, 2005
- “Distributed Peer-to-peer Data Structures,” Harvard Univ., 2006
- “Balancing Life with an Academic Research Career,” Grace Hopper Conference, 2006
- “Computer Security in the Large,” Univ. Texas, San Antonio, 2006
- “Inspirations in Parallelism and Computational Geometry,” Brown Univ., 2006
- “Efficiency and Security Issues for Distributed Data Structures,” Computer Science Distinguished Lecture Series, Johns Hopkins Univ., 2006
- “Efficiency and Security Issues for Distributed Data Structures,” UCLA, 2006
- “Efficiency and Security Issues for Distributed Data Structures,” Edison Distinguished Lecturer Series, Univ. of Notre Dame, 2006
- “Efficiency and Security Issues for Distributed Data Structures,” Computer Science Distinguished Lecturer Series, Texas A & M Univ., 2006
- “Algorithms for Secure Computing and Searching with Applications to Medical Informatics,” Purdue Univ., 2006
- “Blood on the Computer: How Algorithms for Testing Blood Samples can be Used for DNA Sequencing, Wireless Broadcasting, and Network Security,” Univ. of Southern California, 2007
- “Blood on the Computer: How Algorithms for Testing Blood Samples can be Used for DNA Sequencing, Wireless Broadcasting, and Network Security,” Univ. California, San Diego, 2007

- “Blood on the Computer: How Algorithms for Testing Blood Samples can be Used for DNA Sequencing, Wireless Broadcasting, and Network Security,” Univ. Minnesota, 2007
- “Blood on the Database: How Algorithms for Testing Blood Samples can be Used for Database Integrity,” Invited Keynote, 21st Annual IFIP WG 11.3 Working Conference on Data and Applications Security (DBSec), 2007
- “Space-Efficient Straggler Identification,” ALCOM Seminar, Univ. of Aarhus, 2007
- “Blood on the Computer: How Algorithms for Testing Blood Samples can be used in Modern Applications,” ALCOM Seminar, Univ. of Aarhus, 2007
- “Studying Road Networks Through an Algorithmic Lens,” ALCOM Seminar, Univ. of Aarhus, 2008
- “Studying Geometric Graph Properties of Road Networks Through an Algorithmic Lens,” Int. Workshop on Computing: from Theory to Practice, 2009
- “Randomized Shellsort: A Simple Oblivious Sorting Algorithm,” Distinguished Lecture Series, Department of Computer Science, Brown University, 2009
- “Simulating Parallel Algorithms in the MapReduce Framework with Applications to Parallel Computational Geometry,” MASSIVE 2010
- “Data Cloning Attacks for Nearest-Neighbor Searching based on Retroactive Data Structures,” Department of Computer Science, UCSB, 2011
- “Turning Privacy Leaks into Floods: Surreptitious Discovery of Social Network Friendships and Other Sensitive Binary Attribute Vectors,” Department of Computer Science Distinguished Lecturer Series, Univ. of Illinois, Chicago, 2011
- “Turning Privacy Leaks into Floods: Surreptitious Discovery of Social Network Friendships and Other Sensitive Binary Attribute Vectors,” Department of Computer Science, Purdue Univ., 2011
- “Spin-the-bottle Sort and Annealing Sort: Oblivious Sorting via Round-robin Random Comparisons,” Department of Computer Science, Brown Univ., 2012
- “Using Data-Oblivious Algorithms for Private Cloud Storage Access,” Qatar University, 2013
- “Using Data-Oblivious Algorithms for Private Cloud Storage Access,” Department of Computer Science and Engineering Distinguished Speaker Series, University of Buffalo, 2013
- “Force-Directed Graph Drawing Using Social Gravity and Scaling,” invited talk, ICERM Workshop on Stochastic Graph Models, Providence, RI, 2014
- “Invertible Bloom Lookup Tables and Their Applications in Large-Scale Data Analysis,” invited key-note speaker, Algorithms for Big Data, Frankfurt, Germany, 2014
- “Invertible Bloom Lookup Tables and Their Applications in Large-Scale Data Analysis,” Brown University, Providence, RI, 2014
- “Studying Road Networks Through an Algorithmic Lens,” Bold Aspirations Visitor and Lecture, University of Kansas, 2015
- “Learning Character Strings via Mastermind Queries, with Case Studies,” Invited Lecture, Workshop on Pattern Matching, Data Structures and Compression, Bar-Ilan University, Tel Aviv, Israel, 2016
- “Invertible Bloom Lookup Tables and Their Applications in Data Analysis,” University of Hawaii, 2016
- “Invertible Bloom Lookup Tables,” Purdue University, 2016
- “Combinatorial Pair Testing: Distinguishing Workers from Slackers,” Calvin Univ., 2016
- “Invertible Bloom Lookup Tables,” University of California, Riverside, 2016

