IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re *Inter Partes* Review of:)
U.S. Patent No. 8,924,192)
Issued: Dec. 30, 2014)
Application No.: 13/673,692)
Filing Date: Nov. 9, 2012)

For: **Systems Including Network Simulation For Mobile Application Development And Online Marketplaces For Mobile Application Distribution, Revenue Sharing, Content Distribution, Or Combinations Thereof**

DECLARATION OF NENAD MEDVIDOVIC, PH.D. IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,924,192

Table of Contents

I. Introduction and Qualifications

1.   I have been retained by Capital One, N.A. and Capital One Services, LLC ("Petitioners") to provide my opinion concerning the validity of claims 60-69 of U.S. Patent No. 8,924,192 (attached to the accompanying Petition as Ex. 1001 and henceforth referred to as "the '192 patent") in support of this Petition for Inter Partes Review.

2.   I am being compensated for my time in connection with this IPR at my standard consulting rate. My compensation is not dependent in any way upon the outcome of this matter.

3.   I received a Bachelor of Science degree, summa cum laude, from Arizona State University's Computer Science and Engineering department.

4.   I received a Master of Science degree from the University of California at Irvine's Information and Computer Science department.

5.   I received a Doctor of Philosophy degree from the University of California at Irvine's Information and Computer Science department. My dissertation was entitled "Architecture-Based Specification-Time Software Evolution."

6.   For over thirty years, my research has focused on software systems; their design, development, maintenance, and evolution; their individual building blocks and overall architectures; and mechanisms for their implementation and

deployment. My Ph.D. dissertation yielded a new design style for the development and evolution of highly distributed software systems built out of independent components that exchange different types of information encoded in messages to accomplish specific goals. This research focused on the design principles behind those systems, the appropriate support for modeling the systems (both at the level of individual modules as well as their integrations into subsystems and entire systems), and the infrastructure for their implementation, deployment, optimization, and long-term evolution. This work was applied across a wide range of domains, from traditional distributed systems, to mobile devices and applications, to embedded systems and autonomous robots.

7.   My work has been funded by U.S. government agencies (e.g., National Science Foundation, National Institutes of Health, Defense Advanced Research Projects Agency, NASA, Department of Homeland Security) and industrial organizations (e.g., Boeing, IBM, Northrop Grumman, Xerox, Google, Bosch).

8.   I am employed by the University of Southern California ("USC") as a faculty member in the Computer Science Department and have been since January 1999. I am a tenured professor. Since July 2022, I have served as my Department's Chair. Between January 2009 and January 2013, I served as the Director of USC's Center for Systems and Software Engineering (USC-CSSE), a

large research center that involved the work of a number of USC faculty, students, and staff as well as several dozen industry partners. Under my direction, USC-CSSE was involved in a range of cutting-edge projects for our industry partners, ranging from the Aerospace Corporation to Xerox. Between July 2011 and July 2015, I served as my Department's Associate Chair for Ph.D. Affairs. Between July 2021 and June 2022, I served as my Department's Vice Chair for Tenure Affairs.

9. In 2007 I was offered the position of Chief Software Engineer of the Transformational Satellite Communications System (TSAT) program. This was a $4B U.S. Department of Defense (DOD) program, sponsored by the U.S. Air Force. The program's charge was to build the satellite grid of the future. With my university's agreement, I was prepared to go on a multi-year leave-of-absence assignment until the TSAT project was operational. Unfortunately, the program's funding was cut before my involvement could begin.

10. I have created and/or taught undergraduate-, Master's-, and Ph.D.-level courses in software engineering, software requirements, software architecture, and embedded systems. As part of these courses, I have developed and taught modules, and created and guided projects that exposed students to the interplay between software and traditional computing devices on one hand, and a

wide range of physical equipment on the other hand, including sensors, RFID tags, cameras, mobile robots, and wearable computing devices.

11.   A significant portion of my professional activity centers on conducting research through advising Ph.D. students. I have graduated 21 Ph.D. students to date, and I advise seven students currently pursuing their Ph.D. My students have gone on to successful careers in top software companies (e.g., Google, NVIDIA, Intel, Snap), research institutes (e.g., NASA's Jet Propulsion Laboratory, Information Sciences Institute, Quandary Peak Research), and universities (e.g., University of Massachusetts, University of California, University of Edinburgh).

12.   I served as Program Co-Chair for the flagship conference in my field—International Conference on Software Engineering ("ICSE")—held in May 2011. I have served as Chair or Co-Chair for various other conferences in the Software Engineering field, including: the Fifth Working Institute of Electrical and Electronics Engineers ("IEEE")/IFIP Conference on Software Architecture, the Third IEEE International Conference on Self-Adaptive and Self-Organizing Systems, the Fifteenth International Association for Computing Machinery's ("ACM") Special Interest Group on Software Engineering ("SIGSOFT") Symposium on Component Based Software Engineering, the IEEE/CSSE/ISE Workshop on Software Architecture Challenges for the 21st Century, and the

Doctoral Symposia at the Sixteenth ACM SIGSOFT International Symposium on the Foundations of Software Engineering and at the 44th International Conference on Software Engineering.

13.   I have served as an editor of several peer-reviewed journals, including IEEE Transactions on Software Engineering, ACM Transactions on Software Engineering and Methodology, Journal of Software Engineering for Robotics, Elsevier Information and Software Technology Journal, Journal of Systems and Software, Journal of Software Engineering Research and Development, and Springer Computing Journal. I have also served as a guest editor of several special issues for other journals. Between January 2018 and December 2022, I served as Editor-in-Chief of IEEE Transactions on Software Engineering ("TSE"), the flagship software engineering research journal.

14.   Between September 2013 and September 2015, I served as Chair of the ICSE Steering Committee. Both before that (2008-2013) and subsequent to that (2015-present) I have been a member of the ICSE Steering committee. I am currently a member of the Steering Committee of the joint European Conference on Software Engineering and the Symposium on the Foundations of Software Engineering ("ESEC/FSE"). From July 2015 to September 2017, I chaired the Steering Committee of FSE, while it was a standalone symposium. I have served

as a member of the Steering Committees of the Working IEEE/IFIP Conference on Software Architecture on two separate occasions, including presently.

15. Between July 2015 and June 2018, I served as Chair of the ACM SIGSOFT, the largest professional organization in my field. During the past year, I have chaired the committee in charge of ACM's Software System Award, one of the most important technical awards in my field.

16. I co-authored Software Architecture: Foundations, Theory, and Practice, a widely used textbook in software systems architecture.

17. I have served as editor of various books in the Software Engineering field, including Proceedings of the 3rd International Conference on Self-Adaptive and Self-Organizing Systems, Proceedings of the Warm-Up Workshop for the 32nd International Conference on Software Engineering, Proceedings of the 5th Working IEEE/IFIP Conference on Software Architecture, and 40 Editions of ICSE—the Ruby Anniversary Celebration.

18. I have authored or co-authored nearly 300 papers in the Software Engineering field. My work has been cited over 21,000 times. My most cited paper alone has been cited nearly 3,200 times; that paper recently received a decade's Most Influential Paper Award from IEEE TSE. A paper I co-authored in the 1998 ICSE, my field's flagship conference, was given ten years later, in 2008, that conference's Most Influential Paper Award. Another of my publications

received a Most Influential Paper Award in 2020. Several of my other publications have received "best paper" or "most cited" awards.

19.   My research frequently results in the development of software tools that accompany and demonstrate the published ideas. A paper describing a security-vulnerability detection and remediation tool for Android devices built in my lab, won the Best Tool Paper award at the 2017 Automated Software Engineering Conference. That idea was subsequently awarded a U.S. patent. I am a co-inventor on two additional issued patents in distributed systems design, implementation, deployment, and computer security.

20.   I have been named a Distinguished Scientist of the ACM. I have been elected a Fellow of the IEEE. Fellow of the IEEE is IEEE's highest grade; less than 0.1% of its membership earns this grade each year. Additional details of my experience may be found in my CV, which is attached as Exhibit A.

II.   Summary Of Materials Reviewed And Considered

21.   All of the opinions contained in this Declaration are based on the documents I reviewed and my knowledge and professional judgment. In forming the opinions expressed in this Declaration, while drawing on my experience in the field of software development, I reviewed the following documents:

Ex.	Description
1001	U.S. Patent No. 8,924,192 ("'192 patent")

Ex.	Description
1002	Prosecution History of U.S. Patent No. 8,924,192 ("'192 PH")
1004	U.S. Patent Application No. 12/759,543 ("'543 application")
1005	Certified Translation of Korean Patent Publication No. KR 2003-0049670 ("Lee")
1007	U.S. Patent Application Publication No. 2005/0102638 ("Jiang")
1008	U.S. Patent Application Publication No. 2006/0015404 ("Tran")
1009	U.S. Patent No. 7,813,910 ("Poulin-910")
1010	Hassan Artail, *A Multiplatform Methodology: Developing Mobile Device Applications,* 4 IEEE Pervasive Computing 92 (Apr. – June 2005)
1011	Lynne Hall et al., *A Development Environment for Intelligent Applications on Mobile Devices,* 27 Expert Systems with Applications 481 (2004)
1012	U.S. Patent Application Publication No. 2002/0184610 ("Chong")
1013	European Patent Specification No. EP 1 332 439 B1 ("Christfort")
1014	Stuart J. Barnes, *The Mobile Commerce Value Chain: Analysis and Future Developments,* 22 Int'l J. Info. Mgmt. 91 (2002)
1015	U.S. Patent Application Publication No. 2004/0192277 ("Pakarinen")
1016	Bert de Reyck & Zeger Degraeve, *Broadcast Scheduling for Mobile Advertising,* 51 Operations Research 509 (2003)
1017	Ichiro Satoh, *Software Testing For Wireless Mobile Computing,* 11 IEEE Wireless Communications 58 (Oct. 2004)
1018	Trevor J. Young, *Using AspectJ to Build a Software Product Line for Mobile Devices* (Aug. 2005) (Master's thesis, University of British Columbia)
1019	Microsoft Computer Dictionary (5th ed. 2002) (excerpts)

Ex.	Description
1020	Webster's Unabridged Dictionary of the English Language (2001) (excerpts)
1021	S. Kumar & C. Zahn, *Mobile Communications: Evolution and Impact on Business Operations,* 23 Technovation 515 (2003)
1022	Anthony Cataldo, *Kyocera Shows Portable Video Phone,* EDN (May 18, 1999), https://www.edn.com/kyocera-shows-portable-video-phone/
1023	Anita Wilhelm et al., *Photo Annotation on a Camera Phone,* CHI'04 Extended Abstracts of the 2004 Conference on Human Factors in Computing Systems 1403 (Apr. 2004)
1024	Risto Sarvas et al., *Metadata Creation System for Mobile Images,* Proceedings of the 2nd International Conference on Mobile Systems, Applications, and Services 36 (June 2004)
1025	Russell Beale, *Supporting Social Interaction with Smart Phones,* 4 IEEE Pervasive Computing 35 (Apr. – June 2005)
1026	BBC, *A History of Mobile Phones and Smartphones,* https://www.bbc.co.uk/bitesize/articles/z62gjfr (last visited July 10, 2025)
1027	Nenad Medvidovic, *Software Architectural Support for Handheld Computing,* 36 Computer 66 (Sept. 2003)
1028	Tim Kindberg et al., *The Ubiquitous Camera: An In-depth Study of Camera Phone Use,* 4 IEEE Pervasive Computing 42 (2005)
1029	*App*, Britannica, https://www.britannica.com/technology/mobile-app (last visited July 10, 2025)
1032	Matt Curtin, *Write Once, Run Anywhere: Why it Matters* (Apr. 9, 1998)

22.   My opinions are additionally guided by my appreciation of how a person of ordinary skill in the art ("POSITA") would have understood the claims

of the '192 patent at the time of the alleged invention, which I have been asked to assume is June 10, 2005. However, as detailed below, I understand that the '192 patent may not be entitled to the claim priority to the June 10, 2005 date; regardless, my opinions contained below would not change if a later priority date were applicable.

III. Understanding of Legal Standards

23. I am not an attorney, and I do not opine on matters of law. However, I have been informed by Counsel of certain legal standards, which are set forth below. I have applied those standards in my analysis in this declaration. The material in this section has been supplied to me by counsel.

24. I have been informed by Counsel that the validity analysis is a two-step process. First, the patent claims are construed to ascertain their proper scope. Second, the construed claims are compared to the identified prior art to determine if the clams are valid over the prior art.

A. Claim Construction

25. I have been informed by Counsel that the claims of a patent define the limits of the patentee's exclusive rights. I have been informed by Counsel that to determine the scope of the claimed invention, courts typically construe claim terms, the meaning of which the parties may dispute. I have been informed by Counsel that claim terms should generally be given their ordinary and customary

meaning as understood by one of ordinary skill in the art at the time of filing of the patent application, after reading the patent and its prosecution history. I also have been informed by Counsel that a basic tenet of claim construction presumes that different words in a claim have different meanings, unless there is evidence to the contrary.

26.   I have been informed by Counsel that claims must be construed in light of, and consistent with, the intrinsic evidence. In this context, I have been informed by Counsel that intrinsic evidence includes the claims themselves, the written disclosure in the specification, and the patent's prosecution history, including prior art that was considered by the United States Patent and Trademark Office ("USPTO"). I have been informed by Counsel that the specification is always highly relevant to the claim construction analysis and often is the single best guide to the meaning of a disputed term. I have been informed by Counsel that extrinsic evidence may also be considered when construing claims and may include, for example, technical dictionaries, technical publications and books, treatises, and expert testimony.

B.   Obviousness

27.   I have been informed by Counsel that patent claims can be deemed invalid if the differences between the claimed 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 pertinent art. While such conclusions are often based on more than one piece of prior art, only one is required. It is not sufficient that a collection of prior art references merely recites the various elements of a challenged patent claim. Rather, as I have been informed by Counsel, the prior art must present the elements in a manner that is consistent with their arrangement or use in the challenged claims. I have been informed by Counsel that obviousness cannot be based on the hindsight combination of components selectively culled from the prior art.

28. I have been informed by Counsel that a person having ordinary skill in the art ("POSITA") is a hypothetical person who is presumed to have known the relevant art at the time the invention was made. I have been informed by Counsel that the condition "at the time the invention was made" is imposed to rule out impermissible hindsight. I also have been informed by Counsel that an expert is to analyze the prior art from the perspective of a person of ordinary skill in the art at the time the invention was made, and not simply to provide his/her own personal conclusions.

29. I have also been informed by Counsel that an obviousness determination includes several factual inquiries, including (1) determining the scope and content of the prior art; (2) ascertaining the differences between the claimed invention and the prior art; (3) resolving the level of ordinary skill in the

pertinent art; and (4) taking into consideration any objective indicia of nonobviousness.

30.   I have been informed by Counsel that obviousness must be determined as of the date of the invention (i.e., the effective filing date or priority date of the patent).   Thus, in considering the reason or motivation to combine references, it is essential to avoid using hindsight.   For example, the problem examined when considering obviousness is the general problem that confronted the inventor before the invention was made, not the specific problem solved by the invention. Defining the problem in terms of its solution reveals improper hindsight in the selection of the prior art relevant to obviousness. Further, an overly narrow statement of the problem can represent a form of hindsight, because often the inventive contribution lies in defining the problem in a new revelatory way. Similarly, an assertion that a person of ordinary skill could combine the references, rather than that they would have been motivated to do so, is an impermissible form of hindsight. Moreover, knowledge of a problem and motivation to solve it are entirely different from motivation to combine particular references to reach the particular claimed invention.

31.   I have been informed by Counsel that a motivation to solve a problem (or issue) is not the same as a motivation to have combined references. I have been informed by Counsel that whether a skilled artisan would be motivated to make a

combination includes whether he/she would select particular references in order to combine their elements.

32.   I have been informed by Counsel that the analysis of the motivation to combine should be explicit. Additionally, it must include articulated reasoning with rational underpinnings to support the conclusion of obviousness. Providing a full explanation of the motivation to combine the references and the reasonable expectation of success is a necessary component of the obviousness inquiry, as inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known. However, conclusory statements fail to adequately explain why a person of ordinary skill would have a motivation to combine the potential prior art references.

33.   I have been informed by Counsel that common sense, common wisdom, and common knowledge may be used to support a motivation to combine, so long as the use of common sense in the analysis is explained with sufficient reasoning. But, common sense can only be used to supply a limitation missing from the prior art where the technology is unusually simple and straightforward.

34.   I also have been informed by Counsel that evidence suggesting reasons to combine cannot be viewed apart from evidence suggesting reasons not to combine. In analyzing motivation, both advantages and disadvantages must be

considered. Teaching away, for example, is a statement in the prior art that either (i) discourages one from following the path of the claimed invention, or (ii) encourages one to follow a path that diverges from the path of the claimed invention. The concept of teaching away bears directly on whether there was a reason to combine prior art. Known disadvantages in prior art technology or devices which would naturally discourage a search for new inventions may also be taken into account in determining obviousness.

C. Written Description/Priority

35. I understand that the written description requirement of the patent statutes ensures that issued claims of a patent correspond to the scope of the written description that was provided in the original application. I understand that in determining whether the patent satisfies the written description requirement, one must consider the description from the perspective of a POSITA at the time of the application's filing. The written description requirement is satisfied if a POSITA reading the original patent application would have recognized that it describes the full scope of the claimed invention as it is claimed in the patent, and that the application reasonably conveys that the inventor possessed the full scope of the invention by the filing date of the original application.

36. I have been informed that the written description requirement may be satisfied by any combination of the words, structures, figures, diagrams, formulas,

and other material contained in the patent application. The full scope of a claim, or any particular limitation of a claim, need not be expressly disclosed in the original patent application, provided a POSITA would have understood that the full scope or missing limitation is inherently contained in the written description of the application.

37.   I understand that in considering written description, it is important not to determine written description using the benefit of hindsight, or determining what would have been obvious in light of the written description.

IV.   Person of Ordinary Skill in the Art ("POSITA")

38.   I understand that a person of ordinary skill in the art or POSITA is a hypothetical person who is presumed to be aware of all pertinent art, possesses conventional wisdom in the art, is a person of ordinary creativity, and has common sense. I understand that this hypothetical person is considered to have the normal skills and knowledge of a person in a certain technical field (including knowledge of known problems and desired features in the field).

39.   I have been asked to focus my analysis on claims 60-69 of the '192 patent, and prior art relating thereto, from the perspective of such a person at the time of the alleged inventions. I understand that the '192 patent was filed on November 9, 2012, and claims priority to U.S. Patent Application No. 12/759,543, which was filed on April 13, 2010. The '192 patent also claims priority to U.S.

Patent Application No. 11/449,958, which was filed on June 9, 2006, and U.S. Provisional Patent Application No. 60/689,101, filed June 10, 2005.

40.   It is my opinion that a person of ordinary skill in the art in the 2005 timeframe would have had a bachelor's degree in computer science or computer engineering, or a similar discipline, and two years of relevant industry experience with software development and software development tools or a related field. This description is approximate, and a higher level of education or skill might make up for less experience, and vice-versa.

41.   As of June 10, 2005, I would have qualified as at least a POSITA, and my opinions herein are informed by my own knowledge based on my personal experiences and observing others of various skill levels (including those above and below the level of a POSITA).

42.   My opinions below are not restricted to the precise definition of a POSITA above. The claims of the '192 patent are directed to software and software development techniques that were well-known in the art and taught by numerous prior art references, including the references discussed below. Thus, my opinions below would apply under any reasonable definition of a POSITA.

V. Summary of the '192 Patent

A. Description

43. The '192 patent is entitled "Systems Including Network Simulation for Mobile Application Development and Online Marketplaces for Mobile Application Distribution, Revenue Sharing, Content Distribution, or Combinations Thereof" and was issued on December 30, 2014 and filed on November 9, 2012. The patent describes "[a] system and methods" of emulating "an application executing in real time in a mobile device." Ex. 1001 ['192 patent], Abstract. "The mobile device is emulated in real time using a model running on a processor extrinsic to the mobile device," wherein "[t]he model is based on characteristics indicative of performance of the mobile device" such as network characteristics and resource utilization information "by the application for the mobile device." *Id.*

44. Further, claim 60 of the '192 application discloses "an application configured to enable a user to modify a photo on the mobile device," wherein the application is developed "using a software authoring platform" with the functionality to emulate "a plurality of hardware characteristics indicative of performance of the mobile device when executing the application." *Id.* at Claim 60. The dependent claims 61-69 that depend on claim 60 disclose various additional functionalities of the claimed application such as adding content to modify the photo, distributing the modified photo through a server or Internet

connection, and generating mobile revenues through the modified photo or application. *Id.* at Claims 61-69.

B.   Claim Construction

1.   Claims 60-69 are Product-By-Process Claims

45.   Claim 60 recites a system comprising an application that enables a user to modify a photo, wherein the application is developed using the recited software authoring platform. A POSITA would understand the plain meaning of the claim to only require a specific application, one that allows photo modification. I understand the remaining limitation to define the process by which the application was developed, including through a software authoring platform.

46.   A POSITA would have recognized that "an application configured to enable a user to modify a photo on the mobile device" could be developed using any number of software authoring platforms that do not emulate a plurality of hardware characteristics indicative of performance of the mobile device when executing the application. For example, a POSITA would have known that some software authoring platforms were separate from emulators designed to test the performance of a developed application, or that a developed application could be tested on a hardware device. Ex. 1011 [Hall], p. 487 (explaining the development of a mobile application including using an emulator for Palm OS); Ex. 1010 [Artail] (describing integrated development environments for testing mobile

applications). Consistent with the claim language, a POSITA would have known that an "application configured to enable a user to modify a photo on the mobile device" could have been developed using such a software authoring platform and then later tested on that separate emulator or hardware device.

47.   A POSITA would therefore understand that such emulation does not impart a structural or functional difference on the application itself. Ex. 1017 [Satoh]; Ex. 1011 [Hall]. That is, an application configured to enable a user to modify a photo on the mobile device could be developed using a software authoring platform that **did not** emulate hardware characteristics indicative of performance of the mobile device when executing the application. But such a program could have the same structure and functionality as an application developed using a software authoring platform as recited in claim 60 (i.e., an application developed using a software authoring platform that did emulate hardware characteristics). To a user, both applications would be equivalent. As such, it is my understanding that demonstrating invalidity of the limitation "an application configured to enable a user to modify a photo on the mobile device, wherein the application is developed using a software authoring platform configure to simultaneously visually emulate, via one or more profile display windows, a plurality of hardware characteristics indicative of performance of the mobile

device when executing the application" only requires showing, in the prior art, an application that enables a user to modify a photo on a mobile device.

2. Previous Court Constructions of the '192 Patent's Terms

48.   It is my understanding that certain terms of the '192 patent have been subject to construction in prior district court litigations. Specifically, the district court in a prior litigation gave the following terms their ordinary meaning: "emulate," "application," "on the mobile device." *WAPP Tech Ltd. P'ship v. JPMorgan Chase Bank, N.A.*, No. 4:23-CV-1137, 2024 WL 4828080 (E.D. Tex. Nov. 19, 2024). I have applied the plain meaning of these terms as understood by a POSITA.

VI. Background of Mobile Application and Software Development

49.   Before addressing the patentability of the challenged claims, below I provide certain background information about the technological field relevant to the '192 patent, which would have informed a POSITA's knowledge when reviewing the '192 patent and the prior art references discussed in my Declaration.

A. Prevalence of Mobile Devices

50.   The earliest call made from a mobile phone in history was recorded in 1973 and since then, mobile phones officially started to become both increasingly more "mobile" and widely accessible beginning in the 1990s. Ex.

1026 [BBC].[1] The IBM Simon from 1994 was classified as the first ever consumer smartphone, with capabilities such as a touchscreen, ability to send fax/email, and a calendar function. Ex. 1026 [BBC]. The BlackBerry soon followed in 1999 with similar smartphone capabilities. Ex. 1026 [BBC]. As such, well before 2000, mobile devices began to gain public traction and more consumers began to understand the utility mobile devices and smartphones could bring to everyday lives.

51.   By the early 2000s, mobile devices had become increasingly popular. One article noted that, in 2000, worldwide mobile phone sales exceeded 400 million, and were estimated to exceed 400 million in 2002. Ex. 1021 [Kumar], p. 516. According to the article, mobile devices were relied upon by users for a range of functions, including digital camera functionality, digital assistant functionality, and location technology. *See generally* Ex. 1021 [Kumar].

B.   Rise of Mobile Applications

52.   The concept of mobile applications existed since the 1980s with the release of the first personal digital assistants. Ex. 1027 [Britannica]. Starting in

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[1] Although certain documents cited in this Background section were published after the earliest priority date of the '192 patent, they are consistent with and reflect the knowledge of a POSITA as of the earliest priority date of the '192 patent.

the early 2000s, applications designed for mobile devices became prevalent. For example, EP patent 1332439 B1 ("Christfort"), titled "Developing Applications Online", was filed on September 6, 2001, published on August 6, 2003, and granted and issued on December 29, 2004, and detailed use of the World Wide Web with a "client program, referred to as a browser, to request, decode and display information" and noted the trend "to expand Internet access to devices other than conventional computer systems. For example, many mobile clients (or mobile devices), such as wireless phones, have been developed that include embedded web browsers. Due to size and cost constraints, the 'micro browsers' contained in these devices have very limited functionality relative to the browsers that have been developed for full-fledged computer systems." Ex. 1013 [Christfort] at 1, [0003], [0005]. Thus, greater reliance on mobile devices and the demand for further utility in mobile devices (e.g., Web and image browsing) began in at least 2001. This increasing reliance on mobile devices led to greater investment in mobile hardware and software as well as the continued deployment of mobile applications for users. Christfort also disclosed the concept of creating applications and services (developing applications online) as well as deploying hosted applications. Ex. 1013 [Christfort] at [0048], [0053]. Furthermore, Christfort disclosed "initially creating the application, subsequently editing of the application, and testing of the application" and "the development website provides the developer or user with an

interface for writing and editing code for the application." Ex. 1013 [Christfort] at [0053].

53.   Likewise, in the early 2000s, both software developers and cell phone providers were seeking to develop mobile applications as Internet-enabled mobile phones drove the need for productivity tools. Ex. 1021 [Kumar], p. 517. The Kumar article noted that the Palm Economy (including developers of Palm OS applications) had created "more than 13,000 software applications." Ex. 1021 [Kumar], p. 517. The article also noted that developing "applications for mobile units" generated revenues (e.g., for mobile service or cell phone providers). Ex. 1021 [Kumar], p. 517.

54.   Relative to the subject matter of the '192 patent, by the early 2000s, one particular focus of mobile applications included targeting mobile device users who used mobile phones equipped with a camera. Ex. 1023 [Wilhelm], p. 1403. Mobile phones with cameras were introduced to the market in 1999, and by late 2005, they were increasingly common. *See, e.g.*, Ex. 1023 [Wilhelm], p. 1403 (describing   "[n]etworked   mobile   camera   phones");   Ex.   1022 [https://www.edn.com/kyocera-shows-portable-video-phone/].

55.   With consumers producing more digital images, as the Wilhelm article detailed, there was a need for managing those images, and thus, developers created mobile applications tailored to various image-related features. For

example, the Wilhelm researchers developed an application for annotating digital images, while the Sarvas researchers provided solutions for image management. Ex. 1023 [Wilhelm], p. 1403; Ex. 1024 [Sarvas], p. 46. Photo modification applications were also well-known by 2005; for example, the Beale article described a Nokia application that provided "interesting photo-editing … options" on select Nokia phones. Ex. 1025 [Beale], p. 40.

56.   Thus, before 2005, the concept of developing applications for mobile devices was already known. Further, as explained in greater detail below, the concept of testing applications for mobile devices was also known. For example, Christfort disclosed "[t]o test the application, the user can access the application or service via the development website using a mobile device or a mobile device simulator." Ex. 1013 [Christfort] [0059]. Thus, a developer before 2005 would have already been aware of using simulation to test mobile applications on mobile device simulators. The rise of mobile applications along with increased reliance on mobile devices and applications also led to more streamlined mobile application development and testing frameworks for developers.

C.   Mobile Software Development

57.   Indeed, before 2005, the concept of mobile application and software development was already gaining widespread traction. For example, U.S. Patent Application Publication 2002/0184610 A1 ("Chong") filed and published in 2002

disclosed "a visual development tool for rapidly building voice and data applications that may operate across multiple network standards, devices, browsers and languages." Ex. 1012 [Chong] at [0015]. More specifically, Chong disclosed "a graphical user interface adapted to allow a user to visually build a workflow for an application." Ex. 1012 [Chong] at [0031]. Thus, development platforms and tools were contemplated alongside the rise of mobile applications before 2005.

58.   As another example, in 2003, I co-authored a paper published in IEEE Computer titled "Software Architectural Support for Handheld Computing." In the paper, my co-authors and I detailed a "set of challenges" related to "software development for highly distributed, dynamic, mobile, heterogeneous computation on large numbers of small, resource-constrained platforms." Ex. 1027 [Medvidovic], p. 66. The paper detailed the design of an application for "distributed military troop deployment and battle simulations" that utilized "105 mobile devices and mobile device emulators running on PCs." Ex. 1027 [Medvidovic], p. 67. Our paper also noted that the Prism framework that we created was used to develop "more than a dozen applications" involving "traditional desktop platforms, PalmOS and WindowsCE devices, digital cameras, and motion sensors," and that those applications included "digital image processing" and other types of applications. Ex. 1027 [Medvidovic], p. 71. Thus, a POSITA would have recognized that developing and testing applications for

mobile devices, where those applications ran on multiple types of mobile devices, and where those applications included digital image processing applications, were well-known concepts by the 2005 earliest priority date of the '192 patent.

59.   As another example, U.S. Patent Application Publication 2004/0192277 A1 ("Pakarinen"), filed and published in 2004, disclosed a data system that operates "as a software development environment, enabling at least the testing of different software components" and that this software component "may be for instance a mobile communication application software development tool, terminal, system or service emulator, content development tool, testing tool, or an application program of an external system or device." Ex. 1015 [Pakarinen] at [0015]. Furthermore, Pakarinen disclosed an application developer that can "test and/or simulate a Bluetooth application in one data processing device by using a terminal emulator" and "a Bluetooth environment simulator." Ex. 1015 [Pakarinen] at [0050]. Finally, Pakarinen further contemplated the data system associated with the "development and testing of mobile applications" that "can be carried out in several separate devices." Ex. 1015 [Pakarinen] at [0018]. As such, the concept of developing mobile applications and testing in simulated environments already existed pre-2005 and more mobile developers began to appreciate the importance and utility of such simulated environments in mobile application development.

60. Furthermore, the concept of integrated development environments ("IDEs") and their applicability to mobile application development was also known to a POSITA before 2005. For instance, the paper "A development environment for intelligent applications on mobile devices" published in 2004 highlighted the necessity of "a development environment for intelligent applications for mobile devices." Ex. 1011 [Hall] at Abstract. In addition, the paper contemplated the use of "integrated development environments that permit the development of intelligent applications" for mobile devices. Ex. 1011 [Hall], pp. 482-483. The paper additionally disclosed IDEs for mobile devices and the IDE's utility to provide "an interpreter for the programming language, tools for testing and debugging the systems written using this programming language, and a compiler for generating executable versions of a functioning intelligent system which can be targeted at a range of mobile devices. Ex. 1011 [Hall], p. 483.

61. Also, a 2002 paper titled "The mobile commerce value chain: analysis and future developments" highlighted the increasing utility of mobile applications. In particular, the paper emphasized that mobile technology comes "[e]quipped with micro-browsers and other mobile applications" and its "consumer possibilities are endless, including banking, booking or buying tickets, shopping and real-time news." Ex. 1014 [Barnes] at Abstract. As such, with the increase of mobile software development and the emphasis on utility of mobile applications, such

applications began to provide various functionalities in everyday lives of consumers.

62.   As noted above, this background information would have informed the POSITA's knowledge when analyzing the claims of the '192 patent, as set forth in greater detail below.

VII.   Ground 1A: Claims 60-65 are unpatentable over Lee

63.   As set forth below, it is my opinion that claims 60-65 are rendered obvious by the teachings of Lee.

A.   Overview of Lee

64.   Lee is a Korean application that was filed on December 17, 2001 and published on June 25, 2003. I have been informed by Counsel that Lee would at least be § 102(b) prior art because it was published more than one year before the '192 patent's earliest claimed priority date. I understand that Lee was originally filed and published in Korean. I have reviewed a translation of Lee, which I understand is submitted as Exhibit 1005 with the Petition.

65.   Lee discloses a method of editing a photo and sending a photo mail, and a mobile phone implementing the method. Ex. 1005 [Lee], 1:19-20. Lee further discloses a mobile phone comprised of a memory for storing a program that has an algorithmic structure (i.e., an application) that supports configuring and editing a photo or picture as a photo mail. Ex. 1005 [Lee], 1:20-22. This program

allows the user to edit a picture or photo to be sent as a photo mail to another user through a control unit, and to produce various forms of images and pictures. Ex. 1005 [Lee], 1:22-26.
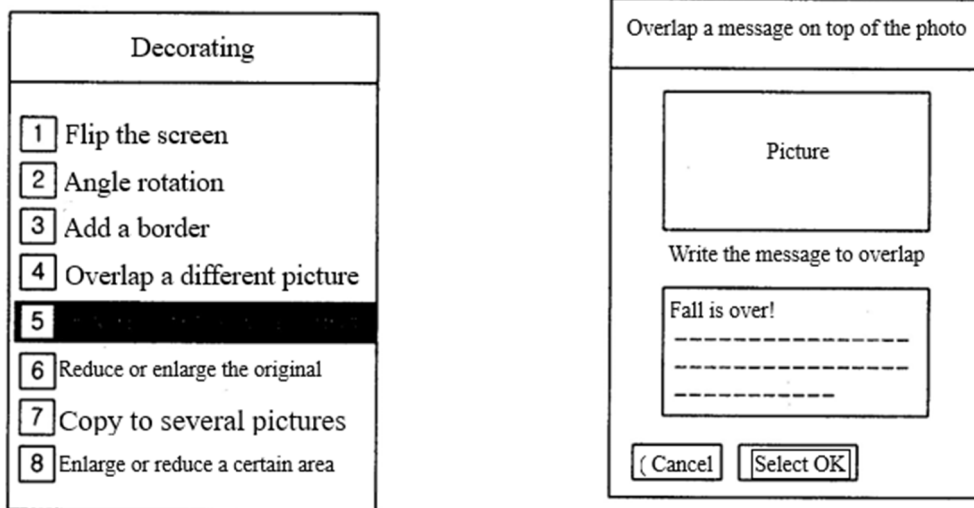
Ex. 1005 [Lee], Figs. 5c, 5d.

66.   Lee is analogous art to the '192 patent, as it is in the same field of endeavor of mobile device applications. *See* Ex. 1001 ['192 patent], Abstract; Ex. 1005 [Lee], 1:19-26.

B.   Claim 60

1.   Preamble: "A system comprising"

67.   I do not provide an opinion as to whether the preamble is limiting. Regardless, to the extent the preamble is limiting, the Lee reference discloses "[a]

mobile phone that supports photo editing." Ex. 1005 [Lee] at 3:1-12, 8:23, 8:3,

Fig. 2, 2:24-28. Thus, Lee's mobile phone discloses a "system" as recited.

Figure 2
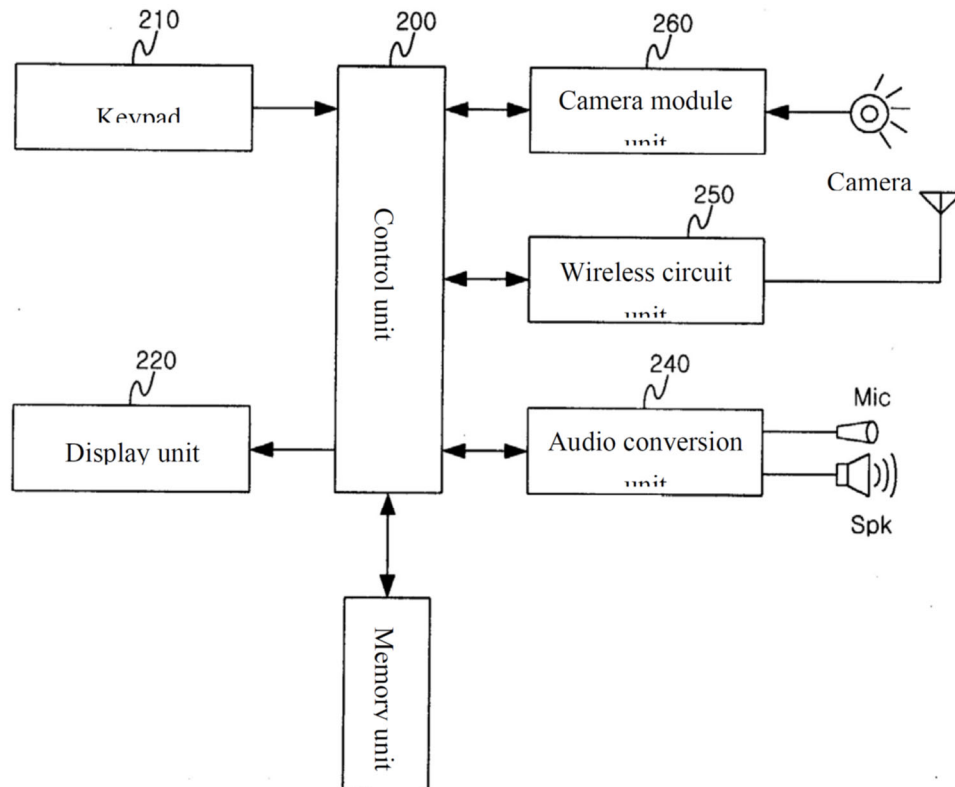
2. Limitation: "an application configured to enable a user to modify a photo on the mobile device"

68. Claim 60 further recites "an application configured to enable a user to

modify a photo on the mobile device, wherein the application is developed using a

software authoring platform configured to simultaneously visually emulate, via

one or more profile display windows, a plurality of hardware characteristics

indicative of performance of the mobile device when executing the application." Ex. 1001 at Claim 60.

69. Lee discloses that its "mobile phone is composed of a memory that stores a program having an algorithmic structure." Ex. 1005 [Lee] at 3:27-4:3, *see also* 3:1-3, 5:2-3, claim 1. A POSITA would have recognized a "program having an algorithmic structure" as an "application." The Microsoft Computer Dictionary (5th edition, published in 2002) also confirms this understanding as it defines an application as "[a] **program** designed to assist in the performance of a specific task…." Ex. 1019 [Microsoft Computer Dictionary], p. 31. Consistent with this definition, Lee's program is designed to assist in the performance of a specific task: photo editing and sending the edited photo as a photo mail. Thus, Lee's program would have been understood to correspond to an "application" as recited.

70. Lee explains that its program having an algorithmic structure (e.g., application) "supports organizing and **editing photos or pictures** in photo mails" and that "[t]herefore, mobile phone **users can edit photos or pictures** and send them as photo mail." Ex. 1005 [Lee] at 3:27-4:3; *see also* 5:2-3 (memory unit "stores a program having a function for allowing a user to edit a picture or photo"), 6:17 ("flow chart showing the process of editing a photo"), Fig. 5c (showing "several editing menus" and "representative functions"), 2:25-28. A POSITA would have recognized from Lee's disclosure that its application supports a user

"editing" photos, which discloses and renders obvious that the application supports a user being able to modify photos. The Webster's Dictionary also confirms my understanding as it defines "edit" as in the computing field as follows: "8. *Computers*. To modify or add to (data or text).". Ex. 1020 [Webster's], p. 620.

71.   Thus, the above disclosures demonstrate Lee would have rendered obvious "an application configured to enable a user to modify a photo on the mobile device" as recited, because a POSITA would have understood a "memory that stores a program having an algorithm structure," where the program (an application) "supports organizing and editing photos or pictures" as disclosed in Lee, to teach and render obvious this limitation.

72.   I understand and have been informed that the claim language of the "wherein" clause of claim 60 may not be treated as a limitation of the claim, under applicable legal standards. Accordingly, because Lee discloses or renders obvious the "application configured to enable a user to modify a photo on the mobile device," and the remainder of claim 60 is not limiting, Lee discloses or renders obvious claim 60.

C.   Dependent claims 61-65

1.   Claim 61: "wherein the application is configured to allow an end user[2] to add content to modify the photo"

73.   Lee teaches a photo application that allows the end user to add content to the photo. Specifically, Lee discloses that its decorating function allows the user to selection a specific function to modify a photo. As Lee explains, "[i]n order to edit pictures or photos using a mobile phone and use them as photo mail, it is possible to configure a 'decorating' function in the menu so that the user can select it from the menu." Ex. 1005 [Lee], 6:19-22. Lee also explains that "alternatively, it is possible to provide a separate dedicated key button on the keypad of the mobile phone." Ex. 1005 [Lee], 6:19-22. Figure 4, shown below, illustrates a flow chart showing the process of editing a photo. Ex. 1005 [Lee], 6:17-18. Lee explains that "[w]hen the user selects the decorating function menu on a mobile phone (step S400), a picture selection screen showing a list of pictures that the user can select is displayed on the screen." Ex. 1005 [Lee], 7:7-8.

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[2] For purposes of my Declaration, I have interpreted "end user" in this claim to refer to the "user" of claim 60.

Figure 4
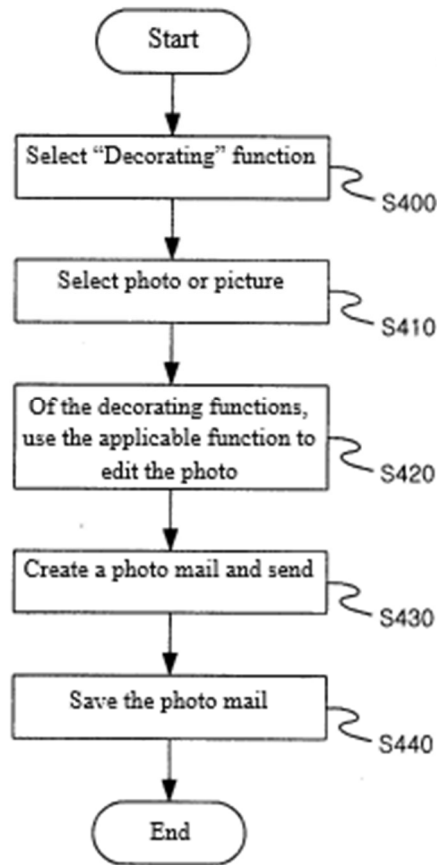
74.   Figure 5b, shown below, provides an example of the decorating function screen. On this screen, "the user selects the name of the picture that he or she wants to decorate (step S410)." Ex. 1005 [Lee], 7:9-10. "This example shows an example in which 'My Picture' (510) containing the user's image is selected." Ex. 1005 [Lee], 7:10-11. Lee's decorating function is shown in its various figures, reproduced below.

Figure 5a

Create a new photo mail

1 With a new photo
2 With my own photo
3 ▮▮▮▮

500

Select OK

Figure 5c

Decorating

1 Flip the screen
2 Angle rotation
3 Add a border
4 Overlap a different picture
5 ▮▮▮▮▮▮▮▮▮
6 Reduce or enlarge the original
7 Copy to several pictures
8 Enlarge or reduce a certain area

Figure 5b

Select photo

1 ▮▮▮▮
2 My love
3 Puppy

510

Select OK View

Figure 5d

Overlap a message on top of the photo

Picture

Write the message to overlap

Fall is over!

Cancel Select OK

75.   As shown in Figure 5c, Lee includes numerous options for the
Decorating function.   For example, Lee further explains "a few of" the
representative functions of the "decorating function":

> "screen flipping, which allows the user to rotate the photo screen 180
> degrees; angle rotation, which allows the user to rotate the photo by
> setting an angle; **border adding, which allows the user to decorate
> the edge of the photo in a certain shape**; **overlap, which allows
> the user to overlap another picture on top of the photo;
> overlapping a message on top of the photo, which allows the user
> to insert a desired message on top of the photo**; reducing and
> enlarging the original, which allows the user to reduce or enlarge the
> size of the photo; copying a photo to multiple pictures, which allows

39

the user to copy a photo to more than one picture; and enlarging and reducing a specific area, which allows the user to enlarge or reduce only a certain area of the photo…"

Ex. 1005 [Lee], 7:15-23, claim 3.

76.   Reviewing the above Lee disclosures, a POSITA would understand that the representative functions of "border adding," "overlap" of images, and "overlapping a message" all disclose that Lee's program is also "configured to allow an end user to add content to modify the photo" as recited in claim 61. For example, "border adding" would add a border (where the border is content) to the photo to modify the photo. The image overlap function allows the user to add another image as content to the photo to modify the photo. And likewise, adding a message allows adding text as content to the photo to modify the photo.

77.   Accordingly, Lee discloses or renders obvious "the application is configured to allow an end user to add content to modify the photo" as recited.

2.   Claim 62: "wherein the content includes text"

78.   As detailed in the analysis of claim 61, above, one of the representative functions of Lee's decorating functionality includes "overlapping a message on top of the photo, which allows the user to insert a desired message on top of the photo." Ex. 1005 [Lee], 7:18-20, claim 3. Lee further explains that "[o]n the editing screen, the user can write or load a desired message and add it to the photo." Ex. 1005 [Lee], 7:27-28. To do so, the application "plac[es] the picture

screen at the top and the message writing screen at the bottom, so that the user can write a message directly or load an existing message." Ex. 1005 [Lee], 7:28-8:1.

Figure 5c

Decorating

1 Flip the screen
2 Angle rotation
3 Add a border
4 Overlap a different picture
5
6 Reduce or enlarge the original
7 Copy to several pictures
8 Enlarge or reduce a certain area

Figure 5d

Overlap a message on top of the photo

Picture

Write the message to overlap

Fall is over!

Cancel   Select OK
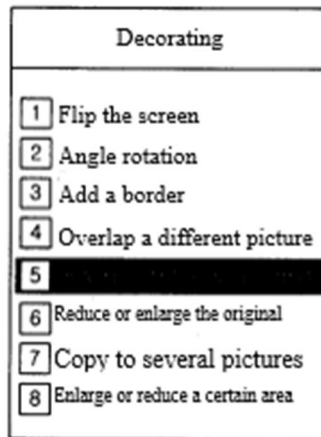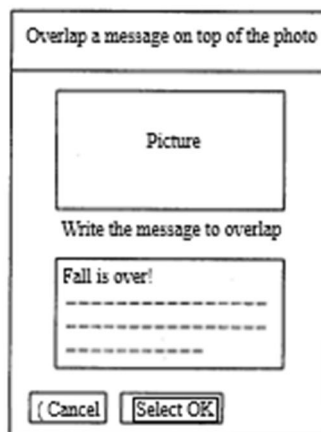
79.   As shown in Figure 5d, the functionality of overlapping a message on the photo adds text to the photo. Accordingly, Lee teaches a user selecting a desired photo, writing or loading a desired message with text, and adding it to the

selected photo, which discloses or renders obvious the limitation of claim 62,
"wherein the content includes text."

3. Claim 63: "wherein the text includes a caption"

80. As detailed in the analysis of claim 62, Lee's decorating functionality
provides the ability for the user to overlap "a message on top of the photo, which
allows the user to insert a desired message on top of the photo" and an editing
screen for doing so. Ex. 1005 [Lee], 7:18-20. Lee further contemplates that adding
the message to the photo "can be done by placing the picture screen at the top and
the message writing screen at the bottom, so that the user can write a message
directly or load an existing message." Ex. 1005 [Lee], 7:27-8:2.

Figure 5c	Figure 5d	Figure 6
Decorating	Overlap a message on top of the photo	Create a photo mail
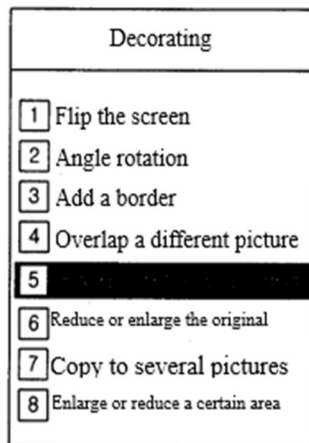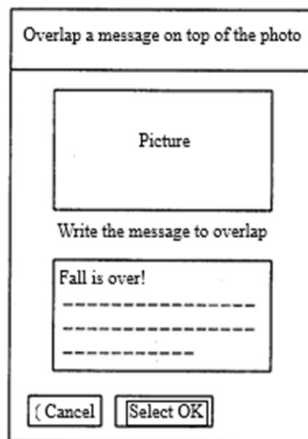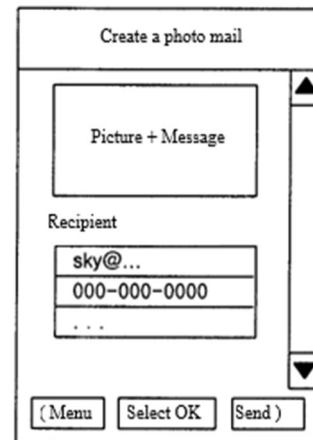
81. The '192 patent does not define what is meant by a "caption."
However, a POSITA would have understood this term according to its common

usage; for example, Webster's dictionary provides a definition of a caption as "1. a title or explanation for a picture or illustration … 3 … the title of a scene, the text of a speech, etc. superimposed …" Ex. 1020 [Webster's], p. 311.