- “2-3 Cuckoo Filters for Faster Triangle Listing and Set Intersection,” Technion, Israel Institute of Technology, Haifa, Israel, 2017
- “2-3 Cuckoo Filters for Faster Triangle Listing and Set Intersection,” University of Arizona, 2017
- “Parallel Computational Geometry,” First Hawaii Workshop on Parallel Algorithms and Data Structures, University of Hawaii, 2017
- “Fighting Gerrymandering with Algorithmic Fairness,” Calvin University, 2019
- “Fighting Gerrymandering with Algorithmic Fairness,” Carnegie Mellon University, 2019
- “Sorting Evolving Data in Parallel,” Second Hawaii Workshop on Parallel Algorithms and Data Structures, University of Hawaii, 2019
- “Dealing with Big Data via External Memory Algorithms and Data Structures,” Aarhus University, Denmark, 2021
- “Dealing with Big Data via External Memory Algorithms and Data Structures,” Royal Danish Academy of Sciences and Letters, 2021
- “Augmenting Networks for Greedy Routing,” Dept. of Electrical and Computer Engineering, Distinguished Lecturer Series, Iowa State University, 2023
- “Augmenting Networks for Greedy Routing,” Dept. of Computer Science, University of California, Riverside, 2024
- “Exact Matching Algorithms,” Dept. of Computer Science, University of Hawaii, 2024
- “When Algorithms and Architectures Meet,” Dept. of Computer Science, Purdue University, 2025
- “Computational Geometry with Probabilistically Noisy Primitive Errors,” Schloss Dagstuhl – Leibniz Center for Informatics, Germany, 2025

**TECHNICAL EXPERT CONSULTING SUMMARY
(LAST FIVE YEARS)**

Michael T. Goodrich, PhD



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TECHNICAL EXPERT CONSULTING

The following is a listing of prior and current expert consulting since 2019, where I have testified as an expert, but it may not include confidential information, as per written agreements.