82.   Based on this definition, a POSITA would have understood Lee's disclosure of adding or overlapping a text message to a photo and the ability to write a message below a photo to disclose or render obvious that "the text includes a caption" as recited.

4.   Claim 64: "wherein the content includes an image"

83.   As also mentioned above, one of the representative functions of Lee's decorating function includes a functionality allowing "the user to overlap another picture on top of the photo." Ex. 1005 [Lee], 7:18, claim 3.

Figure 5c
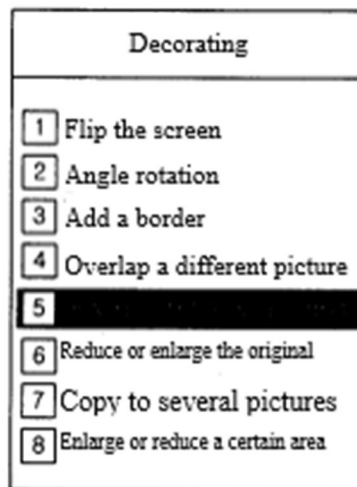
84. Lee's disclosure of functionality to overlap a photo with a different picture teaches that the content added to the photo includes an image for a POSITA. Thus, Lee discloses or renders obvious the limitations of claim 64.

     5.   Claim 65: "wherein the application is configured to allow an end user[3] to distribute the modified photo through a server or other connection to the internet."

85. Lee's program "supports configuring a photo or picture as a photo mail" and discloses a photo mail writing screen in Figure 6 below. Ex. 1005 [Lee], 1:20-24. Lee also further discloses, within the photo mail writing screen, a user being able to write an additional message or "complete the photo mail writing by simply entering the recipient's email or phone number, and when the second command is executed, the photo mail is sent to the other party (step S430)." Ex. 1005 [Lee], 8:5-7.

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[3] For purposes of my Declaration, I have interpreted "end user" in this claim to refer to the "user" of claim 60.

Figure 6

86. Lee further explains that "a photo mail is transmitted to the corresponding browser (360) through a communication network (350)" and "[t]he communication network (350) consists of a mobile phone operator's network or a wired network." Ex. 1005 [Lee], 6:8-11, *see also* 1:19-20, 1:24-26. Lee additionally discloses using a Wireless Application Protocol ("WAP") server to transmit data to a browser on the client side of the Internet. Ex. 1005 [Lee], 6:4-8. A POSTIA would understand that Lee teaches distributing (e.g., sending a photo) through a server or other connection to the internet (e.g., communication network and WAP server).

Figure 3
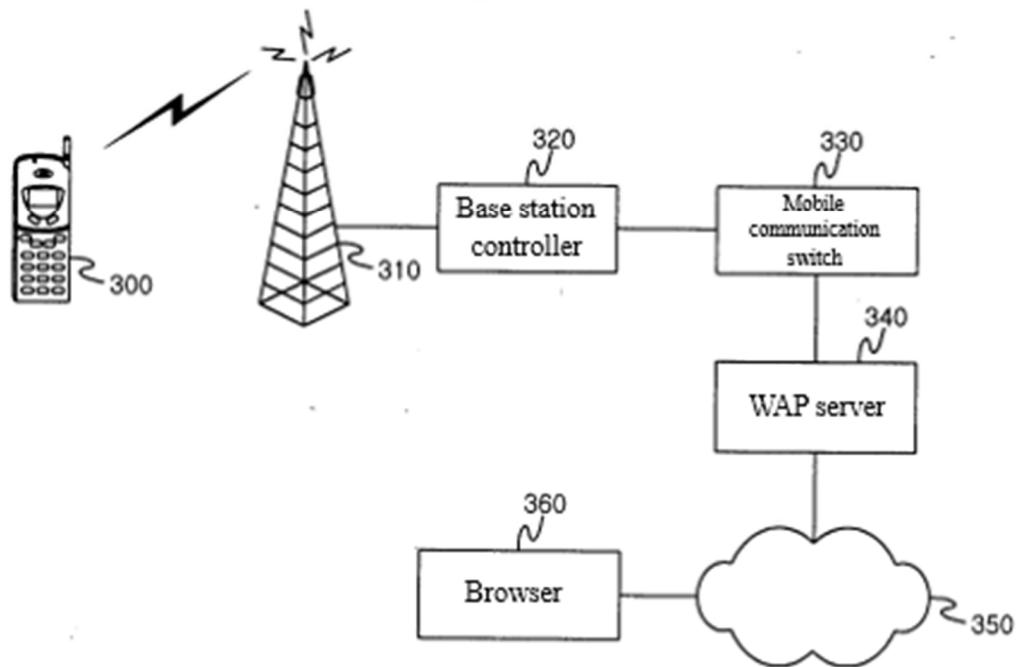
87.   Lee's description of using the application to send the edited photo through a photo mail via a communication network and through a WAP/Internet server discloses and would have rendered obvious that its "application is configured to allow an end user to distribute the modified photo through a server or other connection to the internet" as recited in claim 65.

VIII. Ground 1B: Claim 66 is unpatentable over Lee in view of Jiang

88.   As set forth below, it is my opinion that claim 66 would have been rendered obvious by the combined teachings of Lee and Jiang, and that a POSITA would have been motivated to combine the teachings of Lee and Jiang.

A. Overview of Jiang

89. I have been informed by Counsel that U.S. Publ. No 2005/0102638 to Jiang ("Jiang") would at least be § 102(a) prior art because it was published May 12, 2005, prior to the earliest priority date of the '192 patent.

90. Jiang teaches a system for navigating photos in mobile applications. Specifically, Jiang describes manipulating (e.g., moving and rearranging) images on the display of a mobile device and discloses the involvement of a server in communication link with a plurality of mobile devices. Ex. 1007 [Jiang], [0007]-[0008]. Jiang also discloses a method for providing image movement on a display by click and drag navigation, utilizing placeholders in the memory of the mobile device. Ex. 1007 [Jiang], [0009]. Jiang's system seeks to address the limited memory capacity of mobile devices and improve the range of image viewing and web browsing capabilities with minimal impact on the resource consumption of the device. Ex. 1007 [Jiang], [0006].

91. Jiang is analogous art to the '192 patent, as it also discloses mobile device applications. *See* Ex. 1007 [Jiang], [0002].

B. Motivation to Combine

92. At the time of the '192 patent, consumers were becoming increasingly reliant on the usage of mobile devices as well as appreciative of image viewing and Web browsing capabilities of these mobile devices. For example, in 2005,

researchers at Hewlett-Packard and Microsoft published a paper titled "The Ubiquitous Camera: An In-depth Study of Camera Phone Use," detailing the industry's hopes that "'picture messaging' using mobile phones with integrated cameras will establish photographic images as a new genre in mobile communication." Ex. 1028 [Kindberg], p. 1. With the increased reliance on mobile devices and their associated features, a POSITA would have had the motivation and desire to improve a mobile device's user experience and user interface by providing a streamlined process to manage (e.g., move and rearrange) photos and images using the mobile display as well as within various mobile applications to increase application utility and usage. Indeed, researchers conducted interviews with camera phone users in the United States and United Kingdom to "examine[] the whole range of activities that constitute camera phone usage with an eye to the design of future technologies." Ex. 1028 [Kindberg], p. 2. One implication from the study is that "Better Tools for Deleting and Archiving" photos would be helpful because "users tended to have many images on their phones that they would delete if they had time." Ex. 1028 [Kindberg], p. 9. Kindberg summarized that this meant there was a "need for quicker and easier tools to help people sift through and delete or archive camera phone images." Ex. 1028 [Kindberg], p. 9.

93. Based on this knowledge in the art, a POSITA would have recognized and appreciated the teachings of Jiang as a potential way of improving on prior image viewing and web browsing capabilities, and would have been motivated to incorporate Jiang's teachings of manipulating images on the mobile display as well as Jiang's "backup and restore concept." Ex. 1007 [Jiang], [0008]. A POSITA would have been motivated to improve Lee's photo modification application with Jiang's image manipulation capabilities, including its backup/upload capabilities. Jiang acknowledges that "the advanced display capabilities of mobile devices lack certain user interface features" and thus proposes "ways to improve the range of image viewing and web browsing capabilities with minimal impact on" resource consumption within mobile devices. Ex. 1007 [Jiang], [0005]-[0006]. This motivation would have also been apparent with the continuously increasing amount of data for mobile devices and applications, where such data can consist of images and photos. Thus, a POSITA would have been motivated to combine the teachings of Jiang to improve image and photo viewing capabilities on mobile devices.

94. Further, Jiang teaches that, with the capabilities added by its teachings (in particular, its upload capabilities), "users can capture photo images in their mobile devices, store and manipulate the captured images, and upload data of the captured images to a server (e.g., server 18)." Ex. 1007 [Jiang], [0025]. In this

way, the "server 18 operates as a repository for the data of photo images" which enables "[p]hotos resident on one mobile device [to be] shared with another." Ex. 1007 [Jiang], [0025]. A POSITA would have recognized that incorporating the teachings of Jiang and providing the ability for Lee's users to "upload data" of modified images (consistent with Jiang's teachings of manipulated images) would have been desirable, given the knowledge in the art (e.g., as demonstrated in Kindberg) that sharing images was common prior to the '192 patent, but that barriers existed to sharing images. Ex. 1028 [Kindberg], p. 7. A POSITA would have recognized that incorporating Jiang's teachings of providing a server to upload images for sharing serves as a way of addressing these barriers to sharing. Additionally, Kindberg teaches that users desired an ability to "keep images … long term" including on the web (Ex. 1028 [Kindberg], p. 4), and Jiang's teachings provide this capability, further motivating the combination of Lee's teachings with Jiang.

95. Also, a POSITA would have had a reasonable expectation of success in improving Lee's mobile application which enables a user to modify a photo using Jiang's image viewing capabilities and functionalities, including its upload functionality. Jiang teaches its techniques "can be implemented in various applications" and its application runs "on a mobile phone, and more specifically, a mobile camera phone" (Ex. 1007 [Jiang], [0022]) just like Lee's device, and

therefore, adding Jiang's techniques to mobile devices and applications, like the application of Lee, would have been nothing more than routine software development for a POSITA motivated to address the increasing user demand for more efficient image manipulation and viewing on mobile devices and applications and archiving/sharing functionality. Thus, implementing Jiang's teachings on a mobile device like Lee's would have been both obvious and merely consist of routine software development for a POSITA to increase the overall utility of mobile devices and applications for mobile users.

C. Dependent claim 66

1. Claim 66: "wherein the application is configured to allow an end user[4] to manage or update the modified photo or photo application through a server or other connection to the internet"

96. Jiang teaches that "users can capture photo images in their mobile devices, store and manipulate the captured images, and upload data of the captured images to a server." Ex. 1007 [Jiang], [0025]. Jiang also teaches that the user may manipulate photo images on the mobile phone by selecting the "online album" option on the phone. Ex. 1007 [Jiang], [0046]. The "online album" option "allows the user to access and manipulate photo images that have already been uploaded to

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[4] For purposes of my Declaration, I have interpreted "end user" in this claim to refer to the "user" of claim 60.

the server from the user's PC or mobile phone and stored in the online album." Ex. 1007 [Jiang], [0046]. As Jiang explains, this "online album is dynamically rendered within the client (Mobile device) based on the client-server interactions (i.e., photos are pulled from the server dynamically and placed in the online album)." Ex. 1007 [Jiang], [0046].

97. Jiang further teaches that after the user selects "online album," the user is shown a page that "lists the names of photo albums available to the named user which are associated with the user's account." Ex. 1007 [Jiang], [0048]-[0049]. Figure 4A illustrates the screen flows for the user. The list shown to the user includes "only albums that are on the server and can be dynamically pulled from it." Ex. 1007 [Jiang], [0049]. Once the user selects a photo, it may be opened or other actions can be invoked. *Id.* These actions may include "'save to mobile,' 'email photo,' 'screen saver,' 'thumbnails,' 'online albums,' and 'home,'" are available through a menu. Ex. 1007 [Jiang], [0049]-[0054].

98. Jiang explains that "thumbnails" will "show[] a group of thumbnail photo images from the selected album." Ex. 1007 [Jiang], [0051]. "The user can then move between the images back and forth (scroll back and forth) and select any one of the photos in the 'thumbnails' page." Ex. 1007 [Jiang], [0051]. When a user selects the "save to mobile," "it causes the selected photo image (previously downloaded from the server) to be saved in the mobile album on the mobile

phone." Ex. 1007 [Jiang], [0052]. Jiang also explains that the "email photo" function "shows the photo(s) selected for emailing and prompts the user for the email address." Ex. 1007 [Jiang], [0053]. When the "screen saver" is selected, "the selected photo will be used to populate the screen when the phone is idle, standing by, or starting up." Ex. 1007 [Jiang], [0054].

99. If the user selects "mobile album," it "allows the user to access to manipulate photo images that have been already downloaded from the server and saved in the mobile album." Ex. 1007 [Jiang], [0047], [0055]. Similarly, the user is presented with "two action means, 'open' and 'action.'" Ex. 1007 [Jiang], [0056]. Jiang explains that these actions include "'slide show,' 'move,' 'delete photo,' 'delete all' (photos), 'thumbnails,' 'history,' and 'home.'" Ex. 1007 [Jiang], [0056]-[0061]. Jiang further explains that the "move" function allows the user to "rearrange the photos using the 5-point navigation key, as well as choose to drop a photo or save it." Ex. 1007 [Jiang], [0059]. Based on these teachings, a POSITA would understand that Jiang teaches an application "configured to allow an end user to … manage or update the modified photo … through a server" as recited. For example, in the combination, a photo, edited/modified as taught by Lee, would be uploaded to a server as taught by Jiang and managed or updated (e.g., moved, deleted, etc.).

100. Jiang teaches that the server "operates as a repository for the data of photo images, and users can download from the server to their mobile devices data of previously capture photo images, as well as store and manipulate such images." Ex. 1007 [Jiang], [0025]. As shown in Figure 1, the wireless mobile devices are connected to the server via the Internet. Ex. 1007 [Jiang], Fig. 1, [0024]. Jiang explains that the mobile devices in the system are WAP-enabled and the server supports the world wide web protocol. Ex. 1007 [Jiang], [0026]-[0032]. Additionally, Jiang teaches that the program provides the ability to "push and pull information via the Internet" including photos. Ex. 1007 [Jiang], [0024]; see also [0046] ("live online connection"). Thus, Jiang teaches an application "configured to allow an end user to manage or update the modified photo … through [an] … other connection to the internet."

FIG. 1
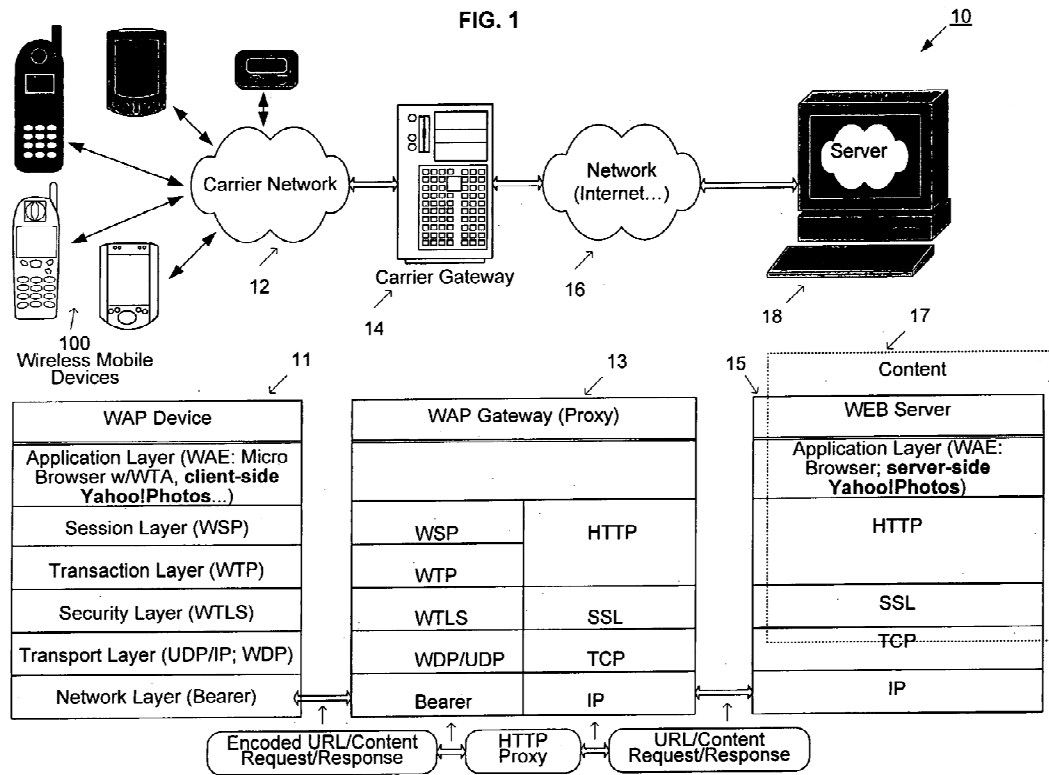
101. Based on the above disclosures, Jiang renders claim 66 obvious, and a POSITA would have had the motivation to combine Jiang and Lee to allow an end user to manage or update the modified photo or photo application through a server or Internet connection as mere routine software development and a necessary improvement to maximize mobile utility for everyday mobile users (*see also* VIII.B on Motivation to Combine).

IX. Ground 1C: Claims 67-69 are unpatentable over Lee in view of Tran

102. As set forth below, it is my opinion that claims 67-69 are rendered obvious by the combined teachings of Lee and Tran, and that a POSITA would have been motivated to combine the teachings of Lee and Tran.

A. **Overview of Tran**

103. I have been informed by Counsel that U.S. Publ. No 2006/0015404 to Tran ("Tran") would at least be § 102(e) prior art because Tran's filing date of May 31, 2005 pre-dates the earliest priority date of the '192 patent.

104. Tran discloses a consumer purchasing behavior profiling system in which consumer profiles are created based on various data points, including demographic data, lifestyle affinity, brand affinity, product preferences, real-time responses to advertising messages, price sensitivity, and market trends. Ex. 1008 [Tran], [0018]. As relevant to challenged claims 67-69, Tran teaches that advertisers "send targeted advertising messages to the consumers" on "wireless devices." Ex. 1008 [Tran], Abstract, [0019].

105. As such, Tran is analogous art to the '192 patent, as it is also in the same field of endeavor of mobile device applications. *See* Ex. 1008 [Tran], [0053] ("application … can be a small program that can be deployed onto the mobile phones").

B. **Motivation to Combine**

106. Before the '192 patent, a POSITA would have recognized that targeted advertisements within mobile devices and applications were already gaining widespread traction and support, and thus a POSITA would have been motivated to incorporate targeted ads within a mobile application, such as the

mobile application taught by Lee. Based on Tran's teachings, a POSITA would have recognized the numerous benefits of targeted ads in mobile devices and applications and thus would have been motivated to incorporate Tran's teachings of mobile targeted advertising on both mobile devices and within applications. Accordingly, a POSITA would have been motivated to improve Lee's mobile photo editing application with Tran's targeted advertising capabilities.

107. With the implementation of mobile targeted advertising on mobile devices and applications, a POSITA would have been motivated to naturally consider generating revenue through mobile webpages or applications, particularly through targeted mobile ads. Furthermore, with targeted advertising, it would have been obvious for a POSITA to consider the marketing of specific brands through mobile ads to generate various revenue streams. Implementing targeted ads in mobile devices and applications to generate revenue streams (also with the incorporation of brand marketing capabilities) would have been both obvious and mere routine software development for a POSITA. Specifically, as Tran teaches, "advertising messages on wireless devices can be fine tuned so that they are relevant, personalized, and anticipated to the individual consumers" (Ex. 1008 [Tran], [0019]) and thus a POSITA would have recognized an explicit benefit and motivation to incorporate Tran's teachings of displaying advertisements on mobile phones, such as the mobile phone of Lee. Further, combining the teachings of

Tran's mobile cookie application and mobile advertising application, which displays advertisements on a user's mobile device (*see, e.g.*, Ex. 1008 [Tran], [0122]), with Lee's mobile phone would have been nothing more than combining these known prior art elements by known methods (e.g., software programming to add Tran's advertising functionality to Lee's code) to yield the predictable result of a mobile phone with software capable of displaying advertisements.

108. Finally, a POSITA would have reasonably expected to succeed in improving mobile applications (such as Lee's mobile application which enables a user to modify a photo) through routine software development with the incorporation of Tran's targeted advertising and consumer profiling system capabilities. For example, a POSITA would have recognized the modification as involving nothing more than routine software programming, within the level of skill in the art, to incorporate code corresponding to the mobile cookie application functionality taught by Tran within the code of Lee's mobile application.

C.   Dependent claims 67-69

1.   Claim 67: "wherein mobile revenues are created using the modified photo or application"

109. Tran teaches a consumer purchasing behavior profiling system on mobile devices that enables advertisers to send targeted advertising to consumers. Ex. 1008 [Tran], [0018]. Tran acknowledges the "[r]ecent advancement of wireless devices such as mobile phones" and that "advertising messages on

58

wireless devices can be fine tuned so that they are relevant, personalized, and anticipated to the individual consumers." Ex. 1008 [Tran], [0019].

110. Tran's system includes a "Membership Service Provider," which is "the entity providing service of distributing electronic coupons, discount offers, advertising messages, and ticket information to consumers." Ex. 1008 [Tran], [0024]. The relationship between the consumer, membership service provider, retailers, and other service companies is illustrated in Tran's Figure 1. Ex. 1008 [Tran], Fig. 1, [0021]-[0025]. Tran explains that the process works with the consumer submitting personal profile data, the service companies and retailers creating incentive programs, the membership service providing the advertisements to consumers, the consumers purchasing products or redeeming coupons, and the service providers reimbursing the retailers and membership service providers. Ex. 1008 [Tran], [0026]-[0044]. The membership service provider creates revenue through a mobile application using Tran's system. Ex. 1008 [Tran], [0044].

111. Tran also discloses a "**mobile application suite**" with various applications and that the wireless ticket distribution and redemption system provides important benefits such as "**revenue recovery** from potentially unsold tickets" and "venue sponsors to launch more personalized incentive programs," maximizing "profit margins." Ex. 1008 [Tran], [0090], [0116].

112. In one implementation of Tran's system, Tran describes a mobile cookie application for implementing advertisements in a nonintrusive manner. Ex. 1008 [Tran], [0045], [0080], [0117]-[0119], [0122], Figs. 2, 7, and 8. Specifically, Tran's "Mobile Cookie application 848" includes a "Mobile Advertising application 850" within the user's mobile phone that "displays [an] ad." Ex. 1008 [Tran], [0121]. Figure 8 illustrates the "Mobile Cookie application 848," which resides on the SIM card 872 of a mobile phone. Ex. 1008 [Tran], Fig. 8, [0117]-[0140].
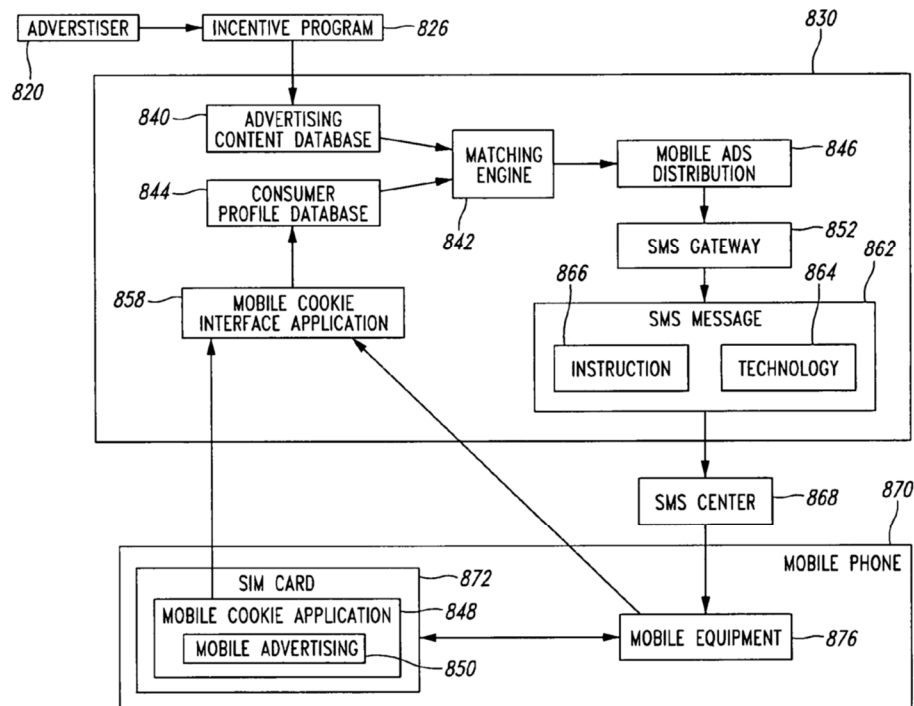
Fig. 8
MOBILE COOKIE APPLICATION

113. The mobile cookie application 848 registers with the mobile phone's operating system and requests it "to forward all messages with specific headers

and/or message types to the Mobile Cookie application 848." Ex. 1008 [Tran], [0121]. When the membership service sends an ad, as described by the process in Figure 1, the mobile phone's operating system recognizes the message is for the mobile cookie application. Ex. 1008 [Tran], [0122]. The application then launches the "Mobile Advertising application 850" if the user is not using the mobile phone. Ex. 1008 [Tran], [0122]. The Mobile Advertising application also determines which technology was used to send the ad and then follows the instructions for retrieving and displaying the ad. Ex. 1008 [Tran], [0122].

114. Tran explains that once a user receives an advertising message, the system sends data about the consumer to the advertisers and manufacturers. Ex. 1008 [Tran], [0059]-[0060], [0067], [0098], [0102]-[0104]. The advertisers and manufacturers in turn pay the membership service provider "for the services associated with distributing and clearing redeemed coupons." Ex. 1008 [Tran], [0067], *see also id.* [0104]. Tran also describes important benefits of such mobile applications, including "revenue recovery from potentially unsold tickets" and "venue sponsors to launch more personalized incentive programs," maximizing "profit margins." Ex. 1008 [Tran], [0116].

115. A POSITA would have recognized that displaying (targeted) advertisements on mobile phones generates revenue for at least the party providing the advertisement display facility (e.g., the provider of Tran's mobile cookie

application and mobile advertising application) and resources to display ads from the advertiser. It is a well-known concept that providing advertising space (e.g., billboards, radio advertising opportunities, television advertising opportunities) generates revenue for the party providing the display facility (e.g., the company owning the billboard, the radio station, or the television station in the above examples). This concept is also explicitly discussed, for example, in Reyck, which details a "broadcast scheduling system developed for a precision marketing firm" that sought to "maximiz[e] customer response and revenues from retailers paying for each ad broadcast." Ex. 1016 [Reyck], 509.

116. Thus, by teaching a mobile device application that displays ads, which a POSITA would have recognized as creating revenue, a POSITA would have been motivated and found it obvious to combine the teachings of both Lee and Tran to render obvious that "mobile revenues are created using the modified photo or application" as recited in claim 67.

2. Claim 68: "wherein the revenues include ads"

117. As described above for claim 67, Tran teaches a consumer purchasing behavior profiling system on mobile devices that enables advertisers to send targeted advertising to consumers. Ex. 1008 [Tran], [0018]. The membership service provider sends an ad, such as a coupon or incentive program, to the mobile phone, and returns consumer data in exchange for payment. Ex. 1008 [Tran],

[0026]-[0044]. When the ad is sent, a mobile cookie application stored on the mobile phone, retrieves and displays the advertisements on the consumer's mobile phone. Ex. 1008 [Tran], Fig. 8, [0117]-[0140]. The ad may be sent via Short Message Service (SMS), Multimedia Messaging Service (MMS), Java 2 Platform Micro Edition (J2ME), Binary Runtime Environment for Wireless (BREW), Wireless Application Protocol (WAP), and WAP Push. Ex. 1008 [Tran], [0122]-[0123].

118. Tran discloses that "it is advantageous to have the ability to display an ad on the consumers' wireless communication devices without requiring the consumer to initiate the ad viewing process and to observe in real-time the consumers' responses to the **targeted ads**." Ex. 1008 [Tran], [0118]. Tran also further contemplates the recent advancement of mobile phones and that "advertising messages on wireless devices can be fine tuned so that they are **relevant, personalized, and anticipated** to the individual consumers." Ex. 1008 [Tran], [0019]. Finally, Tran discloses that the redemption system provides important benefits such as "**revenue recovery** from potentially unsold tickets" and "venue sponsors to launch more personalized incentive programs," maximizing "**profit margins**." Ex. 1008 [Tran], [0116].

119. Tran explains that once a user receives an advertising message and redeems or purchases items, the system sends data about the consumer to the

advertisers and manufacturers. Ex. 1008 [Tran], [0059]-[0060], [0067], [0098], [0102]-[0104]. The advertisers and manufacturers in turn pay the membership service provider "for the services associated with distributing and clearing redeemed coupons." Ex. 1008 [Tran], [0067], *see also id.* [0104].

120. Based on the above disclosures Tran teaches that "revenues include ads" as recited in claim 68.

3. Claim 69: "wherein the revenues include brand marketing"

121. Tran discloses a consumer purchasing behavior profiling system where consumer profiles are created based on various data points, including "**brand affinity**" and that this brand affinity "can include names of products and/or manufacturers that the consumers want to receive advertising messages from." Ex. 1008 [Tran], [0118], [0047]. Also, Tran further contemplates the recent advancement of mobile phones and that "advertising messages on wireless devices can be fine tuned so that they are relevant, personalized, and anticipated to the individual consumers." Ex. 1008 [Tran], [0019]. The membership service provider sends an ad, such as a coupon or incentive program, to the mobile phone, and returns consumer data in exchange for payment. Ex. 1008 [Tran], [0026]-[0044]. The membership service provider constructs "personalized advertising messages" based on the consumer who will receive the coupon. Ex. 1008 [Tran], [0059], *see also id.* [0052], [0088], [0127]-[0128].

122. Tran explains that once a user receives an advertising message and redeems or purchases items, the system sends data about the consumer to the advertisers and manufacturers. Ex. 1008 [Tran], [0059]-[0060], [0067], [0098], [0102]-[0104]. The advertisers and manufacturers in turn pay the membership service provider "for the services associated with distributing and clearing redeemed coupons." Ex. 1008 [Tran], [0067], *see also id.* [0104].

123. Tran additionally discloses that the redemption system provides important benefits such as "**revenue recovery** from potentially unsold tickets" and "venue sponsors to launch more personalized incentive programs," maximizing "profit margins." Ex. 1008 [Tran], [0116]. It is a well-known concept that companies advertise to gain exposure for their brands, and thus a POSITA would have recognized brand marketing as a common method for generating revenue.

124. Based on the above, a POSITA would have recognized that Tran teaches that "revenues include brand marketing" as recited in claim 69.

X. Ground 2A: Claims 60-65 are unpatentable over Lee in view of Poulin-910

125. For the reasons discussed below, it is my opinion that claims 60-65 of the '192 patent would have been obvious to a POSITA in view of the combined teachings of Lee and Poulin-910.

126. As detailed above, I have been informed by Counsel of the written description standard in patent law. I have been informed that a patent's priority

applications must contain sufficient disclosures consistent with the written description standard to support the claims of the later patent for that later patent to claim the benefit of the filing date of the earlier priority applications.

127.   I understand that the '192 patent issued from U.S. Application No. 13/673,692 (the "'692 application"), filed November 9, 2012. I understand that the '692 application was a continuation of U.S. Application No. 12/759,543, filed April 13, 2010, which in turn was a continuation of U.S. Application No. 11/449,958, filed June 9, 2006. The '692 application further claims priority to an earlier provisional application filed on June 10, 2005.

128.   I understand this means that, for those claims of the '192 patent for which written description support appears in the '543 application or an earlier application, the claims of the '192 patent are considered to have been filed on the filing date of that earlier application for the purposes of determining, as to those claims, whether a reference will qualify as prior art.

129.   I also understand that, for any claims of the '192 patent for which written description support ***does not*** appear in the earlier application (such as the '543 application), the '192 patent is not considered to have been filed on the date of the earlier application's filing. Thus, depending on the adequacy of written description support for any particular claim, the effective filing date for that particular claim may be as early as June 9, 2006 (i.e., the filing date of the '543

application or earlier, e.g., June 10, 2005), or as late as November 9, 2012, the filing date of the '692 application that issued as the '192 patent.

130. I understand that claims 60-69 of the '192 patent are being challenged in this inter partes review, with claim 60 being the independent claim. I have reviewed claim 60 and the '543 application to determine whether the claims of the '192 patent have written description support in the '543 application. In view of the limitations recited in independent claim 60, it is my opinion that independent claim 60 recites subject matter that is not expressly disclosed, and is not reasonably conveyed, by the '543 application.

131. I understand that this means that the '192 patent is only entitled to its actual filing date of November 9, 2012. I understand that this means that Poulin-910 qualifies as prior art to the '192 patent.

A. The '192 patent's claims are not supported by its parent, the '543 Application

132. As previewed above, I have been informed by Counsel that a patent's ancestor application must contain sufficient disclosures to support the claims of the patent. As I explained in the Legal Understanding section near the beginning of this declaration, a claim has sufficient written description support when the disclosure (including the as-filed claims) would have reasonably conveyed to a POSITA that the inventor was in possession of the claimed subject matter as of the filing date.

133. Claim 60 of the '192 patent recites an "application configured to enable a user to modify a photo on the mobile device." *See* Ex. 1001 ['192 patent], Claim 60. The dependent claims 61-69 recite further features of the application, including adding content (e.g., text, an image) to the photo, distributing the modified photo, managing or updating the modified photo or photo application, or creating mobile revenues. *See* Ex. 1001 ['192 patent], Claims 61-69.

134. For the reasons discussed below, it is my opinion that the '543 application (including its as-filed claims), which is the '192 patent's immediate parent, lacks the disclosure necessary to support the claims of the '582 patent.

135. All of the '192 patent's challenged claims require an "application configured to enable a user to modify a photo on the mobile device." *See* Ex. 1001 ['192 patent], Claim 60. The '543 application lacks any disclosure of such an application.

136. The '543 application describes a system and method for developing a mobile application, where the application may be a frame based application. Ex. 1004 ['543 App.], [0024]. The system comprises an emulator implemented on a computer for testing the developed frame based applications on an emulated mobile device. Ex. 1004 ['543 App.] [0024]-[0028]. However, the '543 application does not provide any specific examples of the frame based applications that are developed using the emulator. That is, the '543 application fails to provide

any specific examples of frame based applications that are developed using the disclosed emulator in the '543 application. In particular, as relevant to the limitations recited in the challenged claims, the '543 application does not describe or provide written description support for, or reasonably convey to a POSITA possession of, the development of any application that enables "a user to modify a photo on the mobile device" as required by claim 60.

137. At most, the '543 application states, in one portion, that a frame based application being developed using the emulator may include multiple frames. Those frames may include "graphics and/or action scripts that generate the graphical image for display." Ex. 1004 ['543 App.] [0043]. Additionally, a frame may include "multiple graphic elements and/or action scripts that involve image manipulation (e.g., retrieving data from non-volatile storage, Avatar manipulations, animations, etc.)", that is, the described frame based application with an action script may provide a software author the ability to create moving images within the application. But this does not disclose or reasonably convey to a POSITA possession of providing any ability for a **user** (i.e., a mobile device user) of an application to **modify** a photo, as would be required for written description support of claim 60. Accordingly, it is my opinion that the '543 application does not provide written description support for the full scope of claim 60 of the '192 patent.

138. Additionally, the '543 application does not describe the specific modifications to a photo that the application recited in claim 60 provides (by way of the limitations recited in the dependent claims), including adding content, such as text, a caption, an image, or animation. There is likewise no description of allowing the end user to distribute the modified photo or manage or update the modified photo or photo application through a server or other connection to the internet.

139. The '543 application's as-filed claims do not provide the requisite written description support, either. Those claims instead recite a system and method for emulating an application executing on a mobile device, not a mobile application, let alone a mobile application that enables a user to modify a photo.

140. In sum, nowhere does the '543 application, including its as-filed claims, describe or reasonably convey to a POSITA possession of a mobile application that enables a user to modify a photo, as required by claim 60, and accordingly, claim 60 does not have written description support in the '543 application. Based on this conclusion, it is my understanding that claims 60-69 of the '192 patent are not entitled to claim priority to the effective filing date of the '543 application or any effective filing date any earlier than the filing date of the application that matured into the '192 patent. I understand that this means that the proper priority date of the '192 patent is therefore no earlier than the filing date

of U.S. Application No. 13/673,692 that matured into the '192 patent: November 9, 2012. Accordingly, I understand that Poulin-910 qualifies as prior art and may be used against the '192 patent in an obviousness analysis.

B. Motivation to Combine

141. For the reasons detailed below, it is my opinion that a POSITA would have been motivated to combine the teachings of Lee with those of Poulin-910.

142. As a preliminary matter, Poulin-910, the patent that issued from the earliest non-provisional application in the '192 patent's alleged priority chain, is analogous art to the '192 patent, as both are within the field of endeavor of developing mobile device applications.

143. Lee discloses an application on a mobile device that allows users to modify photos. Ex. 1005 [Lee], 3:24-4:3 ("mobile phone users can edit photos or pictures and send them as photo mail"). However, Lee does not explain how the mobile device application was developed. A POSITA developing software (particularly software for mobile devices) prior to the '192 patent would have been aware of development environments for software, including software development environments for mobile applications, and thus would have been motivated to consider and combine the teachings of Poulin-910 of a software authoring platform which emulates characteristics indicative of performance of a mobile device when executing an application. Further, a POSITA would have recognized that models

for the software development processes included various steps of testing, debugging, and validation, and thus would have combined the teachings of a testing environment for software development (like Poulin-910), when developing a photo modification application like disclosed in Lee.

144. As one example of the well-known nature of software authoring platforms for emulating hardware characteristics indicative of performance of a mobile device when executing an application, in 2005, a professor described his "senior and graduate course on pervasive computing taught at the American University of Beirut" that included "a strong programming component that includes three different platforms for developing mobile applications." Ex. 1010 [Artail], p. 92. Professor Artail described how his course focused on "three integrated development environment (IDE) packages" for various mobile device platforms: "Microsoft's Visual Studio .NET 2003 for developing WinCE applications, Metrowerks' CodeWarrior for developing Palm OS applications, and Sun's Open Network Environment Studio 5 Mobile Edition for developing J2ME applications." Ex. 1010 [Artail], p. 93. The article also noted that "[f]or testing and deployment, students depend mostly on the emulators that come with the three development environments." Ex. 1010 [Artail], p. 93. A POSITA would understand that the state of the mobile application development and testing as of

2005 relied on emulators to test mobile applications as part of developing mobile applications.

145.   As another example of the well-known nature of software authoring platforms for emulating hardware characteristics indicative of performance of a mobile device when executing an application, a 2004 article titled "A development environment for intelligent applications on mobile devices," detailed the challenges and potential solutions when constructing "intelligent systems" and applications … targeted at a range of different mobile devices." Ex. 1011 [Hall], p. 482. The Hall article detailed "a number of applications and environments that have been developed to permit the development of intelligent applications for mobile devices" (i.e., software authoring platforms) that address issues including application "portability across multiple platforms for intelligent applications" using "the use of integrated development environments." Ex. 1011 [Hall], p. 482-483.   The Hall article described an IDE called "MADE … used to construct prototype intelligent systems that are ultimately to be targeted at a range of mobile devices." Ex. 1011 [Hall], p. 485. The article explains that "[o]nce a working intelligent system has been constructed using MADE, target versions of the working software can be generated for a range of mobile devices" and then "tested using an emulator." Ex. 1011 [Hall], p. 486. Thus, the Hall article shows that it

was known for software authoring platforms (e.g., its IDE called MADE) to be used to develop software and known for emulators to be used to test the software.

146. Another researcher, Ichiro Satoh, published a new approach for "testing software designed to run on mobile terminals" in 2004. Ex. 1017 [Satoh], p. 58. Satoh explained that "4G wireless networks make it increasingly difficult to develop and test application software for mobile terminals in comparison with 3G or earlier generations." Ex. 1017 [Satoh], p. 58. In order "[t]o construct correct software to run in mobile terminals for 4G wireless networks and wireless LANs, it must be tested in all the networks to which the terminal could be moved and be connected," Satoh "present[ed] a new approach, called Flying Emulator, to test[] software designed to run on mobile terminals." Ex. 1017 [Satoh], p. 58. The emulator allowed the view of graphical user interface (GUI) data during use of the tested software. Satoh's Flying Emulator uses multiple windows in a graphical user interface to control the emulation and test the software. *See, e.g.*, Ex. 1017 [Satoh], p. 63. Thus, like the articles above, the Satoh article shows that it was known to develop software for mobile devices and test that software using an emulator.

147. Other researchers noted that "[s]oftware development for mobile devices has become very popular in the last few years" and there were "hundreds of programmable micro devices on the market." Ex. 1018 [Young] at Abstract (ii).

There was a desire to "save a great deal of time and effort to program an application in a way that allows it to run on all of these devices without modification." Ex. 1018 [Young] at Abstract (ii). Young "designed and implemented a prototype application in J2ME and tested the execution and build process on a variety of micro devices and emulators." Ex. 1018 [Young], p. 4. Specifically, Young "designed a mobile application": "a photo album (image viewer) appropriate for cellular phones, personal digital organizers or Blackberry devices." Ex. 1018 [Young], p. 11. The application was designed to "run on multiple devices with different variations in API support." Ex. 1018 [Young], p. 11. Young tested one version of its MobilePhoto application "on a number of device emulators from different vendors" including Nokia, Palm, Motorola, and RIM. Ex. 1018 [Young], p. 18. As of 2005, a POSITA would have understood that developing mobile photo applications was well-known and testing such applications was part of the software development process.

148. Based on the above knowledge of a POSITA, it was therefore well-known that, during the software development process for an application for mobile devices, that mobile applications would have been developed for many varying types of mobile devices, and thus it was known and desirable to test the mobile application on multiple types of varying mobile device hardware and characteristics, and to do so using emulators. Indeed, long before the '192 patent,

the computing industry had also sought to develop software applications in a manner than would permit running applications on multiple types of varying devices for maximum compatibility. *See, e.g.*, Ex. 1032 [Curtin], p. 1 (describing the "Write Once, Run Anywhere" philosophy of the Java programming language, which was intended to support development of applications that could run on different types of computers).

149. Consistent with this knowledge in the art, a POSITA would have recognized Poulin-910's software authoring tool as an example similar to the many software development tools available before the earliest effective filing date of the '192 patent that allowed developers to develop mobile applications and test those applications by emulating hardware characteristics of multiple mobile devices to test the applications. Thus, utilizing a software authoring tool like Poulin-910's to develop a mobile application like the application disclosed in Lee would have been nothing more than using or applying a widely known technique (software development tools including the ability for emulating mobile devices) to a known method (e.g., development of mobile device applications, like Lee's mobile device application), which would have improved the process of software development for Lee's mobile applications, and would have resulted in the predictable result of a mobile device application developed using a software development tool with emulation capabilities.

150. A POSITA would have also been motivated to develop Lee's mobile application using Poulin-910's software authoring tool because Poulin-910 provides an express motivation to do so, which would have been known to a POSITA. Poulin-910 acknowledges that "[w]hen an application is targeted to play on many types of mobile device, it must be transferred and tested on a mobile device representative of each targeted mobile device type" but this "transferring and testing process is time-consuming and therefore costly for the application author." Ex. 1009 [Poulin-910], 1:58-62. Poulin-910 purports to provide a solution to this problem, as it teaches a development system whereby "[c]haracteristics for each mobile device to be emulated may be downloaded from a server for a determined price" that would "save each developer purchasing each target mobile device … as well as alleviating the need to travel to a wireless network location whilst testing each mobile device before public release, two substantial development and release costs." Ex. 1009 [Poulin-910], 12:26-43. Poulin-910 also notes that the increase in the numbers of mobile devices "requires that applications designed to run on these mobile devices also sustain rapid development" and provides techniques for such rapid development. Ex. 1009 [Poulin-910], 12:26-43. Thus, a POSITA would have recognized an express motivation to combine Poulin-910's teachings, e.g., reduced software development costs and faster software development.

151. Thus, a POSITA would have recognized that combining Lee and Poulin-910 would have been nothing more than the combination of known prior art elements (Lee's mobile device application and Poulin-910's software development environment for mobile device applications) according to known methods (developing an application using a development environment). Additionally, a POSITA would have recognized an express motivation to combine Poulin-910's teachings in order to streamline and reduce software development costs which would also lead to more efficient, faster (mobile) software development. Finally, a POSITA would have reasonably expected to succeed in developing Lee's mobile application (which enables a user to modify a photo) using the software authoring tool disclosed by Poulin-910, because combining the teachings of Poulin-910 and Lee merely involves applying Poulin-910's widely known software development environment to a particular, well known piece of software, an image modification tool.

C. Independent Claim 60

1. Preamble: "A system comprising"

152. To the extent the preamble is limiting, Lee discloses it for the same reasons detailed above in Section VII.B.1.

2. **Limitation 60[a]: "an application configured to enable a user to modify a photo on the mobile device"**

153.   Lee discloses or renders obvious limitation 60[a] of claim 60 for the same reasons as detailed above in Section VII.B.2.

3. **60[b]: wherein the application is developed using a software authoring platform configured to simultaneously visually emulate, via one or more profile display windows, a plurality of hardware characteristics indicative of performance of the mobile device when executing the application**

154.   As noted above, Lee does not explicitly disclose how its application is developed. However, a POSITA would have combined teachings of a software development environment to develop Lee's application, and in particular, for the reasons stated above, would have been motivated to combine the teachings of Poulin-910's software authoring platform to develop the application of Lee.

155.   Poulin-910 describes developing an application using its software authoring platform. For example, Poulin-910 states that an "[a]pplication 104 may be developed using a frame based application development tool 112." Ex. 1009 [Poulin-910], 3:38-40; *see also* Ex. 1009 [Poulin-910], 3:38-58 (the mobile application is "transferred to emulator 101 for playing within mobile device model 102 to estimate resource usage of application 104 when played on mobile device 114" and the "emulator 101 is integrated with flash development tool 112 to form an authoring environment 122 that facilitates development and testing of

application 104"). Thus, Poulin-910 teaches "the application is developed using a software authoring platform."

156. Next, Poulin-910 teaches emulating "a plurality of hardware characteristics indicative of performance of the mobile device when executing the application." Poulin-910 explains that it provides a "system 100 for emulating and profiling a frame based application 104 playing on a mobile device 114." Ex. 1009 [Poulin-910], 3:19-31. Poulin-910 further states that "Emulator 101 generates a mobile device model 102, based upon mobile device characteristics 115 of mobile device 114." Ex. 1009 [Poulin-910], 3:19-31. The emulator in Poulin-910 also includes "model algorithms 148 [that] define operation of mobile device 114 based upon mobile device characteristics." *Id.*, 4:10-19. Further, Table 1 below includes an exemplary list of characteristics of the mobile device, including processor speed and storage access speed. A POSITA would have recognized at least the mobile device characteristics in Table 1 to teach "hardware characteristics indicative of performance of the mobile device when executing the application" as recited. For example, in Table 1 below, a POSITA would have known that "Processor Speed," "Processor Availability," "RAM Availability, "Storage Availability," and other characteristics would be "indicative of performance of the mobile device when executing the application." *See, e.g.*, Ex. 1019 [Microsoft Computer Dictionary], p. 55 ("benchmark[] n. A test used to measure hardware or software performance.