1. Apr. 2016 to Sep. 2024, Technical expert and deponent, retained through Kramer Levin LLP on behalf of Acceleration Bay LLC, in IPR proceedings and patent litigation, Acceleration Bay LLC v. Activision Bizzard, Inc., Electronic Arts Inc., Take-Two Interactive Software, Inc., Rockstar Games, Inc., and 2K Sports, Inc. Civil Actions No. 1:16-cv-00453-RGA, No. 1:16-cv-00454-RGA, No. 1:16-cv-00455-RGA (D. Del.), IPR2015-01951, IPR2015-01953, IPR2015-01964, IPR2015-01970, IPR2015-01972, IPR2015-01996, IPR2016-00724, and IPR2016-00747 (PTAB).
2. May 2016 to Apr. 2023, Technical expert and deponent, retained through Kramer Levin LLP (transferred to Fish & Richardson) on behalf of Finjan, Inc., in PTO proceedings and patent litigations, Finjan, Inc. v. Blue Coat, Finjan, Inc. v. ESET, LLC, Finjan, Inc. v. Juniper Networks, Inc., Finjan, Inc. v. Cisco Systems, Inc., Finjan, Inc. v. Qualys, Inc., Finjan, Inc. v. Rapid7, Inc., and Finjan, Inc. v. SonicWall, Inc., IPR2015-01974, IPR2015-01979, IPR2016-00478, IPR2016-00159 (PTAB), 5:15-cv-03295-BLF-PSG (N.D. Cal.), 3:17-cv-05659-WHA (N.D. Cal.), 3:17-cv-0183-CAB-BGS (S.D. Cal.), 17-cv-0072-BLF-SVK (N.D. Cal.), 4:18-cv-07229-YGR (N.D. Cal.), 1:18cv-01519-MN (Del.), and 5:17-cv-04467-BLF (N.D. Cal.).
3. Jan. 2017 to Jan. 2021, Technical expert and deponent, retained by Fitzpatrick, Cella, Harper & Scinto, Venable LLP, on behalf of Koninklijke Philips N.V. and U.S. Philips Corp., in patent litigation, Philips v. Acer Inc., ASUSTeK Computer, Double Power Tech., HTC, Southern Telecom, Visual Land, Zowee Marketing Co., Ltd., Shenzhen Zowee Technology Co., Ltd., YiFang USA, Inc. d/b/a EFun, Inc., and Intervenor/Counterclaim Defendant Microsoft Corporation. Civil Actions No. 15-1125-GMS, No. 15-1126-GMS, No. 15-1127-GMS, No. 15-1128-GMS, No. 15-1130-GMS, No. 15-1131-GMS, No. 15-1170-GMS (D. Del.), and 4:18-cv-01885-HSG (N.D. Cal., Oakland Div.).
4. Jun. 2018 to present, Technical expert, declarant, deponent, and testifying trial expert witness, retained through Kramer Levin LLP on behalf of Centripetal Networks, Inc., in IPRs

- and patent litigation, Centripetal Networks, Inc. v. Keysight Technologies, Inc., Ixia, and Cisco. Civil Actions No. 2:17-cv-00383/HCM-LRL and 2:18-cv-00094-HCM-LRL (E.D. Virginia), 2:22-cv-00002 (E.D. Virginia), IPR2018-01386, IPR2018-01443, IPR2018-01444, IPR2018-01512, IPR2018-01513, IPR2022-01525, IPR2023-00445, IPR2023-00446, IPR2023-00448 (PTAB), and Inv. No. 337-TA-1314 (ITC).
5. Feb. 2019 to present, Technical expert, declarant, deponent, and testifying trial expert witness, retained through Reichman Jorgensen LLP on behalf of Kove IO, Inc., in patent litigation, Kove IO, Inc. v. Amazon Web Services, Inc., Civil Action No. 1:18-cv-08175 (N.D. Illinois, Eastern Div.).
 6. Apr. 2019 to Sep. 2020, Technical expert, declarant, and deponent, retained by McKool Smith on behalf of SEVEN Networks LLC in patent litigation, SEVEN Networks LLC v. Apple, Inc. Civil Action No. 2:19-cv-115 (E.D. Texas).
 7. Jun. 2019 to Jun. 2023, Technical expert, declarant, and deponent, retained through Kramer Levin LLP on behalf of CUPP Cybersecurity LLC, in patent litigation, CUPP Cybersecurity LLC, et al., v. Trend Micro, Inc. IPR2021-00813, IPR2021-01236, IPR2021-01237 (PTAB), Civil Action no. 3:18-cv-01251-M, 3:20-cv-03206-M (N.D. Texas).
 8. Jul. 2020 to Feb. 2021, Technical expert and declarant, retained through Goodwin Procter LLP on behalf of MobileIron, Inc., in patent litigation, MobileIron, Inc. v. BlackBerry Corp. IPR2020-01741 (PTAB).
 9. Aug. 2020 to present, Technical expert and declarant, retained through Thompson & Knight LLP (now Holland & Knight) on behalf of Broadcom Corp., in patent litigation, Broadcom Corp. and Avago Technologies International Sales PTE. Limited v. Netflix, Inc. Civil actions no. 8:20-cv-529 (C.D. Cal.), 3:20-cv-04677-JD (N.D. Cal.).
 10. Nov. 2020 to Dec. 2021, Technical expert and deponent, retained through Kramer Levin LLP on behalf of Midwest Athletics and Sports Alliance LLC (MASA), in patent litigation, Midwest Athletics and Sports Alliance LLC v. RICOH USA, Inc., and Midwest Athletics and Sports Alliance LLC v. Xerox Corp. Civil Action Nos. 19-CV-00514 (E.D. Penn.) and 6:19-CV-06036-EAW-JFW (W.D. New York).
 11. Mar. 2021 to Feb. 2024, Technical expert, declarant, and deponent, retained through Nix Patterson LLP on behalf of Ikorongo Technology LLC, in patent litigation, Ikorongo v. Samsung, LG, Lyft, Uber, and Bumble Trading, Civil Action Nos. 6:20-cv-00256-ADA, 6:20-cv-00257-ADA, 6:20-cv-00258-ADA, 6:20-cv-00259-ADA, 6:20-cv-00843-ADA (W.D. Texas, Waco), and IPR2021-00204 (PTAB).
 12. May 2021 to Aug. 2024, Technical expert, declarant, and deponent, retained by McKool Smith on behalf of SEVEN Networks LLC in patent litigation, SEVEN Networks, LLC v. Motorola Mobility LLC. Civil Action Nos. 2:21-cv-88 (E.D. Texas) and 3:21-cv-1036 (N.D. Texas).
 13. Aug. 2021 to present, Technical expert, declarant, and deponent, retained through Holland & Knight LLP on behalf of CA, Inc., in patent litigation, CA, Inc. and Avago Technologies International Sales PTE. Limited v. Netflix, Inc. Civil action no. 2:21-cv-00080-JRG-RSP (E.D. Texas).