80

Benchmarks for hardware use programs that test the capabilities of the equipment—for example, the speed at which a CPU can execute instructions….").

TABLE 1

Mobile Device Characteristics

Parameter	Value
Name	NOKIA 3650
Processor	ARM 4T
Processor Speed	104 MHz
Storage Access Speed	5.88 files/second
RAM Size	256 MB
Storage Size	512 MB
Display Width	256
Display Height	394
Pixel Depth	24
Processor Availability	60%
RAM Availability	60%
Storage Availability	40%

157. In addition, Poulin-910 teaches that its software authoring platform is "configured to simultaneously visually emulate, via one or more profile display windows, a plurality of hardware characteristics indicative of performance of the mobile device when executing the application." For instance, Poulin-910 teaches displaying resource utilization of each frame of the application as it is played in real time on the emulated mobile device. Ex. 1009 [Poulin-910], 6:51-65 (explaining that "one or more profiler modules 202, 204, 206 and 208 within profiler 106 monitor resource utilization of each frame, storing results as profiled data 152" which is then "displayed as a frame based profile data 110 on display 140 for review by the user"). For example, in Figure 3, Poulin-910 shows a display

81

with a timeline of the application where each vertical bar indicates resource utilization of the processor of the emulated device. Ex. 1009 [Poulin-910], 6:65-7:22 ("display 300 is shown with a timeline 302 that represents timeline 222 of application 104" and "each bar 304 indicates processor resource utilization for certain frames 223 of application 104").
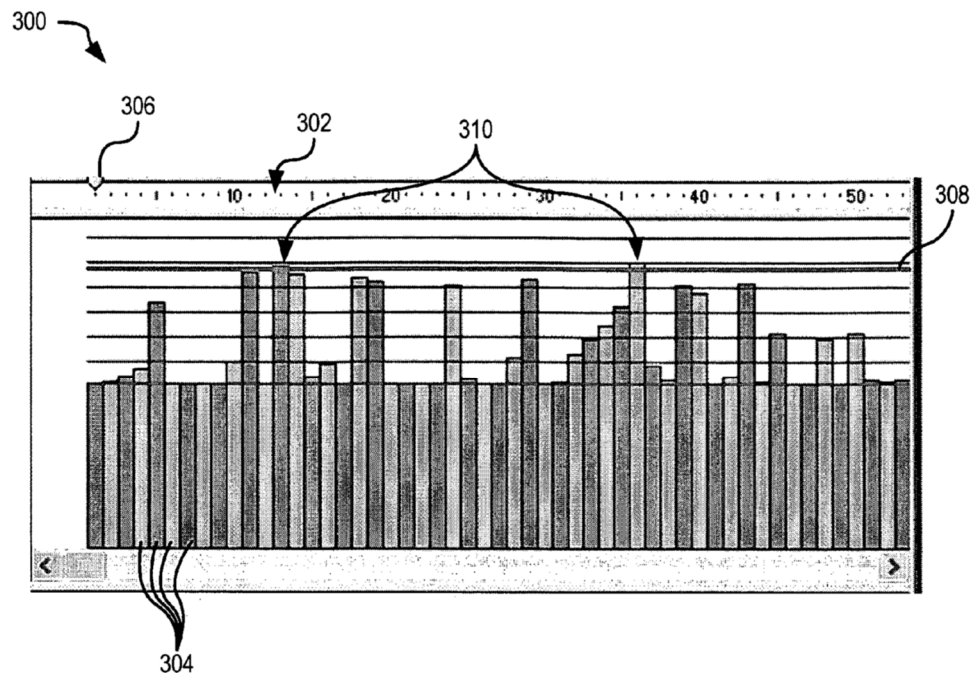
FIG. 3

158. Although Poulin only shows a single "profile display window," it would have been obvious for a POSITA to display multiple such windows to show, for instance, where one window shows the processor performance of the emulated mobile device, and a second window shows the storage performance of the emulated mobile device.

82

159. Accordingly, Poulin-910 teaches an "application" that "is developed using a software authoring platform configured to simultaneously visually emulate, via one or more profile display windows, a plurality of hardware characteristics indicative of performance of the mobile device when executing the application."

160. The combined teachings of both Lee and Poulin-910 therefore render obvious claim 60's limitations as recited.

D.   Dependent claims 61-65

161. Dependent claims 61-65 are disclosed or rendered obvious by Lee's teachings for the same reasons as set forth above in the analysis of Ground 1A.

XI.   Ground 2B: Claim 66 is unpatentable over Lee in view of Poulin-910 and Jiang

162. Claim 66 is rendered obvious by the combined teachings of Lee, Poulin-910, and Jiang for the same reasons as set forth above in the analysis of Ground 1B.

XII.   Ground 2C: Claims 67-69 are unpatentable over Lee in view of Poulin-910 and Tran

163. Claims 67-69 are rendered obvious by the combined teachings of Lee, Poulin-910, and Tran for the same reasons as set forth above in the analysis of Ground 1C.

XIII. CONCLUSION

All statements made herein of my own knowledge are true, and all statements made on information and belief are believed to be true. Further, I am aware that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001. I declare under penalty of perjury that the foregoing is true and correct.

Executed on July 15, 2025, in Barcelona, Spain.

_____

Nenad Medvidovic

EXHIBIT A

Nenad Medvidović

Professor and Chair

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Table of Contents

1 Education

Doctor of Philosophy (3/99, Cumulative GPA: 4.00)
 University of California, Irvine — Department of Information and Computer Science
 Dissertation: *Architecture-Based Specification-Time Software Evolution*

Master of Science (6/95, Cumulative GPA: 4.00)
 University of California, Irvine — Department of Information and Computer Science

Bachelor of Science, *Summa Cum Laude* (8/92, Cumulative GPA: 4.00) Arizona State
 University — Computer Science and Engineering Department

2 Employment and Major Organization Leadership

7/22 - present Chair, Thomas Lord Department of Computer Science
 University of Southern California, Los Angeles

2/11 - present Professor, Thomas Lord Department of Computer Science
 University of Southern California, Los Angeles
 3/05 - 2/11 Associate Professor with Tenure, USC
 1/99 - 3/05 Assistant Professor, USC

7/21 - 6/22 Vice-Chair for Tenure Affairs, Computer Science Department
 University of Southern California, Los Angeles

1/18 - 12/22 Editor-in-Chief
 IEEE Transactions on Software Engineering

7/15 - 6/18 Chair, Special Interest Group on Software Engineering (SIGSOFT)
 Association for Computing Machinery (ACM)

7/15 – 9/17 Chair, Steering Committee
 ACM SIGSOFT Symposium on the Foundations of Software Engineering

11/13 – 10/15 Chair, Steering Committee
 International Conference on Software Engineering

7/11 - 6/15 Associate Chair for Ph.D. Affairs, Department of Computer Science, University
 of Southern California, Los Angeles

1/09 - 1/13 Director, Center for Systems and Software Engineering
 Viterbi School of Engineering, University of Southern California, Los Angeles

9/94 - 12/98 Graduate Student Researcher
 University of California, Irvine

9/93 - 8/94 Teaching Assistant
 University of California, Irvine

6/93 - 8/93 Software Engineering Intern
 Rupp Technology, Phoenix, AZ

8/92 - 8/93 Teaching Assistant
 Arizona State University, Tempe

3 Honors, Awards, Fellowships

2024	Most Influential Paper Award, IEEE Transactions on Software Engineering
2023	Alumni Hall of Fame, School of Information and Computer Sciences, University of California, Irvine
2023	IEEE Computer Society Golden Core Member
2022	Elected Member of IFIP Working Group 2.4 – Software Implementation Technologies
2020	ACM SIGSOFT Distinguished Service Award
2020	Most Influential Paper Award, International Symposium on Software Engineering for Adaptive and Self-Managing Systems
2018	Distinguished Engineering Merit Award, Orange County Engineering Council
2018	Best Paper Award, International Conference on Software Architecture
2017	Best Tool-Paper Award, International Conference on Automated Software Engineering
2017	Best Paper Award, International Conference on Software Architecture
2016	Fellow, IEEE
2015	Distinguished Scientist, ACM
2010	USC Mellon Mentoring Award
2009	Best Poster Award, International Conference on Program Comprehension
2008	Most Influential Paper Award, International Conference on Software Engineering
2005, 2009	Finalist, Most Influential Paper Award, International Conference on Software Engineering
2007	IBM Real-Time Innovation Faculty Award
2007	Most cited software engineering paper published in a scientific journal in 2000
2005	Okawa Foundation Research Grant
2000-2005	National Science Foundation (NSF) CAREER Award
1999, 2000	USC, School of Engineering Teaching Honor Roll
1993-94	UC Irvine, Department of Information and Computer Science Fellowship
1992	Arizona State University, Moeur Award (top student in the graduating class)
1991-93	UPE National Honor Society for the Computing Sciences
1990-93	Golden Key National Honor Society
1990-92	Arizona Regents International Student Scholarship
1989-92	Dean's Honor List, Arizona State University

4 Selected Statistics

- *Total number of citations*   21,356
  (scholar.google.com)
- *h-index*   65
  (scholar.google.com)
- *Most Influential Scholars in Software Engineering*   6th all-time
  (aminer.org)
- *Most cited publication*   3,197 citations [J27]
  (scholar.google.com)
- *Most cited papers, IEEE Trans. on Software Engr.*   7th [J27]
  (academic.microsoft.com)
- *Most cited papers, ACM Trans. on Software Engr. & Methodology* 10th [J25]
  (academic.microsoft.com)

5 Graduated Doctoral Students

PhD1   Marija Mikic, July 2004
currently VP of AI Foundations at Cruise
previously Senior Engineering Director at Google Labs

PhD2   Nikunj R. Mehta, September 2004
currently a Founder and CEO at Falkonry
formerly Consulting Member of Technical Staff at Oracle

PhD3   Roshanak Roshandel, December 2006
currently Project Manager at Amazon
previously *Associate Professor* and *Department Chair* at Seattle University

PhD4   Sam Malek, May 2007
currently *Professor* at UC Irvine

PhD5   Chris Mattmann, August 2007
currently CTIO at Jet Propulsion Laboratory and *Adjunct Professor* at USC

PhD6   Yuriy Brun, March 2008
currently *Professor* at University of Massachusetts
formerly *Computing Innovation (CI) Post-Doctoral Fellow* at U. of Washington

PhD7   Chiyoung Seo, May 2008
currently Senior Engineer at AirBnB
formerly a Software Architect at Couchbase

PhD8   George Edwards, July 2010
currently founder of Quandary Peak Research

PhD9   David Woollard, January 2011
currently VP of Engineering at MoveWith

PhD10 Daniel Popescu, November 2011
currently Staff Software Engineer at Google

PhD11 Ivo Krka, January 2014
currently Co-Founder and Chief Software Engineer at Sportening

PhD12 Hossein Tajalli, May 2014
currently Machine Learning Performance Architect at Intel
previously Senior Software Architect at NVIDIA

PhD13 Joshua Garcia, May 2014
currently Assistant Professor at UC Irvine

PhD14 Jae young Bang, March 2015
currently Software Litigation Consultant at Quandary Peak Research

PhD15 Gholamreza Safi, July 2016
currently Software Engineer at Cloudera

PhD16 Youn Kyu Lee, October 2017
currently Assistant Professor at Hongik University, Seoul, South Korea

PhD17 Arman Shahbazian, May 2018
currently Software Engineer at Google

PhD18 Duc Minh Le, August 2018
currently Software Engineer at Bloomberg

PhD19 Yixue Zhao, December 2020
currently Researcher, Information Sciences Institute
formerly Computing Innovation (CI) Post-Doctoral Fellow at U. of Massachusetts

PhD20 Adriana Sejfia, December 2023
currently Assistant Professor (Lecturer) at University of Edinburgh

PhD21 Saghar Talebipour, August 2024
currently Software Engineer at Snap

6 Publications

Authored Books

AB1 Richard N. Taylor, **Nenad Medvidović**, and Eric M. Dashofy. Software Architecture: Foundations, Theory, and Practice. *John Wiley & Sons*, January 2009, 736 pages. ISBN-10: 0470167742. ISBN-13: 978-0470167748.

Edited Books and Journals

EB2 Hakan Erdogmus, **Nenad Medvidović**, and Frances Paulisch, eds. IEEE Software – Special Issue on 50 Years of Software Engineering. *IEEE Computer Society*, vol. 35, no. 5, September/October 2018.

Winner of the 2019 APEX Award for Publication Excellence.

EB3 Domenico Bianculli, **Nenad Medvidović**, and David Rosenblum, eds. 40 Editions of ICSE – The Ruby Anniversary Celebration. International Conference on Software Engineering, May 2018.

EB4 **Nenad Medvidović** and Santonu Sarkar, eds. Proceedings of the 2017 Innovations in Software Engineering Conference, ACM, February 2017.

EB5 Barbora Buhnova, Jorge Cuellar, Magnus Larsson, Javier López, **Nenad Medvidović**, Antonio Vallecillo, eds. Special Issue on Component-Based Software Engineering and Software Architecture, *Science of Computer Programming*, September 2014.

EB6 Magnus Larsson and **Nenad Medvidović**, eds. Proceedings of the The 15th International ACM SIGSOFT Symposium on Component Based Software Engineering (CBSE-2012). ACM, June 2012.

EB7 Harald Gall and **Nenad Medvidović**, eds. Proceedings of the 33rd International Conference on Software Engineering (ICSE 2011). ACM, May 2011.

EB8 Fabrice Saffre, **Nenad Medvidović**, and Alberto Montresor, eds. Proceedings of the 3rd International Conference on Self-Adaptive and Self-Organizing Systems. IEEE Computer Society, September 2009.

EB9 **Nenad Medvidović** and Tetsuo Tamai, eds. Proceedings of the Warm Up Workshop for the 32nd International Conference on Software Engineering. ACM, April 2009.

EB10 Robert Nord, **Nenad Medvidović**, Rene Krikhaar, Judith Stafford, Jan Bosch, eds. Proceedings of the 5th Working IEEE/IFIP Conference on Software Architecture. *IEEE Computer Society*, March 2006.

Refereed Journal Articles

J1 Jae young Bang, Yuriy Brun, and **Nenad Medvidović**. Collaborative Design Conflicts: Costs and Solutions. *IEEE Software*, vol. 35, no. 6 (November/December 2018).

J2 Thibaud Lutellier, Devin Chollak, Joshua Garcia, Lin Tan, Derek Rayside, **Nenad Medvidović**, and Robert Kroeger. Measuring the Impact of Code Dependencies on Software Architecture Recovery Techniques. *IEEE Transactions on Software Engineering*, vol. 44, no. 2 (February 2017).

J3 Pooyan Behnamghader, Duc Minh Le, Joshua Garcia, Daniel Link, Arman Shahbazian, and **Nenad Medvidović**. A Large-Scale Study of Architectural Evolution in Open-Source Software Systems. *Journal of Empirical Software Engineering*, vol. 22, no. 3 (June 2017).

J4 Hamid Bagheri, Joshua Garcia, Alireza Sadeghi, Sam Malek, and **Nenad Medvidović**. Software Architectural Principles in Contemporary Mobile Software: from Conception to Practice. *Journal of Systems and Software*, vol. 119 (September 2016).

J5 Yuriy Brun, Jae young Bang, George Edwards, and **Nenad Medvidović**. Self-Adapting Reliability in Distributed Systems. *IEEE Transactions on Software Engineering*, vol. 41, no. 8 (August 2015).

J6 Chris Mattmann, Joshua Garcia, Ivo Krka, Daniel Popescu, and **Nenad Medvidović**. Revisiting the Anatomy and Physiology of the Grid. *Journal of Grid Computing*, vol. 13, no. 1 (March 2015).

J7 Yuriy Brun and **Nenad Medvidović**. Entrusting Private Computation and Data to Untrusted Networks. *IEEE Transactions on Dependable and Secure Computing*, vol. 10, no. 4 (July/ August 2013).

J8 Hossein Tajalli and **Nenad Medvidović**. iDARE — A Reference Architecture for Integrated Software Environments. *Journal of Software: Practice and Experience*, vol. 44, no. 3 (March 2014).

J9 Chris A. Mattmann, **Nenad Medvidović**, Sam Malek, George Edwards, and Somo Banerjee. A Middleware Platform for Providing Mobile and Embedded Computing Instruction to Software Engineering Students. *IEEE Transactions on Education*, vol. 55, no. 3 (August 2012).

J10 Sam Malek, **Nenad Medvidović**, and Marija Mikic-Rakic. An Extensible Framework for Improving a Distributed Software System's Deployment Architecture. *IEEE Transactions on Software Engineering*, vol. 38, no. 1 (January/February 2012).

J11 **Nenad Medvidović**, Hossein Tajalli, Joshua Garcia, Yuriy Brun, Ivo Krka, and George Edwards. Engineering Heterogeneous Robotics Systems: A Software Architecture-Based Approach. *IEEE Computer*, vol. 44, no. 5 (May 2011).

J12 Sam Malek, George Edwards, Yuriy Brun, Hossein Tajalli, Joshua Garcia, Ivo Krka, **Nenad Medvidović**, Marija Mikic-Rakic, and Gaurav Sukhatme. An Architecture-Driven Software Mobility Framework. *Journal of Systems and Software*, special issue on Software Architecture and Mobility, vol. 83, no. 6 (June 2010).

J13 **Nenad Medvidović** and George Edwards. Software Architecture and Mobility: A Roadmap. *Journal of Systems and Software*, special issue on Software Architecture and Mobility, vol. 83, no. 6 (June 2010).

J14 David Woollard, **Nenad Medvidović**, Yolanda Gil, and Chris A. Mattmann. Scientific Software as Workflows: From Discovery to Distribution. *IEEE Software*, special issue on Developing Scientific Software, vol. 25, no. 4 (July/August, 2008).

J15 George Edwards, Chiyoung Seo, and **Nenad Medvidović**. Model Interpreter Frameworks: A Foundation for the Analysis of Domain-Specific Software Architectures. *Journal of Universal Computer Science*, special issue on Software Components, Architectures, and Reuse, volume 14, number 8 (2008).

J16 **Nenad Medvidović**, Eric M. Dashofy, and Richard N. Taylor. Moving Architectural Description from Under the Technology Lamppost. *Journal of Information and Software Technology*, vol. 49, no. 1 (January 2007).

J17 **Nenad Medvidović**, Rene Krikhaar, Robert Nord, and Judith Stafford. Understanding the Past, Improving the Present, and Mapping out the Future of Software Architecture. *Journal of Systems and Software*, vol. 79, no. 12 (December 2006).

J18 **Nenad Medvidović** and Vladimir Jakobac. Using Software Evolution to Focus Architectural Recovery. *Journal of Automated Software Engineering*, vol. 13, no. 2 (April 2006).

J19 Sam Malek, Marija Mikic-Rakic, and **Nenad Medvidović**. A Style-Aware Architectural Middleware for Resource-Constrained, Distributed Systems. *IEEE Transactions on Software Engineering*, vol. 31, no. 3 (March 2005).

J20 Roshanak Roshandel, Andre van der Hoek, Marija Mikic-Rakic, and **Nenad Medvidović**. Mae - A System Model and Environment for Managing Architectural Evolution. *ACM Transactions on Software Engineering and Methodology*, vol. 11, no. 2 (April 2004).

J21 Paul Gruenbacher, Alexander Egyed, and **Nenad Medvidović**. Reconciling Software Requirements and Architectures with Intermediate Models. *Springer Journal of Software and System Modeling*, vol. 3, no. 3, pages 235-253 (August 2004).

J22 **Nenad Medvidović**, Paul Gruenbacher, Alexander Egyed, and Barry W. Boehm. Bridging Models across the Software Lifecycle. *Journal of Systems and Software*, vol. 68, no. 3 (December 2003).

J23 **Nenad Medvidović**, Marija Mikic-Rakic, Nikunj Mehta, and Sam Malek. Software Architectural Support for Handheld Computing. *IEEE Computer*, special issue on Handheld Computing, vol. 36, no. 9 (September 2003).

J24 **Nenad Medvidović**, Eric M. Dashofy, and Richard N. Taylor. The Role of Middleware in Architecture-Based Software Development. *International Journal of Software Engineering and Knowledge Engineering*, vol. 13, no. 4 (August 2003).

J25 **Nenad Medvidović**, David S. Rosenblum, David F. Redmiles, and Jason E. Robbins. Modeling Software Architectures in the Unified Modeling Language. *ACM Transactions on Software Engineering and Methodology*, vol. 11, no. 1 (January 2002).

J26 Alexander Egyed, **Nenad Medvidović**, and Cristina Gacek. A Component-Based Perspective on Software Mismatch Detection and Resolution. *IEE Proceedings - Software Engineering*, vol. 147, no. 6 (December 2000).

J27 **Nenad Medvidović** and Richard N. Taylor. A Classification and Comparison Framework for Software Architecture Description Languages. *IEEE Transactions on Software Engineering*, vol. 26, no. 1 (January 2000).

Reprinted in *Rational Developer Network: Seminal Papers on Software Architecture*, Rational Software Corp. (July 2001). Named most widely cited software engineering paper published in 2000 by the *Journal of Information and Software Technology* (January 2007). Selected Most Influential Paper of IEEE TSE's 3rd decade (October 2024).

J28 Peyman Oreizy, Michael M. Gorlick, Richard N. Taylor, Dennis Heimbigner, Gregory Johnson, **Nenad Medvidović**, Alex Quilici, David S. Rosenblum, and Alexander L. Wolf. An Architecture-Based Approach to Self-Adaptive Software. *IEEE Intelligent Systems and Their Applications*, vol. 14, no. 3 (May/June 1999).

J29 **Nenad Medvidović** and Richard N. Taylor. Exploiting Architectural Style to Develop a Family of Applications. *IEE Proceedings - Software Engineering*, vol. 144, no. 5-6 (October-December 1997).

J30 Richard N. Taylor, **Nenad Medvidović**, Kenneth M. Anderson, E. James Whitehead, Jr., Jason E. Robbins, Kari A. Nies, Peyman Oreizy, and Deborah L. Dubrow. A Component- and Message-Based Architectural Style for GUI Software. *IEEE Transactions on Software Engineering*, vol. 22, no. 6 (June 1996).

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C1 Satyaki Das, Syeda Tasnim Fabiha, Saad Shafiq, and **Nenad Medvidović**. Are We Learning the Right Features? A Framework for Evaluating DL-Based Software Vulnerability Detection Solutions. To appear in Proceedings of the 47th IEEE/ACM International Conference on Software Engineering (ICSE 2025), Ottawa, Canada, April-May 2025.

C2 Sadra Sabouri, Philipp Eibl, Xinyi Zhou, Morteza Ziyadi, **Nenad Medvidović**, Lars Lindemann, and Souti Chattopadhyay. Trust Dynamics in AI-Assisted Development: Definitions, Factors, and Implications. To appear in Proceedings of the 47th IEEE/ACM International Conference on Software Engineering (ICSE 2025), Ottawa, Canada, April-May 2025.

C3 Adriana Sejfia, Satyaki Das, Saad Shafiq, and **Nenad Medvidović**. Toward Improved Deep Learning-based Vulnerability Detection. In Proceedings of the 46th IEEE/ACM International Conference on Software Engineering (ICSE 2024), Lisbon, Portugal, April 2024.

C4 Yutian Yan, Yunhui Zheng, Xinyue Liu, **Nenad Medvidović**, and Weihang Wang. AdHere: Automated Detection and Repair of Intrusive Ads. In Proceedings of the 45th IEEE/ACM International Conference on Software Engineering (ICSE 2023), Melbourne, Australia, May 2023.

C5 Saghar Talebipour, Hyojae Park, Kesina Baral, Leon Yee, Safwat Ali, Kevin Moran, Yuriy Brun, **Nenad Medvidović**, and Yixue Zhao. AVGUST: A tool for Generating Usage-Based Tests from Videos of App Executions. In Proceedings of the 45th IEEE/ACM International Conference on Software Engineering (ICSE 2023), Demonstrations Track, Melbourne, Australia, May 2023.

C6 Yixue Zhao, Saghar Talebipour, Kesina Baral, Hyojae Park, Leon Yee, Safwat Ali Khan, Yuriy Brun, **Nenad Medvidović**, and Kevin Moran. AVGUST: Automating Usage-Based Test Generation from Videos of App Executions. In Proceedings of the 30th ACM Joint Meeting on European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE 2022), Singapore, November 2022.

C7 Saghar Talebipour, Yixue Zhao, Luka Dojcilovic, Chenggang Li, and **Nenad Medvidović**. UI Test Migration Across Mobile Platforms. In Proceedings of the 36th IEEE/ACM International Conference on Automated Software Engineering (ASE 2021), November 2021.

C8 Adriana Sejfia, Yixue Zhao, and **Nenad Medvidović**. Identifying Casualty Changes in Software Patches. In Proceedings of the 29th ACM Joint Meeting on European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE 2021), September 2021.

C9 Yixue Zhao, Siwei Yin, Adriana Sejfia, Marcelo Schmitt Laser, Haoyu Wang, and **Nenad Medvidović**. Assessing the Feasibility of Web-Request Prediction Models on Mobile Platforms. In Proceedings of the 8th International Conference on Mobile Software Engineering and Systems (MobileSoft 2021), May 2021.

C10 Marcelo Schmitt Laser, Duc Minh Le, Joshua Garcia and **Nenad Medvidović**. Architectural Archipelagos: Technical Debt in Long-Lived Software Research Platforms. In Proceedings of the 4th International Conference on Technical Debt (TechDebt 2021), May 2021.

C11 Joshua Garcia, Mehdi Mirakhorli, Lu Xiao, Yutong Zhao, Ibrahim Mujhid, Khoi Pham, Ahmet Okutan, Sam Malek, Rick Kazman, Yuanfang Cai, and **Nenad Medvidović**. Constructing a Shared Infrastructure for Software Architecture Analysis and Maintenance. In Proceedings of the IEEE 18th International Conference on Software Architecture (ICSA 2021), March 2021.

C12 Duc Minh Le, Suhrid Karthik, Marcelo Schmitt Laser, and **Nenad Medvidović**. Architectural Decay as Predictor of Issue-and Change-Proneness. In Proceedings of the IEEE 18th International Conference on Software Architecture (ICSA 2021), March 2021.

C13 Arman Shahbazian, Suhrid Karthik, Yuriy Brun, and **Nenad Medvidović**. eQual: Informing Early Design Decisions. In Proceedings of the ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE 2020), Sacramento, CA, November 2020.

C14 Yixue Zhao, Justin Chen, Adriana Sejfia, Marcelo Schmitt Laser, Jie Zhang, Federica Sarro, Mark Harman, and **Nenad Medvidović**. FrUITeR - A Framework for Evaluating UI Test Reuse. In Proceedings of the ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE 2020), Sacramento, CA, November 2020.

C15 Gvozden Marinkovic, Nikola Lukic, and **Nenad Medvidović**. Online Sports Betting Through the Prism of Software Engineering. In Proceedings of the ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE 2020), Industrial Track, Sacramento, CA, November 2020.

C16 Marcelo Schmitt Laser, Duc Minh Le, Joshua Garcia, and **Nenad Medvidović**. ARCADE: An Extensible Workbench for Architecture Recovery, Change, and Decay Evaluation. In Proceedings of the ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE 2020), Tool Demonstrations Track, Sacramento, CA, November 2020.

C17 Nikola Lukic, Saghar Talebipour, and **Nenad Medvidović**. Remote Control of iOS Devices via Accessibility Features. In Proceedings of the Workshop on Forming an Ecosystem Around Software Transformation (FEAST 2020), November 2020.

C18 Nikola Lukic, Saghar Talebipour, and **Nenad Medvidović**. AirMochi - A Tool for Remotely Controlling iOS Devices. In Proceedings of the 35th International Conference on Automated Software Engineering (ASE 2020), Melbourne, Australia, September 2020.

C19 Adriana Sejfia and **Nenad Medvidović**. Strategies for Pattern-Based Detection of Architecturally-Relevant Software Vulnerabilities (Don't Try This at Home - It Doesn't Work). In Proceedings of the 4th IEEE International Conference on Software Architecture (ICSA 2020), Salvador, Brazil, March 2020.

C20 Yixue Zhao and **Nenad Medvidović**. A Microservice Architecture for Online Mobile App Optimization. In Proceedings of the 6th International Conference on Mobile Software Engineering and Systems (MOBILESoft 2019), Montreal, Canada, 2019.

C21 Suhrid Karthik and **Nenad Medvidović**. Automatic Detection of Latent Component Relationships from Online Q&A Sites. In Proceedings of the 7th International Workshop on Realizing Artificial Intelligence Synergies in Software Engineering (RAISE 2019), Montreal, Canada, May 2019.

C22 Yixue Zhao, Paul Wat, Marcelo Laser, and **Nenad Medvidović**. Empirically Assessing Opportunities for Prefetching and Caching in Mobile Apps. In Proceedings of the 33rd IEEE/ACM International Conference on Automated Software Engineering (ASE 2018), Montpelier, France, September 2018.

C23 Daye Nam, Youn Kyu Lee, and **Nenad Medvidović**. EVA: A Tool for Visualizing Software Architectural Evolution. In Proceedings of the 40th International Conference on Software Engineering (ICSE 2018), Tool Demonstrations Track, Gothenburg, Sweden, May 2018.

C24 Yixue Zhao, Marcelo Laser, Yingjun Lyu, and **Nenad Medvidović**. Leveraging Program Analysis to Reduce User-Perceived Latency in Mobile Applications. In Proceedings of the 40th International Conference on Software Engineering (ICSE 2018), Gothenburg, Sweden, May 2018.

C25 Arman Shahbazian, Daye Nam, and **Nenad Medvidović**. Toward Predicting Architectural Significance of Implementation Issues. In Proceedings of the 15th IEEE/ACM International Conference on Mining Software Repositories (MSR 2018), Gothenburg, Sweden, May 2018.

C26 Duc Minh Le, Daniel Link, Arman Shahbazian, and **Nenad Medvidović**. An Empirical Study of Architectural Decay in Open-Source Software. In Proceedings of the 15th IEEE International Conference on Software Architecture (ICSA 2018), Seattle, WA, April 2018.

Winner of the ICSA 2018 Best Paper Award

C27 Arman Shahbazian, Youn Kyu Lee, and **Nenad Medvidović**. Recovering Architectural Design Decisions. In Proceedings of the 15th IEEE International Conference on Software Architecture (ICSA 2018), Seattle, WA, April/May 2018.

C28 Youn Kyu Lee, Peera Yoodee, Arman Shahbazian, Daye Nam, and **Nenad Medvidović**. SEALANT: A Detection and Visualization Tool for Inter-app Security Vulnerabilities in Android. In Proceedings of the 32nd IEEE/ACM International Conference on Automated Software Engineering (ASE 2017), Urbana-Champaign, USA, November 2017.

Winner of the ASE 2017 Best Tool-Paper Award

C29 Youn Kyu Lee, Jae Young Bang, Gholamreza Safi, Arman Shahbazian, Yixue Zhao, and **Nenad Medvidović**. A SEALANT for Inter-App Security Holes in Android. In Proceedings of the 39th International Conference on Software Engineering (ICSE 2017), Buenos Aires, Argentina, May 2017.

C30 Jae young Bang, Yuriy Brun, and **Nenad Medvidović**. Continuous Analysis of Collaborative Design. In Proceedings of the 14th IEEE International Conference on Software Architecture (ICSA 2017), Gothenburg, Sweden, April 2017.

Winner of the ICSA 2017 Best Paper Award

C31 Martin Robillard and **Nenad Medvidović**. Disseminating Architectural Knowledge on Open-Source Projects. In Proceedings of the 38th International Conference on Software Engineering (ICSE 2016), Austin, TX, May 2016.

C32 Arman Shahbazian, George Edwards, and **Nenad Medvidović**. An End-to-End Domain-Specific Modeling and Analysis Platform. In Proceedings of the 8th International Workshop on Modeling in Software Engineering (MISE 2016), Austin, TX, May 2016.

C33 Michael Langhammer, Arman Shahbazian, **Nenad Medvidović**, and Ralf Reussner. Automated Extraction of Rich Software Models from Limited System Information. In Proceedings of the 13th Working IEEE/IFIP Conference on Software Architecture (WICSA 2016), Venice, Italy, April 2016.

C34 Duc Minh Le, Carlos Carrillo, Rafael Capilla, and **Nenad Medvidović**. Relating Architectural Decay and Sustainability of Software Systems. In Proceedings of the 13th Working IEEE/IFIP Conference on Software Architecture (WICSA 2016), Venice, Italy, April 2016.

C35 Gholamreza Safi, Arman Shahbazian, William G.J. Halfond, and **Nenad Medvidović**. Detecting Event Anomalies in Event-Based Systems. In Proceedings of the 10th joint meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE 2015), Bergamo, Italy, September 2015.

C36 Duc Minh Le, Pooyan Behnamghader, Joshua Garcia, Daniel Link, Arman Shahbazian, and **Nenad Medvidović**. An Empirical Study of Architectural Change in Open-Source Software Systems. In Proceedings of the 12th Working Conference on Mining Software Repositories (MSR 2015), Florence, Italy, May 2015.

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C151 Paul Gruenbacher, Alexander Egyed, and **Nenad Medvidović**. Reconciling Software Requirements and Architectures: The CBSP Approach. In Proceedings of the 5th IEEE International Symposium on Requirements Engineering (RE'01), Toronto, Canada, August 2001.

C152 Lei Ding and **Nenad Medvidović**. Focus: A Light-Weight, Incremental Approach to Software Architecture Recovery and Evolution. In Proceedings of the 2001 Working IEEE/ IFIP Conference on Software Architectures (WICSA-2), Amsterdam, the Netherlands, August 2001.

C153 **Nenad Medvidović**, Paul Gruenbacher, Alexander Egyed, and Barry W. Boehm. Software Model Connectors: Bridging Models across the Software Lifecycle. In Proceedings of the 13th International Conference on Software Engineering and Knowledge Engineering (SEKE 2001), Buenos Aires, Argentina, June 2001.

Fast-tracked for journal publication as one of the best papers of the conference.

C154 Marija Rakic and **Nenad Medvidović**. Increasing the Confidence in Off-the-Shelf Components: A Software Connector-Based Approach. In Proceedings of the 2001 Symposium on Software Reusability (SSR 2001), Toronto, Canada, May 2001.

C155 Alexander Egyed and **Nenad Medvidović**. Consistent Architectural Refinement and Evolution Using the Unified Modeling Language. In Proceedings of the Workshop on Describing Software Architecture with UML, Toronto, Canada, May 2001.

C156 Alexander Egyed, Paul Gruenbacher, and **Nenad Medvidović**. Refinement and Evolution Issues in Bridging Requirements and Architecture - The CBSP Approach. In Proceedings of the First International Software Requirements to Architectures Workshop (STRAW 2001), Toronto, Canada, May 2001.

C157 Marija Rakic and **Nenad Medvidović**. Runtime Support for Architecture-Level Configuration Management. In Proceedings of the Tenth International Workshop on Software Configuration Management (SCM-10), Toronto, Canada, May 2001.

C158 **Nenad Medvidović** and Marija Rakic. Exploiting Software Architecture Implementation Infrastructure in Facilitating Component Mobility. In Proceedings of the Workshop on Software Engineering and Mobility, Toronto, Canada, May 2001.

C159 Nicolas Rouquette, **Nenad Medvidović**, and David Garlan. Dependable Autonomous Systems = knowing well what to do + knowing how to do it well. In Proceedings of the NASA High Dependability Computing Consortium Workshop, NASA AMES, Moffet Field, CA, January 2001.

C160 Rohit Khare, Michael Guntersdorfer, Peyman Oreizy, **Nenad Medvidović**, Richard N. Taylor. xADL: Enabling Architecture-Centric Tool Integration With XML. In Proceedings of the 34th Hawaii International Conference on System Sciences (HICSS-34), Maui, Hawaii, January 2001.

C161 Nikunj R. Mehta, **Nenad Medvidović**, and Sandeep Phadke. Towards a Taxonomy of Software Connectors. In Proceedings of the 22nd International Conference on Software Engineering (ICSE 2000), Limerick, Ireland, June 2000.

C162 Paul Gruenbacher, Alexander Egyed, and **Nenad Medvidović**. Dimensions of Concerns in Requirements Negotiation and Architecture Modeling. In Proceedings of the Workshop on Multi-Dimensional Separation of Concerns in Software Engineering, Limerick, Ireland, June 2000.

C163 **Nenad Medvidović**, Rose F. Gamble, and David S. Rosenblum. Towards Software Multioperability: Bridging Heterogeneous Software Interoperability Platforms. In Proceedings of the Fourth International Software Architecture Workshop (ISAW-4), Limerick, Ireland, June 2000.

C164 Alexander Egyed and **Nenad Medvidović**. A Formal Approach to Heterogeneous Software Modeling. In Proceedings of the 2000 Conference on the Fundamental Approaches to Software Engineering (FASE 2000), Berlin, Germany, March-April 2000.

C165 Alexander Egyed, Nikunj R. Mehta, and **Nenad Medvidović**. Software Connectors and Refinement in Family Architectures. In Proceedings of the Third International Workshop on Software Architectures for Product Families (IW-SAPF3), Las Palmas de Gran Canaria, Spain, March 2000.

C166 Alexander Egyed and **Nenad Medvidović**. Extending Architectural Representation in UML with View Integration. In Proceedings of the 2nd International Conference on The Unified Modeling Language (UML'99), Fort Collins, CO, October 1999.

C167 Marwan Abi-Antoun and **Nenad Medvidović**. Enabling the Refinement of a Software Architecture into a Design. In Proceedings of the 2nd International Conference on The Unified Modeling Language (UML'99), Fort Collins, CO, October 1999.

C168 **Nenad Medvidović**, Alexander Egyed, and David S. Rosenblum. Round-Trip Software Engineering Using UML: From Architecture to Design and Back. In Proceedings of the Second International Workshop on Object-Oriented Reengineering (WOOR'99), Toulouse, France, September 1999.

C169 Eric M. Dashofy, **Nenad Medvidović**, and Richard N. Taylor. Using Off-the-Shelf Middleware to Implement Connectors in Distributed Software Architectures. In Proceedings of the 21st International Conference on Software Engineering (ICSE'99), Los Angeles, CA, May 1999.

C170 **Nenad Medvidović**, David S. Rosenblum, and Richard N. Taylor. A Language and Environment for Architecture-Based Software Development and Evolution. In Proceedings of the 21st International Conference on Software Engineering (ICSE'99), Los Angeles, CA, May 1999.

Finalist for the ICSE'99 Most Influential Paper Award

C171 **Nenad Medvidović** and David S. Rosenblum. Assessing the Suitability of a Standard Design Method for Modeling Software Architectures. In Proceedings of the First Working IFIP Conference on Software Architecture (WICSA-1), San Antonio, TX, February 1999.

C172 **Nenad Medvidović** and Richard N. Taylor. Separating Fact from Fiction in Software Architecture. In Proceedings of the Third International Software Architecture Workshop (ISAW-3), Orlando, FL, November 1998.

C173 **Nenad Medvidović**, Eric M. Dashofy, and Richard N. Taylor. Employing Off-the-Shelf Connector Technologies in C2-Style Architectures. In Proceedings of the California Software Symposium (CSS'98), Irvine, CA, October 1998.

C174 Jason E. Robbins, **Nenad Medvidović**, David F. Redmiles, and David S. Rosenblum. Integrating Architecture Description Languages with a Standard Design Method. In Proceedings of the 20th International Conference on Software Engineering (ICSE'98), Kyoto, Japan, April 1998.

C175 Peyman Oreizy, **Nenad Medvidović**, and Richard N. Taylor. Architecture-Based Runtime Software Evolution. In Proceedings of the 20th International Conference on Software Engineering (ICSE'98), Kyoto, Japan, April 1998.

Winner of the ICSE'98 Most Influential Paper Award, awarded at ICSE 2008

C176 **Nenad Medvidović**, Richard N. Taylor, and David S. Rosenblum. An Architecture-Based Approach to Software Evolution. In Proceedings of the International Workshop on the Principles of Software Evolution (IWPSE-1), Kyoto, Japan, 1998.

C177 Peyman Oreizy, **Nenad Medvidović**, Richard N. Taylor, and David S. Rosenblum. Software Architecture and Component Technologies: Bridging the Gap. In Proceedings of the Workshop on Compositional Software Architectures, Monterey, CA, January 1998.

C178 **Nenad Medvidović** and David S. Rosenblum. Domains of Concern in Software Architectures and Architecture Description Languages. In Proceedings of the USENIX Conference on Domain-Specific Languages (DSL'97), Santa Barbara, CA, October 1997.

C179 **Nenad Medvidović** and Richard N. Taylor. A Framework for Classifying and Comparing Architecture Description Languages. In Joint proceedings of the Sixth European Software Engineering Conference together and Fifth ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC-FSE'97), Zurich, Switzerland, September 1997.

C180 **Nenad Medvidović**, Peyman Oreizy, and Richard N. Taylor. Reuse of Off-the-Shelf Components in C2-Style Architectures. In Proceedings of the 1997 Symposium on Software Reusability (SSR'97), Boston, MA, May 1997. Also in Proceedings of the 1997 International Conference on Software Engineering (ICSE'97), Boston, MA, May 1997.

C181 **Nenad Medvidović** and Richard N. Taylor. Reusing Off-the-Shelf Components to Develop a Family of Applications in the C2 Architectural Style. In Proceedings of the First International Workshop on Software Architectures for Product Families (IW-SAPF-1), Las Navas del Marques, Avila, Spain, November 1996.

C182 **Nenad Medvidović**, Peyman Oreizy, Jason E. Robbins, and Richard N. Taylor. Using Object-Oriented Typing to Support Architectural Design in the C2 Style. In Proceedings of the Fourth ACM SIGSOFT Symposium on the Foundations of Software Engineering (FSE4),San Francisco, CA, October 1996.

C183 **Nenad Medvidović**. ADLs and Dynamic Architecture Changes. In Alexander L. Wolf, ed., Proceedings of the Second International Software Architecture Workshop (ISAW-2), San Francisco, CA, October 1996.

C184 **Nenad Medvidović**, Richard N. Taylor, and E. James Whitehead, Jr. Formal Modeling of Software Architectures at Multiple Levels of Abstraction. In Proceedings of the California Software Symposium 1996, Los Angeles, CA, April 1996.

C185 Richard N. Taylor, **Nenad Medvidović**, Kenneth M. Anderson, E. James Whitehead Jr. and Jason E. Robbins. A Component- and Message-Based Architectural Style for GUI Software. In Proceedings of the Seventeenth International Conference on Software Engineering (ICSE17),Seattle, WA, April 1995.

Fast-tracked journal publication as one of the best papers of the conference Finalist for the ICSE'95 Most Influential Paper Award

C186 E. James Whitehead, Jr., Jason E. Robbins, **Nenad Medvidović**, and Richard N. Taylor. Software Architecture: Foundation of a Software Component Marketplace. In Proceedings of the First International Workshop on Architectures for Software Systems (ISAW-1), Seattle, WA, April 1995.

Refereed Book Chapters

B1 **Nenad Medvidović** and Alessandro Orso. Software Analytics Under the Lamppost (or What Star Trek Teaches Us About the Importance of Asking the Right Questions). In T. Menzies, L. Williams, and T Zimmermann, eds., *Perspectives on Data Science for Software Engineering*, Morgan Kaufmann, July 2016.

B2 Chris A. Mattmann, Daniel J. Crichton, Andrew F. Hart, Cameron Goodale, J. Steven Hughes, Sean Kelly, Luca Cinquini, Thomas H. Painter, Joseph Lazio, Duane Waliser, **Nenad Medvidović**, Jinwon Kim, and Peter Lean. Architecting Data-Intensive Systems. In B. Furht and A. Escalante, eds., *Handbook of Data Intensive Computing*, Springer Verlag, 2011.

B3 Ivo Krka, George Edwards, Leslie Cheung, Leana Golubchik, and **Nenad Medvidović**. A Comprehensive Exploration of Challenges in Architecture-Based Reliability Estimation. In R. de Lemos, J.-C. Fabre, C. Gacek, F. Gadducci, and M. ter Beek, eds., *Architecting Dependable Systems VI*, Springer Verlag, December 2009.

B4 Sam Malek, Nels Beckman, Marija Mikic-Rakic, and **Nenad Medvidović**. A Framework for Ensuring and Improving Dependability in Highly Distributed Systems. In R. de Lemos, et al., eds., *Architecting Dependable Systems III*, Springer Verlag, October 2005.

B5 Paris Avgeriou, Nicolas Guelfi, and **Nenad Medvidović**. Software Architecture Description and UML. In N. J. Nunes, B. Selic, A. Rodrigues da Silva, eds., *UML Modeling Languages and Applications*, LNCS 3297, Springer Verlag, February 2005.

B6 Roshanak Roshandel and **Nenad Medvidović**. Multi-View Software Component Modeling for Dependability. In R. de Lemos, C. Gacek, and A. Romanowski, eds., *Architecting Dependable Systems II*, Lecture Notes in Computer Science 3069, Springer Verlag, June 2004.

B7 **Nenad Medvidović** and Nikunj Mehta. Java Beans and Software Architecture. In Hossein Bidgoli, ed., *The Internet Encyclopedia*, John Wiley & Sons, Inc., vol. 2, December 2003.

B8 **Nenad Medvidović**, Marija Mikic-Rakic, and Nikunj Mehta. Improving Dependability of Component-Based Systems via Multi-Versioning Connectors. In R. de Lemos, et al., eds., *Architecting Dependable Systems*, Lecture Notes in Computer Science (LNCS 2677), Springer Verlag, August 2003.

Invited, Weakly Refereed, and Non-Refereed Publications

I1 **Nenad Medvidović**. Software Engineering Research Trends 1994-2024: Stepping Beyond the Lamppost. To appear in IEEE Transactions on Software Engineering, March 2025.

I2 **Nenad Medvidović**, Richard N. Taylor, and Eric M. Dashofy. Software Architecture Description Revisited. To appear in IEEE Transactions on Software Engineering, March 2025.

I3 Joshua Garcia, Mehdi Mirakhorli, Lu Xiao, Sam Malek, Rick Kazman, Yuanfang Cai, and **Nenad Medvidović**. SAIN: A Community-Wide Software Architecture Infrastructure. In Proceedings of the 45th IEEE/ACM International Conference on Software Engineering (ICSE 2023), Technical Briefing Track, Melbourne, Australia, May 2023.

I4 Joshua Garcia, Mehdi Mirakhorli, Lu Xiao, Sam Malek, Rick Kazman, Yuanfang Cai, and **Nenad Medvidović**. SAIN: A Community-Wide Software Architecture Infrastructure. In Proceedings of the 45th IEEE/ACM International Conference on Software Engineering (ICSE 2023), Technical Briefing Track, Melbourne, Australia, May 2023.

I5 **Nenad Medvidović**. Pains and Gains of Peer Reviewing in Software Engineering: A Journal-Centric Perspective. ACM SIGSOFT Software Engineering Notes, vol. 46, no. 3, July 2021.

I6   Yixue Zhao and **Nenad Medvidović**. Mobile-App Analysis and Instrumentation Techniques Reimagined with DECREE. In Recognizing and Rewarding Open Science in Software Engineering (ROSE Festival), held at ICSE 2019, Montreal, Canada, May 2019.

I7   **Nenad Medvidović**. Editorial: State of the Journal. IEEE Transactions on Software Engineering, vol. 45, no. 1, January 2019.

I8   Hakan Erdogmus, **Nenad Medvidović**, and Frances Paulisch. 50 Years of Software Engineering. IEEE Software, vol. 25, no. 6, November/December 2018.

I9   Arman Shahbazian, Yuriy Brun, and **Nenad Medvidović**. eQual: Search-Based Software Design Optimization Poster paper. In Proceedings of the 40th International Conference on Software Engineering (ICSE 2018), Gothenburg, Sweden, May 2018.

I10   Barbora Buhnova, Antonio Vallecillo, **Nenad Medvidović**, Magnus Larsson, Javier López, Jorge Cuellar. Guest editorial to the Special Issue on Component-Based Software Engineering and Software Architecture. Science of Computer Programming, vol. 90, part B, September 2014.

I11   **Nenad Medvidović** and Chris A. Mattmann. Leveraging Software Architecture to Reconcile the Promise and Reality of Grid Computing. Infosys Technology Roundtable, September 2009. http://www.infosys.com/newsletter/technology-roundtable/web.htm

I12   Peyman Oreizy, **Nenad Medvidović**, and Richard N. Taylor. Runtime Software Adaptation: Framework, Approaches, and Styles. In Proceedings of the 30th International Conference on Software Engineering (ICSE 2008), follow-on to the Most Influential Paper of ICSE 1998, Leipzig, Germany, May 2008.