14. Aug. 2021 to present, Technical expert, declarant, deponent, and testifying trial expert witness, retained through Kramer Levin LLP on behalf of Centripetal Networks, Inc., in patent litigation and IPRs, Centripetal Networks, Inc. v. Palo Alto Networks, Inc. Civil Action No. 2:21-cv-00137 (E.D. Virginia, Norfolk Div.), IPR2021-01149, IPR2021-01150, IPR2021-01152, IPR2021-01157, IPR2022-00182 (PTAB).
15. Jul. 2022 to May 2024, Technical expert, deponent, and declarant, retained through McKool Smith on behalf of the State of Texas, in litigation State of Texas v. Meta Platforms, Inc., Cause No. 22-0121.
16. Aug. 2022 to present, Technical expert and declarant, retained through Stamoulis & Weinblatt LLC on behalf of Ameranth, Inc., in a patent-related matter.
17. Sep. 2022 to present, Technical expert, deponent, and declarant, retained through Reichman Jorgensen Lehman & Feldberg LLP on behalf of VideoLabs, Inc., in patent-related matters, VideoLabs v. Netflix, and Starz Entertainment, LLC, et al. v. VL Collective IP, LLC and VideoLabs, Inc., Civil Action No. 21-cv-1448-JLH (D. Del.), IPR2022-01086, IPR2023-00628, IPR2023-00630, IPR2023-00891.
18. Nov. 2022 to Jun. 2023, Technical expert and declarant, retained through McKool Smith on behalf of American Airlines, Inc., in a patent-related litigation, R2 Solutions LLC v. American Airlines, Inc., Civil Action No.4:22-cv-00353 (E.D. Tex.).
19. Feb. 2023 to Nov. 2023, Technical expert and declarant, retained through Kirkland and Ellis LLP on behalf of Forcepoint LLC in a patent-related litigation, Webroot, Inc. et al. v. Forcepoint LLC, Case No. 6:22-cv-00341-ADA (W.D. Tex.).
20. Feb. 2023 to Dec. 2023, Technical expert and declarant, retained through Holland & Knight LLP on behalf of MDSave Shared Services, Inc., in a patent-related litigation.
21. Aug. 2023 to Sep. 2024, Technical expert, declarant, and deponent, retained through Kramer Levin LLP on behalf of Acceleration Bay LLC in patent-related litigation, Acceleration Bay LLC v. Amazon Web Services, Inc., Case No. 1:22-cv-904 (D. Del.).
22. Feb. 2024 to May 2024, Technical expert and declarant, retained through McKool Smith on behalf of AlphaSense, Inc., in patent litigation, AlphaSense, Oy and AlphaSense, Inc. v. Tegus, Inc. and Bamsec, LLC, Case No. cv-23-1030-MN (D. Del.).
23. May 2024 to Jan. 2025, Technical expert and declarant, retained through Reichman Jorgensen Lehman & Feldberg LLP on behalf of Kove IO, Inc., in patent litigation, Kove IO, Inc. v. Google, LLC, No. 1:23-cv-04244 (N.D. Ill.).
24. July 2024 to present, Technical expert, declarant, and deponent, retained through McKool Smith on behalf of Carbyne Biometrics, LLC, in patent litigation, Apple, Inc., Petitioner v. Carbyne Biometrics, LLC, Patent Owner in Case: (1) IPR2024-00329, U.S. Patent No. 9,972,010; (2) IPR2024-00330, U.S. Patent No. 10,713,656; (3) IPR2024-00331, U.S. Patent No. 11,526,886; (4) IPR2024-00332, U.S. Patent No. 10,929,512; (5) IPR2024-00333, U.S. Patent No. 11,475,105; (6) IPR2024-00334, U.S. Patent No. 11,514,138; and (7) IPR2024-00507, U.S. Patent No. 11,475,105.
25. Oct. 2024 to present, Technical expert and declarant, retained through Kramer Levin LLP on behalf of Cyandia, Inc., in patent litigation Cyandia, Inc. v. SAP America, Inc., and SAP SE, Case No. 2:22-cv-00096-JRG.