I13   **Nenad Medvidović**. Foreword to Rogerio De Lemos, Cristina Gacek, and Alexander Romanovsky, eds., Architecting Dependable Systems, LNCS 4615, Springer Verlag, 2007.

I14   Leslie Cheung, Leana Golubchik, **Nenad Medvidović**, and Gaurav Sukhatme. Identifying and Addressing Uncertainty in Architecture-Level Software Reliability Modeling. In Proceedings of the NSF Next Generation Software Program (NSFNGS) Workshop, Long Beach, CA, February 2007.

I15   **Nenad Medvidović**. Moving Architectural Description from Under the Technology Lamppost. In Proceedings of the 32nd EUROMICRO Conference on Software Engineering and Advanced Applications, Dubrovnik, Croatia, August 2006.

I13   David Woollard and **Nenad Medvidović**. High Performance Software Architectures: A Connector-Oriented Approach. In Proceedings of the Institute for Software Research Graduate Research Symposium, Irvine, CA, June 2006.

I16   Somo Banerjee, Leslie Cheung, Leana Golubchik, **Nenad Medvidović**, Roshanak Roshandel, and Gaurav Sukhatme. Engineering Reliability into Hybrid Systems via Rich Design Models: Recent Results and Current Directions. In Proceedings of the NSF Next Generation Software Program (NSFNGS) Workshop, Rhodes Island, Greece, April 2006.

I17   **Nenad Medvidović**. Software Architectures and Embedded Systems: A Match Made in Heaven? IEEE Software, September-October 2005.

I18   **Nenad Medvidović** and Vladimir Jakobac. A Focused Approach to Architectural Recovery. In Proceedings of the 7th Ground System Architectures Workshop (GSAW 2003), Manhattan Beach, CA, March 2003.

I19 **Nenad Medvidović**. Coupling Architectural Discovery and Recovery to Stem Architectural Erosion. Invited paper for the Dagstuhl Workshop on Software Architecture Recovery and Modeling (SWARM), Dagstuhl, Germany, February 2003.

I20 Andre van der Hoek, Ebru Dincel, and **Nenad Medvidović**. Using Service Utilization Metrics to Assess and Improve Product Line Architectures. In Proceedings of the 6th Ground System Architectures Workshop (GSAW 2002), El Segundo, CA, March 2002.

I21 Roshanak Roshandel and **Nenad Medvidović**. Static and Dynamic Modeling of Software Architecture. In Proceedings of the 6th Ground System Architectures Workshop (GSAW 2002), El Segundo, CA, March 2002.

I22 Nikunj R. Mehta, **Nenad Medvidović**, and Sandeep Phadke. Rich Software Interconnections. In Proceedings of the Fourth Ground System Architectures Workshop (GSAW 2000), El Segundo, CA, February 2000.

I23 **Nenad Medvidović**. Modeling Software Architectures in UML. Invited paper for the Workshop on Software Architectures and the Unified Modeling Language, Rational Software Corporation, Denver, CO, April 1999.

I24 **Nenad Medvidović**. An Approach to Architecture-Based Software Integration. In Proceedings of the Ground System Architectures Workshop (GSAW 99), El Segundo, CA, March 1999.

I25 Richard N. Taylor, **Nenad Medvidović**, and Peyman Oreizy. Architectural Implications of Common Operator Interfaces. In Proceedings of the Ground System Architectures Workshop (GSAW 98), El Segundo, CA, February 1998.

I26 Jeffrey J. Blevins, Deborah L. Dubrow, Nancy Eickelmann, Rebecca Grinter, **Nenad Medvidović**, Ronald Reimer, Jonathan Shaw, Clark S. Turner, and Gary Wong. Report on the Software Project Management Technical Research Review. In Proceedings of the California Software Symposium (CSS'95), Irvine, CA, March 1995.

Non-Refereed Technical Reports

N1 Youn Kyu Lee, Ruhollah Shemirani, Jae young Bang, Arman Shahbazian, Gholamreza Safi, and **Nenad Medvidović**. SEALANT: Preventing Inter-Application Attacks in Android. USC Center for Systems and Software Engineering Technical Report, USC-CSSE-2016-601, March 2016.

N2 Duc M. Le, Pooyan Behnamghader, Joshua Garcia, Daniel Link, Arman Shahbazian, and **Nenad Medvidović**. An Empirical Study of Architectural Change in Open-Source Software Systems. USC Center for Systems and Software Engineering Technical Report, USC-CSSE-2014-509, December 2014.

N3 Ivo Krka, Yuriy Brun, and **Nenad Medvidović**. Automatically Mining Specifications from Invocation Traces and Method Invariant. USC Center for Systems and Software Engineering Technical Report, USC-CSSE-2013-509, September 2013.

N4 George Edwards and **Nenad Medvidović**. Model Interpreter Frameworks. USC Center for Systems and Software Engineering Technical Report, USC-CSSE-2009-514, July 2009.

N5 Yuriy Brun, George Edwards, Jae Young Bang, and **Nenad Medvidović**, Online Reliability Improvement via Smart Redundancy in Systems with Faulty and Untrusted Participants. USC Center for Systems and Software Engineering Technical Report, USC-CSSE-2009- 510, May 2009.

N6 Yuriy Brun and **Nenad Medvidović**. Preserving Privacy in Distributed Computation via Self-Assembly. USC Center for Systems and Software Engineering Technical Report, USC- CSSE-2008-819, September 2008.

N7 Yuriy Brun and **Nenad Medvidović**. Discreetly Distributing Computation via Self-Assembly. USC Center for Systems and Software Engineering Technical Report, USC-CSSE-2007-714, April 2007.

N8 David Woollard, Chris A. Mattmann, and **Nenad Medvidović**. Injecting Software Architectural Constraints into Legacy Scientific Applications. USC Center for Software Engineering Technical Report, USC-CSE-2007-701, January 2007.

N9 Chiyoung Seo, Sam Malek, and **Nenad Medvidović**. An Energy Consumption Framework for Distributed Java-Based Software Systems. Technical Report USC-CSE-2006-604, Center for Software Engineering, University of Southern California, December 2006.

N10 Sam Malek, Marija Mikic-Rakic, and **Nenad Medvidović**. A Decentralized Redeployment Algorithm for Improving the Availability of Distributed Systems. Technical Report USC-CSE-2004-506, USC Center for Software Engineering, March 2004.

N11 Nikunj Mehta and **Nenad Medvidović**. Checking Style Conformance of Software Architectural Compositions. Technical Report USC-CSE-2004-504, USC Center for Software Engineering, February 2004.

N12 Nikunj Mehta and **Nenad Medvidović**. Composition of Style-Based Software Architectures from Architectural Primitives. Technical Report USC-CSE-2004-503, USC Center for Software Engineering, February 2004.

N13 Nikunj Mehta and **Nenad Medvidović**. Toward Composition Of Style-Conformant Software Architectures. Technical Report USC-CSE-2004-500, USC Center for Software Engineering, January 2004.

N14 Marija Mikic-Rakic, Sam Malek, and **Nenad Medvidović**. Improving Availability in Large, Distributed, Component-Based Systems via Redeployment. Technical Report USC-CSE- 2003-515, USC Center for Software Engineering, December 2003.

N15 Nikunj Mehta and **Nenad Medvidović**. Concise Composition of Architectural Styles from Architectural Primitives. Technical Report USC-CSE-2003-510, USC Center for Software Engineering, October 2003

N16 Roshanak Roshandel and **Nenad Medvidović**. Relating Software Component Models. Technical Report USC-CSE-2003-504, USC Center for Software Engineering, March 2003.

N17 Nikunj R. Mehta and **Nenad Medvidović**. Distilling Software Architecture Primitives from Architectural Styles. Technical Report USC-CSE-2002-509, USC Center for Software Engineering, September 2002.

N18 Marija Mikic-Rakic and **Nenad Medvidović**. Software Architecture-Based Development Support for Ubiquitous Systems. Technical Report USC-CSE-2002-508, USC Center for Software Engineering, September 2002.

N19 Ebru Dincel, **Nenad Medvidović**, and Andre van der Hoek. An Example Product Line Architecture: The Library System. Technical Report USC-CSE-2002-507, USC Center for Software Engineering, September 2002.

N20 Ebru Dincel, **Nenad Medvidović**, and Andre van der Hoek. An Example Product Line Architecture: Troops Deployment System. Technical Report USC-CSE-2002-506, USC Center for Software Engineering, September 2002.

N21 Ebru Dincel, **Nenad Medvidović**, and Andre van der Hoek. An Example Product Line Architecture: Digital Library Projects. Technical Report USC-CSE-2002-505, USC Center for Software Engineering, September 2002.

N22 Marija Mikic-Rakic, **Nenad Medvidović**, and Vladimir Jakobac. Middleware for Software Architecture-Based Development in Distributed, Mobile, and Resource-Constrained Environments. Technical Report USC-CSE-2002-501, USC Center for Software Engineering, February 2002.

N23 **Nenad Medvidović** and Marija Mikic-Rakic. Architectural Support for Programming-in-the-Many. Technical Report USC-CSE-2001-506, USC Center for Software Engineering, September 2001.

N24 Ebru Dincel, Roshanak Roshandel, and **Nenad Medvidović**. ADL-Independent Architectural Representation in XML. Technical Report USC-CSE-00-519, USC Center for Software Engineering, May 2000.

N25 **Nenad Medvidović**. On the Role of Middleware in Architecture-Based Software Development. Available as Technical Report USC-CSE-00-517, USC Center for Software Engineering, April 2000.

N26 **Nenad Medvidović**, Peyman Oreizy, Richard N. Taylor, Rohit Khare, and Michael Guntersdorfer. An Architecture-Centered Approach to Software Environment Integration. Technical Report USC-CSE-00-516, USC Center for Software Engineering, March 2000.

N27 Nikunj R. Mehta, **Nenad Medvidović**, and Marija Rakic. Why Consider Implementation-Level Decisions in Software Architectures? Technical Report USC-CSE-00-514, USC Center for Software Engineering, February 2000.

N28 Alexander Egyed, Paul Gruenbacher, and **Nenad Medvidović**. Refinement and Evolution Issues between Requirements and Product Line Architectures. Technical Report USC-CSE- 00-515, USC Center for Software Engineering, February 2000.

N29 **Nenad Medvidović**, David S. Rosenblum, and Richard N. Taylor. A Type Theory for Software Architectures. Technical Report, UCI-ICS-98-14, Department of Information and Computer Science, University of California, Irvine, April 1998.

N30 **Nenad Medvidović** and Richard N. Taylor. Reuse of Off-the-Shelf Constraint Solvers in C2-Style Architectures. Technical Report UCI-ICS-96-28, Department of Information and Computer Science, University of California, Irvine, July 1996.

N31 **Nenad Medvidović**. Formal Definition of the Chiron-2 Software Architectural Style. Technical Report UCI-ICS-95-24, Department of Information and Computer Science, University of California, Irvine, August 1995.

N32 Jason E. Robbins, E. James Whitehead Jr., **Nenad Medvidović**, and Richard N. Taylor. A Software Architecture Design Environment for Chiron-2 Style Architectures. Arcadia Technical Report UCI-95-01, University of California, Irvine, January 1995.

7 Research Support

Current Support

G1 National Science Foundation — Software and Hardware Foundations
<u>Sole PI</u> at USC; collaborative proposal with Georgia Institute of Technology and UC
　　Irvine
A General Framework for Automated Test Transfer
Duration: 10/1/21 - 9/30/25
Grant Number: 2105871
Award Amount to USC: *$400,000*

Past Support

G2 Department of Homeland Security
<u>Sole PI</u>; subcontract to Rochester Institute of Technology
National Vulnerability Intelligence Platform
Duration: 1/1/23 - 10/1/23
Subcontract Amount: *$493,522*

G3 Google Research
<u>Sole PI</u>
Automatic Program Patching and Synthesis
Duration: 5/1/22 - 12/31/23
Award Amount: *$50,000*

G4 National Science Foundation — Community Infrastructure Planning
<u>Sole PI</u> at USC; lead institution on collaborative proposal with UC Irvine, Rochester
　　Institute of Technology, University of Hawaii,
Drexel University, and Stevens Institute of Technology
Constructing a Community-Wide Software Architecture Infrastructure
Duration: 9/1/18 - 8/31/23
Grant Number: 1823354
Award Amount to USC: *$684,000*

G5 National Science Foundation — Software and Hardware Foundations
<u>Sole PI</u>
Rooting Out Data- and Control-Flow Anomalies in Event-Based Systems Duration:
8/15/17 - 7/31/22
Grant Number: 1717963
Award Amount: *$500,000*

G6   Office of Naval Research
Co-PI
Ensuring Security of Android Software via Tailorable Multi-Layer Customization
Co-PIs: Chao Wang, USC (lead PI)
            William GJ Halfond, USC
Duration: 9/1/17 - 8/31/21
Grant Number: N00014-17-1-2896
Award Amount: *$1,082,320*

G7   Google
Sole PI
Mining Architectural Information to Stem Technical Debt
Duration: 10/1/19 - 4/30/21
Award Amount: *$42,500*

G8   National Science Foundation — Community Infrastructure Planning
Sole PI
Planning and Prototyping a Community-Wide Software Architecture Instrument
Duration: 8/1/16 - 7/31/19
Grant Number: 1629977
Award Amount: *$70,000*

G9   Huawei Technologies
Sole PI
Advanced Support for Software Architecture Recovery and Maintenance
Duration: 2/15/18 - 2/14/19
Award Amount: *$200,000*

G10   National Science Foundation — Software and Hardware Foundations
Sole PI
Techniques for Pruning Problem and Solution Spaces to Enable Methodical Exploration
          of Software Development Alternatives
Duration: 6/1/16 - 5/31/19
Grant Number: 1618231
Award Amount: *$500,000*

G11   Huawei Technologies
Sole PI
Automated, Intelligent Support for Architecture-Based Forward- and Reverse-
          Engineering
Duration: 12/1/16 - 11/30/17
Award Amount: *$145,000*

G12   Northrop Grumman
Sole PI
Parametric and Simulation Models Research and Calibration
Duration: 8/16/2014 - 5/15/2017
Award Amount: *$30,000*

G13 National Science Foundation — Software and Hardware Foundations
<u>Co-PI</u>
Helping Developers Improve the Energy Consumption of Smartphone Applications
Co-PIs: William GJ Halfornd, USC (lead PI)
　　　　Ramesh Govindan, USC
Duration: 7/1/13 - 6/30/17
Grant Number: 1321141
Award Amount: *$500,000*

G14 National Science Foundation — Software and Hardware Foundations
Sole PI
From Scenario-Based Software Requirements to Component-Level Behavior
Duration: 9/01/12 - 8/31/16
Grant Number: 1218115
Award Amount: *$500,000*

G15 National Science Foundation — Software and Hardware Foundations
<u>Sole PI</u>
Automating the Detection of Architectural Degradation in Software Systems
Duration: 8/01/11 - 7/31/15
Grant Number: 1117593
Award Amount: *$300,000*

G16 Defense Advanced Research Projects Agency (DARPA)
<u>Lead PI</u>
Testing Privacy-Preserving Distributed Systems on SAFERlab
Co-PIs: Yuriy Brun, University of Massachusetts
　　　　Sam Malek, George Mason University
Contract Number: N66001-11-C-4021
Duration: 11/1/13 - 2/28/15
Award Amount: *$300,000*

G17 Intelligence Advanced Research Projects Activity (IARPA)
<u>Lead PI</u>
OpTile: Private Computing in the Open
Co-PIs: Yuriy Brun, University of Massachusetts
　　　　Sam Malek, George Mason University
Contract Number: N66001-13-1-2006
Duration: 9/27/13 - 9/26/14
Award Amount: *$300,000*

G18 Northrop Grumman
<u>Sole PI</u>
Architectural Transformation of Legacy Systems to Future Systems
Duration: 1/1/14 - 5/15/14
Award Amount: *$30,000*

G19 Northrop Grumman
Sole PI
Domain-Specific Modeling and Simulation in Collaborative Software Development
Projects
Duration: 8/16/13 - 5/15/14
Award Amount: *$10,000*

G20 Infosys Technologies Ltd.
Sole PI
CoDesign - A Collaborative Software Design Environment
Duration: 10/1/11 - 8/31/14
Award Amount: *$200,000*

G21 Northrop Grumman
Sole PI
Domain-Specific Modeling and Simulation
Duration: 8/16/12 - 5/15/13
Award Amount: *$10,000*

G22 Northrop Grumman
Sole PI
Exploring Design Alternatives in Software-Intensive Projects
Duration: 8/16/11 - 5/15/12
Award Amount: *$10,000*

G23 National Science Foundation — Software and Hardware Foundations
Lead PI
Early Reliability Modeling and Prediction of Embedded Software Systems
Duration: 3/01/10 - 8/31/12
Co-PIs: Leana Golubchik, USC
        Gaurav Sukhatme, USC
Grant Number: 0905665
Award Amount: *$210,000*

G24 Stevens Institute of Technology — Systems Engineering Research Center
Sole PI
Requirements for Net-Centric Enterprises (RT-25)
Duration: 10/1/10 - 12/31/11
Award Amount: *$270,298*

G25 National Science Foundation — Software for Real-World Systems
Sole PI at USC; collaborative proposal with UC Irvine
Recombinant Services - Recasting the Web for Continuously Evolving Systems
Duration: 9/15/08 - 8/31/11
Grant Number: 0820170
Award Amount to USC: *$193,670*

G26 Office of Secretary of Defense — UAST
<u>Sole PI</u>; subcontract to MIT
A Prescriptive and Adaptive Testing Framework (PATFrame) for Unmanned and
       Autonomous Systems of Systems
Duration: 10/1/09 - 9/30/10
Subcontract Amount: *$128,649*

G27 Infosys Technologies Ltd.
<u>Sole PI</u>
An Extensible Infrastructure for Collaborative Architecture-Based Development of
       Distributed Software-Intensive Systems
Duration: 9/1/08 - 12/31/10
Grant Number: 0208
Award Amount: *$200,000*

G28 Jet Propulsion Laboratory — SURP
<u>Co-PI</u>
Reconfigurable Software for Recovering from Component Failures in Long Duration
       Missions
Co-PIs: Gaurav Sukhatme, USC (co-PI)
Duration: 9/1/09 - 5/31/10
Award Amount: *$75,000*

G29 National Institutes of Health <u>Co-PI</u>
Mobile Device Biomonitoring to Prevent and Treat Obesity in Underserved Minority
       Youth
Duration: 8/1/08 - 7/31/10
Co-PIs: Donna Spruijt-Metz, USC (lead PI)
       Murali Annavaram, USC
       Urbashi Mitra, USC
       Shrikanth Narayanan, USC
       Gaurav Sukhatme, USC
Award Amount: *$948,348*

G30 Robert Bosch Research and Technology Centers
<u>Sole PI</u>
Software Architectural Support for Embedded Systems
Duration: 3/1/06 - 5/31/09
Award Amount: *$470,000*

G31 National Science Foundation — Information Technology Research
<u>Sole PI</u>
Software Architectural Support for Programming-in-the-Small-and-Many
Duration: 9/1/03 - 8/31/09
Grant Number: 0312780
Award Amount: *$448,000*

G32 National Science Foundation — Computer Systems Research
<u>Lead PI</u>
Engineering Reliability into Hybrid Systems: A Compositional and Hierarchical
      Approach
Duration: 8/01/07 - 7/31/09
Co-PIs: Leana Golubchik, USC
Grant Number: 0720612
Award Amount: *$40,000*

G33 U.S. Army
<u>Co-PI</u>
Future Combat Systems Software Definition, Design, Development, and Deployment
Duration: 1/1/08 - 12/31/08
Co-PIs: Barry Boehm (lead PI)
Award Amount: *$425,000*

G34 IBM Real-Time Innovation
<u>Sole PI</u>
Prism-RT: A Java-Based Architectural Middleware Platform for Real-Time Embedded
      Systems
Duration: 12/1/2007 - 12/31/08
Award Amount: *$20,000*

G35 National Science Foundation — Science of Design
Co-PI
Value-Based Science of Design
Duration: 12/15/04 - 11/30/08
Co-PIs: Barry W. Boehm, USC (lead PI)
Grant Number: 0438931
Award Amount: *$400,000*

G36 National Science Foundation — Computer Systems Research
<u>Lead PI</u>
Engineering Reliability Into Hybrid Systems via Rich Design Models
Duration: 7/1/05 - 6/30/07
Co-PIs: Leana Golubchik, USC
Grant Number: 0509539
Award Amount: *$100,000*

G37 National Science Foundation — Federal Cyber Service: Scholarship for Service
<u>Co-PI</u>
An Innovative Information Assurance and Security Technology Capacity Development
      and Outreach Program
Duration: 8/1/04 - 7/31/07
Co-PIs: Leana Golubchik, USC (lead PI)
      B. Clifford Neuman, USC
      Gerard Medioni, USC
Grant Number: 0417274
Award Amount: *$300,000*

G38 Okawa Research Foundation
Sole PI
The GridLite DREAM: Bringing the Grid to Your Pocket
Duration: 10/1/05 - 9/30/06
Award Amount: *$10,000*

G39 Boeing
Sole PI
C4ISR SADD Development Assistance (FCS)
Duration: 10/1/05 - 3/31/06
Award Amount: *$100,000*

G40 Jet Propulsion Laboratory Sole PI
Software Connectors for Data Distribution
Duration: 7/1/05 - 8/31/05
Award Amount: *$18,144*

G41 NASA High-Dependability Computing Consortium
Co-PI
Empirical Research on High Dependability Computing
Duration: 4/1/01 - 3/31/06
Co-PIs: Barry W. Boehm, USC (lead PI)
Award Amount: *$2,500,000*

G42 National Science Foundation — CAREER
Sole PI
Architecture-Based Support for Software Application Families
Duration: 7/1/00 - 6/30/05
Grant Number: 9985441
Award Amount: *$241,000*

G43 Boeing
Sole PI
Software Architecture-Based Development of Product Lines for the Tactical Radio
      Domain
Duration: 1/1/04 - 12/31/04
Award Amount: *$57,500*

G44 Jet Propulsion Laboratory
Sole PI
Extensible Architectural Technology for Managing Complex Space Data Systems
Duration: 11/1/03 - 8/31/04
Contract Number: 579951
Award Amount: *$50,000*

G45 Defense Advanced Research Projects Agency (DARPA)
Lead PI
Dynamic Assembly, Assessment, Assurance, and Adaptation via Heterogeneous
      Software Connectors
Duration: 7/1/00 - 10/31/03
Co-PIs: Barry W. Boehm, USC
Contract Number: F30602-00-2-0615
Award Amount: *$460,000*

G46 Jet Propulsion Laboratory
Sole PI
Relating State-Based and Component/Connector-Based Architectural Styles
Duration: 8/1/00 - 8/31/03
Contract Number: 1219801
Award Amount: *$95,672*

G47 U.S. Army Tank-Automotive and Armaments Command
Sole PI
COTS Components and Connectors
Duration: 9/1/01 - 3/31/03
Contract Number: 1400508
Award Amount: *$68,350*

G48 Xerox Corporation
Sole PI
Architecting Application Families
Duration: 9/1/00 - 8/31/02
Award Amount: *$60,000*

G49 Intel Corporation
Lead PI
Embedded Systems Lab: A Teaching and Research Facility
Award Date: July 2001, July 2002
Co-PIs: Gaurav Sukhatme, USC
Award Amount: *$95,000* (in equipment and cash)

G50 Defense Advanced Research Projects Agency (DARPA)
Sole PI; subcontract to UC Irvine
Architecture-Centric Dynamic Adaptation of Deeply Networked Embedded Systems
Duration: 9/23/99 - 1/22/01
Contract Number: F30602-99-C-0174
Subcontract Amount: *$92,500*

8 Patents

07/2022   Latency Minimization in Mobile Applications
        U.S. Patent 11,379,551
11/2020   SEALANT: Security for End-users of Android via Light-weight ANalysis Techniques
        U.S. Patent 10,827,349
12/2012   Tile Architectural Style for Privacy-Preserved Distributed Computing
        U.S. Patent 8,332,457