26. Nov. 2024 to present, Technical expert and declarant, Kramer Levin LLP on behalf of NTECH Properties, Inc. in patent litigation NTECH Properties, Inc. in v. ByteDance LTD., ByteDance PTE. LTD, TikTok PTE. LTD., and TikTok Inc., Case No. 2:24-cv-00130-JRG and IPR2024-01340, IPR2024-01341, IPR2024-01342, and IPR2024-01343.
27. Dec. 2024 to present, Technical expert, retained through Kramer Levin LLP and Noerr Partnerschaftsgesellschaft mbB on behalf of Centripetal Networks, Inc., in UPC proceedings between Centripetal and Keysight Technologies, Inc. at Mannheim Local Division, case no. 414/2024.
28. Dec. 2024 to present, Technical expert, retained through McKool Smith on behalf of American Airlines, Inc., in patent-related litigation, Intellectual Ventures I LLC et al. v. American Airlines, Inc., No. 4:24-cv-980 (E.D. Tex.).
29. Apr. 2025 to present, Technical expert, retained through Reichman Jorgensen on behalf of Corent Technology, Inc., in patent-related litigation.
30. Apr. 2025 to present, Technical expert, retained through Reichman Jorgensen on behalf of Xtone, Inc., in patent-related litigation, Xtone, Inc. v. Amazon.com, Inc., Amazon Web Services, Inc. and Amazon.com Services, LLC.
31. Apr. 2025 to present, Technical expert, retained through McKool Smith on behalf of AT&T Corp., in patent-related litigation, Headwater Research, LLC v. AT&T Corp. *et al.*, Case No. 2:25-cv-00215.
32. May 2025 to present, Technical expert, retained through Reichman Jorgensen Lehman & Feldberg LLP on behalf of VideoLabs, Inc., in patent-related matters, VideoLabs v. Meta Platforms, Inc., et al., Civil Action No. 22-cv-00680 (D. Del.).