9 Teaching

University of Southern California

Courses Developed and Taught

T1   CSCI 699 — Software Forensics
Ph.D.-level seminar
Spring 2020

T2   CSCI 578 — Software Architectures
Graduate-level course, a core course for the M.S. specialization in Software Engineering
Spring 1999, 2000, 2001, 2002, 2004, 2005, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2015, 2016, 2017, 2018
Fall 2008, 2009, 2010, 2011, 2012, 2014; 2019, 2020

T3   CSCI 310 — Software Engineering
Upper-division undergraduate course Spring 2021
Fall 2016, 2017

T4   CSCI 589 — Software Engineering for Embedded Systems
Graduate-level course
Fall 2001, 2002, 2003, 2004, 2006, 2007, 2015

T5   CSCI 499 — Modeling Software-Intensive Systems
Upper-division undergraduate / lower-division graduate seminar
Spring 2011

T6   CSCI 377 — Introduction to Software Engineering
Upper-division undergraduate course
Fall 2004, 2006, 2007, 2008, 2009

T7   CSCI 599 — Formal Methods in Software Architectures
Graduate seminar
Fall 2000

T8   CSCI 599 — Current Issues in Software Architectures
Graduate seminar
Fall 1999

Courses Developed

T9   CSCI 568 — Requirements Engineering
Graduate-level course, a core course for the Certificate in Software Architecture

Courses Taught

T10   CSCI 591 — Computer Science Research Colloquium
M.S.-level research seminar series
Fall 2023

T11   CSCI 477 — Design and Construction of Large Software Systems
Upper division undergraduate / lower-division graduate course
Spring 2003

Other Universities

T12 Mining Software Repositories for Architectural Knowledge
International Summer School on Software Engineering, Salerno, Italy
Graduate, half-day course
July 2017

T13 Software Architecture and Robotics
LASER Summer School
Advanced graduate, one-week course
September 2017

T14 Software Architectures
Universidad Politécnica de Madrid, Spain
Graduate, one-week course, part of European Master of Software Engineering program
March 2011

T15 Advanced Software Architectures
Politecnico di Milano, Italy
Graduate course
July 2010
Two-week course, part of PoliMi's Ph.D. program

T16 Software Architecture
University of Buenos Aires, Argentina
Graduate, one-week course
Part of UBA's Winter School
August 2009

T17 NSEN 6111 — Software Architectures
Walden University, USA
Graduate online course
Co-taught with Richard N. Taylor and Eric Dashofy
Spring 2008

Industry

T18 Advanced Topics in Software Architecture
Samsung Electronics Co. Ltd., Suwon, South Korea
2-day professional development course
June 2013

T19 Software Architecture
Samsung Electronics Co. Ltd., Suwon, South Korea
3-day professional development course
June 2013

T20 Software Architecture
Infosys Technologies Ltd., Mysore, India
3-week professional development course
December 2009

T21 Software Architectures
Jet Propulsion Laboratory, Pasadena, CA
10-week professional development course
Spring 2001, 2002; Summer 2001, 2002

Teaching Assistantships

T22 ICS 121 — Introduction to Software Engineering
Junior/senior-level undergraduate course (Summer 1994)
University of California, Irvine

T23 ICS 141 — Programming Languages
Junior/senior-level undergraduate course (Spring 1994)
University of California, Irvine

T24 ICS 52 — Systematic Software Construction
Sophomore-level undergraduate course (Fall 1993, Winter 1994)
University of California, Irvine

T25 CSE 460/598 — Software Project Management and Development I
Senior-level undergraduate course (Fall 1992, Spring 1993, Summer 1993)
Arizona State University

10 Supervised Students

Current Doctoral Students - Advisor

- Satyaki Das
  Start date: August 2021

- Syeda Tasnim Fabiha
  Start date: August 2022

- Abid Hassan
  Start date: August 2023

- Jincheng He
  Start date: August 2020

- Tooraj Helmi
  Start date: August 2020

- Tuan Ngo
  Start date: August 2023

- Ghazal Rafiei
  Start date: August 2013

Doctoral Students - Dissertation Committee Member
Current

- Yazeed Alabdulkarim
- Reem Alfayez
- Celia Chen
- Paul Chiou
- Greg Harris

- Yannan Li
- Sara Mohammadinejad
- Khiem Ngo
- Xin Qin
- Selva Samuel, Carnegie Mellon University
- Hao Shi
- Sasha Volokh
- Jingbo Wang
- Di Wu

Graduated
- Marwan Abi-Antoun, CMU
- Negarsadat Abolhassani
- Mohammad-Mirza Aghatabar
- Abdulmajeed Alameer
- Mohamed Al Said
- Muhammad Ali Amer
- Jesper Andersson, Linkoping University, Sweden
- Pongtip Aroonvatanaporn
- Adi Azar
- Jongmoon Baik
- Sumita Barahmand
- Pooyan Behnamghader
- Jesal Bhuta
- Yue Chen
- Zhihao Chen
- Hugo Cheung
- Leslie Cheung
- Kun Young Chung
- Jürgen Cito, University of Zurich
- Eric Dashofy, UC Irvine
- Shirin Ebrahimi-Taghizadeh
- Alexander Egyed
- Ragy Eleish
- Alessio Gambi, University of Lugano, Switzerland
- Jiaping Gui
- Shuai Hao
- Anandi Hira
- I-De Huang
- LiGuo Huang
- Shahdad Irajpour

- Jinwoo Kim
- Hasan Kitapci
- Yoon-Ju Lee
- Ding Li
- In-Young Ko
- Supannika Koolmanojwong
- Alexander Lam
- DeWitt Lattimer
- Joo H. Lee
- Keun Lee
- Qi Li
- Sonal Mahajan
- Ali Malik
- Muhammad Murtaza
- David Naffin
- Vu Nguyen
- Brandon Paulsen
- Luis Pedrosa
- Gustavo Perez
- Monvorath Phongpaibul
- Kan Qi
- Hitesh Sajnani, UC Irvine
- Aaron Schram, University of Colorado, Boulder
- Shideh Shahidi
- Doochul Shin
- Chungha Sung
- Giordano Tamburrelli, Politecnico di Milano, Italy
- Thomas Tan
- Shahzad Tiwana
- Marcos Vieira
- Mian Wan
- Dan Wu
- Ye Yang
- Jason Yap

Masters Students

Graduated

- Ian Elston
- John Morse
- Marwan Abi-Antoun
- Raghbir Banwait

- Miheer Bhachech
- Ebru Dincel
- Lei Ding
- Luka Dojcilovic
- Brian D'Souza
- Eder Figueroa
- Prakash Gupta
- Sheryl John
- Himanshu Joshi
- Suhrid Karthik
- Armagan Kilic
- Vishal Kudchadkar
- Chenggang Li
- Mehrdad Mahdavi
- Sean McCleese
- Suhas Mehta
- Daye Nam
- Mahindra Pai
- Sandeep Phadke
- Aliasgar Rampurwala
- Tatsuhiko Tomita
- Vinaynathan Viswanathan
- Michael Wakerly
- Dongwoo Won
- David Woollard

Undergraduate Students
Graduated
- Nels Beckman
- Morgan Brown
- Vanessa Carson
- Justin Chen (Columbia University)
- Charles DeBergh
- Kelly Dickson
- Eric Dong
- Joshua Garcia
- Kevin Jing
- Trevor Johns
- Yi (Nick) Kuang
- Jerry Lin
- Jacob Schaider

- Anita Singh
- Markus Snelder
- Paul Wat
- Yifeng Yu

11 Formal Presentations

Keynote Presentations

P1 *Software Archipelagos as Impediments to Scientific Progress*. Montenegrin Academy of Sciences and Arts, Podgorica, Montenegro, November 2022.

P2 *Software Archipelagos as Impediments to Scientific Progress*. Central European Conference on Information and Intelligent Systems (CECIIS 2022), Dubrovnik, Croatia, September 2022.

P3 *Mining Architectural Information to Stem Technical Debt*. International Workshop on Mining Software Repositories for Software Architecture (MSR4SA), held with the European Conference on Software Architecture, online, September 2021.

P4 *Human Archipelagos Have Been Induced by COVID but Architectural Archipelagos Are All Our Own Doing.* IEEE 18th International Conference on Software Architecture (ICSA 2021), online, March 2021.

P5 *Stemming Architectural Decay in Software Systems*. Fourth International conference on Tools and Methods of Program Analysis (TMPA-2017), Moscow, Russia, March 2017.

P6 *Software Decay as a Big-Data Problem Viewed Through the Architectural Lens.* 2016 International Simulation Multi-Conference (AsiaSim / SCS AutumnSim 2016), Beijing, China, October 2016.

P7 *Viewing Software Decay Through the Architectural Lens*. International Symposium on Software Engineering and Applications (SEA 2015), Marina del Rey, CA, October 2015.

P8 *What Architecture Can Teach Us About When, Where, and Why Software Systems Decay*. 9th European Conference on Software Architecture (ECSA 2015), Dubrovnik/Cavtat, Croatia, September 2015.

P9 *Adapting Our View of Software Adaptation: An Architectural Perspective.* 9th International Symposium on Software Engineering for Adaptive and Self-Managing Systems (SEAMS 2014), Hyderabad, India, June 2014.

P10 *PhD Research: What, Where, Why, When, How*. INCOSE/CSER Systems Engineering and Architecting Doctoral Student Network (SEANET), University of Southern California, Los Angeles, CA, March 2014.

P11 *When, Where, and Why Software Systems Decay and What We Can Do about It*. University of California Irvine (UCI) Institute for Software Research Forum, Irvine, CA, May 2013.

P12 *Software Architecture Challenges & Opportunities for the 21st Century: Dynamism, Mobility, Autonomy, Services, Grids & Clouds*. 11th Brazilian Symposium on Software Quality, Fortaleza, Brazil, June 2012.

P13 *Software Architecture Challenges & Opportunities for the 21st Century: Dynamism, Mobility, Autonomy, Services, Grids & Clouds*. 5th India Software Engineering Conference (ISEC 2012), Kanpur, India, February 2012.

P14 *Software Architecture and Mobility: A Perfect Marriage or an Uneasy Alliance*. International Workshop on Software Architectures and Mobility (SAM 2008), Leipzig, Germany, May 2008.

P15 *Moving Architectural Description from Under the Technology Lamppost*. Brazilian Symposium on Software Components, Architectures, and Reuse (SBCARS 2007), Campinas, Brazil, August 2007.

P16 *Moving Architectural Description from Under the Technology Lamppost*. 32nd EUROMICRO Conference on Software Engineering and Advanced Applications (EUROMICRO'06), Dubrovnik, Croatia, August, 2006.

P17 *From Dependable Architectures to Dependable Systems*. Workshop on Architecting Dependable Systems (WADS 2004) held in conjunction with the International Conference on Dependable Systems and Networks (DSN 2004), Florence, Italy, June 2004.

Academic Conference Presentations

P18 *Software Architecture and COVID: A Marriage of (In)Confenience*. New and Emerging Ideas Panel: Software Architecture in the COVID-19 Reality. IEEE 18th International Conference on Software Architecture (ICSA 2021), online, March 2021.

P19 *Online Sports Betting Through the Prism of Software Engineering*. Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE 2020), November 2020.

P20 *An Architectural Style for Solving Computationally Intensive Problems on Large Networks*. (with Yuriy Brun) 15th International Symposium on Software Engineering for Adaptive and Self-Managing Systems (SEAMS 2020), Seoul, South Korea, May 2020.

P21 *ARCADE: A Workbench for Mining Architectural Information and Identifying Technical Debt*. Workshop on the National Java Repository Project, San Diego, CA, November 2019

P22 *Mining Architectural Information to Stem Technical Debt*. Southern California Software Engineering Symposium, Irvine, CA, June 2016.

P23 *Viewing Software Decay Through the Architectural Lens*. 2nd Latin American School on Software Engineering, Porto Alegre, Brazil, July 2016.

P24 *An End-to-End Domain-Specific Modeling and Analysis Platform*. 8th International Workshop on Modeling in Software Engineering (MISE 2016), Austin, TX, May 2016.

P25 *Extracting the Essence of Software Systems' Architectures Through Unstructured-Data Mining*. Mining and Modeling Unstructured Data in Software - Challenges for the Future, Shonan Village, Japan, March 2016.

P26 *An Empirical Study of Architectural Decay in Software Systems*. 39th International Conference on Software Engineering (ICSE 2017) Warm-up Workshop, Maceio, Brazil, October 2014.

P27 *An ARCADE for Architecture Analytics*. Dagstuhl Seminar on Software Development Analytics, Dagstuhl, Germany, June 2014.

P28 *Component-Aware Triggered Scenarios.* Working IEEE/IFIP Conference on Software Architecture (WICSA 2014), Sydney, Australia, April 2014.

P29 *When, Where, and Why Software Systems Decay and What We Can Do about It.* International Symposium to Commemorate the 45th Anniversary of the First Software Engineering Conference (SE@45), University of Southern California, Los Angeles, CA, October 2013.

P30 *Platform Architectures.* Dagstuhl Seminar on Customizing Service Platforms, Dagstuhl, Germany, April 2013.

P31 When, Where, and Why Do Software Systems' Architectures Decay? Workshop on Modularity and Software Architecture, Rio de Janeiro, Brazil, March 2013.

P32 *Impact Analysis for Distributed Event-Based Systems.* 6th ACM International Conference on Distributed Event-Based Systems (DEBS 2012), Berlin, Germany, July 2012.

P33 *The Impact of Architectural Design Decisions on Non-Functional Properties of Software Systems.* OOP 2010 - Software Engineering and Management Conference, Munich, Germany, January 2010.

P34 *A Framework for Modeling Software Product Lines.* OOP 2010 - Software Engineering and Management Conference, Munich, Germany, January 2010.

P35 *LVC Software Architecture Support for PATFrame.* International Test and Evaluation Association (ITEA) Live Virtual Constructive Conference, El Paso, TX, January 2010.

P36 *The Anatomy and Physiology of the Grid Revisited.* IEEE/CSSE/ISR Workshop on Software Architecture Challenges for the 21st Century, Los Angeles, CA, June 2009.

P37 *Center for Systems and Software Engineering Overview.* IEEE/CSSE/ISR Workshop on Software Architecture Challenges for the 21st Century, Los Angeles, CA, June 2009.

P38 *Architecture-Based Software Development of Mobile and Embedded Systems.* 2nd International ICSE Warm-up Workshop (WUP 2009), Cape Town, South Africa, April 2009.

P39 *Service-Oriented Architectures.* 13th Ground System Architectures Workshop (GSAW 2009), Torrance, CA, March 2009.

P40 *Architecture and Mobile/Embedded Systems - An Uneasy Alliance or a Marriage Made in Heaven.* USC-CSSE Annual Research Review Executive Workshop, Los Angeles CA, March 2009.

P41 *Software Architecture Modeling with Uncertainty.* AADL Workshop, Los Angeles, CA, February 2009.

P42 *Architecture and Hardware/Software/System Engineering Integration.* USC-CSSE COCOMO Workshop, Los Angeles, CA, October 2008.

P43 *Runtime Software Adaptation: Framework, Approaches, and Styles.* (with Peyman Oreizy and Richard N. Taylor) 30th International Conference on Software Engineering (ICSE 2008), Leipzig, Germany, May 2008.

P44 *Estimating the Energy Consumption in Pervasive Java-Based Systems.* 6th IEEE International Conference on Pervasive Computing and Communications (PerCom 2008), Hong Kong, March 2008.

P45 *An Introduction to Architecture-Level Reliability Analysis*. Tutorial, with Roshanak Roshandel, Working IEEE/IFIP Conference on Software Architecture (WICSA), Vancouver, Canada, February 2008.

P46 *Software Architectures and Embedded Systems*. Korean Computer Scientists and Engineers Association in America, University of Southern California, Los Angeles, CA, December 2007.

P47 *Improving a Distributed Software System's Quality of Service via Architecture-Driven Dynamic Redeployment*. Tutorial, Brazilian Symposium on Software Components, Architectures, and Reuse (SBCARS 2007), Campinas, Brazil, August 2007.

P48 *Construction of Analytic Frameworks for Component-Based Architectures.* Brazilian Symposium on Software Components, Architectures, and Reuse (SBCARS 2007), Campinas, Brazil, August 2007.

P49 *From Dependable Architectures to Dependable Systems*. USC-CSSE Annual Research Review, Los Angeles, CA, February 2007.

P50 *A Classification of Disconnected Operation Techniques*. 32nd EUROMICRO Conference on Software Engineering and Advanced Applications (EUROMICRO'06), Dubrovnik, Croatia, August, 2006.

P51 *Improving a Distributed Software System's Quality of Service via Redeployment*. Workshop on State of the Art in Software Engineering, Rutgers University, New Brunswick, NJ, June 2006.

P52 *The GridLite DREAM: Bringing the Grid to Your Pocket*. Monterey Workshop, Laguna Beach, CA, September 22-23, 2005.

P53 *A View from the Trenches*. ICSE 2005 New Software Engineering Faculty Symposium, St. Louis, MO, May 2005.

P54 *Modeling Behavior in Compositions of Software Architectural Primitives*. 19th IEEE International Conference on Automated Software Engineering (ASE 2004), Linz, Austria, September 2004.

P55 *Toward Architecture-Based Reliability Estimation*. Workshop on Architecting Dependable Systems (WADS 2004) held in conjunction with the International Conference on Dependable Systems and Networks (DSN 2004), Florence, Italy, June 2004.

P56 *Style-Based Software Architectural Compositions as Domain-Specific Models*. Workshop on Directions in Software Engineering Environments (WoDiSEE 2004), Edinburgh, UK, May 2004.

P57 *Software Architectures and Embedded Systems*. Monterey Workshop on Software Engineering for Embedded Systems: From Requirements to Implementation, Chicago, IL, September 2003.

P58 *Coupling Architectural Discovery and Recovery to Stem Architectural Erosion*. Dagstuhl Workshop on Software Architecture Recovery and Modeling (SWARM), Dagstuhl, Germany, February 2003.

P59 *A Family of Software Architecture Implementation Frameworks*. 2002 Working IEEE/IFIP Conference on Software Architectures (WICSA-3), Montreal, Canada, August 2002.

P60 *On the Role of Middleware in Architecture-Based Software Development.* 14th International Conference on Software Engineering and Knowledge Engineering (SEKE 2002), Ischia, Italy, July 2002.

P61 *Architecture-Level Support for Software Component Deployment in Resource Constrained Environments.* IFIP/ACM Working Conference on Component Deployment (CD 2002), Berlin, Germany, June 2002.

P62 *Focus: A Light-Weight, Incremental Approach to Software Architecture Recovery and Evolution.* 2001 Working IEEE/IFIP Conference on Software Architectures (WICSA-2), Amsterdam, the Netherlands, August 2001.

P63 Software Model Connectors: Bridging Models across the Software Lifecycle. 13th International Conference on Software Engineering and Knowledge Engineering (SEKE 2001), Buenos Aires, Argentina, June 2001.

P64 *What Young Faculty Members Still Want to Know.* ICSE 2001 New Software Engineering Faculty Symposium, Toronto, Canada, May 2001.

P65 *Exploiting Software Architecture Implementation Infrastructure in Facilitating Component Mobility.* ICSE 2001 Workshop on Software Engineering and Mobility, Toronto, Canada, May 2001.

P66 *xADL: Enabling Architecture-Centric Tool Integration With XML.* 34th Hawaii International Conference on System Sciences (HICSS-34), Maui, Hawaii, January 2001.

P67 *Programming in the Small and Many: A Software Engineering Research Agenda for the 21st Century.* 2000 ACM SIGSOFT Symposium on the Foundations of Software Engineering (FSE-8), Wild Ideas and Fun Flames, San Diego, CA, November 2000.

P68 *Towards Software Multioperability: Bridging Heterogeneous Software Interoperability Platforms.* Fourth International Software Architecture Workshop (ISAW-4), Limerick, Ireland, June 2000.

P69 *Using Off-the-Shelf Middleware to Implement Connectors in Distributed Software Architectures.* 21st International Conference on Software Engineering (ICSE'99), Los Angeles, CA, May 1999.

P70 A Language and Environment for Architecture-Based Software Development and Evolution. 21st International Conference on Software Engineering (ICSE'99), Los Angeles, CA, May 1999.

P71 *Modeling Software Architectures in UML.* Workshop on Software Architectures and the Unified Modeling Language, Denver, CO, April 1999.

P72 *An Approach to Architecture-Based Software Integration.* Ground System Architectures Workshop (GSAW 99), El Segundo, CA, March 1999.

P73 *Assessing the Suitability of a Standard Design Method for Modeling Software Architectures.* First Working IFIP Conference on Software Architecture, San Antonio, TX, February 1999.

P74 *A Comparative Analysis of Architecture Description Languages.* USC-CSE Annual Research Review, Los Angeles, CA, February 1999.

P75 *Assessing UML's Suitability for Modeling Software Architectures.* USC-CSE Annual Research Review, Los Angeles, CA, February 1999.

P76 *Employing Off-the-Shelf Connector Technologies in C2-Style Architectures*. California Software Symposium (CSS'98), Irvine, CA, October 1998.

P77 *An Architecture-Based Approach to Software Evolution*. International Workshop on the Principles of Software Evolution, Kyoto, Japan, April 1998.

P78 *Domains of Concern in Software Architectures and Architecture Description Languages.* USENIX Conference on Domain-Specific Languages, Santa Barbara, CA, October 1997.

P79 *A Framework for Classifying and Comparing Architecture Description Languages.* Sixth European Software Engineering Conference together with the Fifth ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE'97), Zurich, Switzerland, September 1997.

P80 *Reuse of Off-the-Shelf Components in C2-Style Architectures.* 1997 Symposium on Software Reusability (SSR'97) and 1997 International Conference on Software Engineering (ICSE'97), joint session on Software Reuse, Boston, MA, May 1997.

P81 *Reusing Off-the-Shelf Components to Develop a Family of Applications in the C2 Architectural Style.* First International Workshop on Development and Evolution of Software Architectures for Product Families, Las Navas del Marqués, Spain, November 1996.

P82 *ADLs and Dynamic Architecture Changes.* Second International Software Architecture Workshop (ISAW-2), San Francisco, CA, October 1996.

P83 *Using Object-Oriented Typing to Support Architectural Design in the C2 Style.* Fourth ACM SIGSOFT Symposium on the Foundations of Software Engineering (FSE4), San Francisco, CA, October 1996.

P84 *Formal Modeling of Software Architectures at Multiple Levels of Abstraction.* California Software Symposium, Los Angeles, CA, April 1996.

P85 *A Component- and Message-Based Architectural Style for GUI Software.* Technology Presentation Track, 17th International Conference on Software Engineering (ICSE17), Seattle, WA, April 1995.

University and Research Institute Presentations

P86 *Mining Architectural Information to Stem Technical Debt*. Georgia Institute of Technology, Atlanta, GA, November 2019

P87 *Mining Architectural Information to Stem Technical Debt*. University College London, UK, July 2019

P88 *Loose Coupling in Mobile Systems: Challenges and Opportunities*. Harbin Institute of Technology, Harbin, China, April 2019.

P89 *Mining Architectural Information to Stem Technical Debt*. Harbin Institute of Technology, Harbin, China, April 2019.

P90 *Teaching CS and SE at USC*. Harbin Institute of Technology, Harbin, China, April 2019.

P91 *Publishing Strategies for Top SE Venues*. Harbin Institute of Technology, Harbin, China, April 2019.

P92 *Ph.D. Research: What, Where, Why, When, How*. Harbin Institute of Technology, Harbin, China, April 2019.

P93   *Introduction to Software Architecture.* Faculty of Organizational Sciences, University of Belgrade, Serbia, March 2017.

P94   *Architectural Decay in Software Systems: Symptoms, Causes, and Remedies.* University of Massachusetts, Amherst, MA, November 2013.

P95   *Architectural Decay in Software Systems: Symptoms, Causes, and Remedies.* McGill University, Montreal, Canada, October 2013.

P96   *When, Where, and Why Do Software Systems' Architectures Decay?* University of Lugano, Lugano, Switzerland, October 2012.

P97   *When, Where, and Why Do Software Systems' Architectures Decay?* University of Arizona, Tucson, AZ, October 2012.

P98   *Architectural Degradation - The Plague of Maturing Software Systems.* University of California Irvine Institute for Software Research Annual Research Review, Irvine, CA, May 2012.

P99   *Overview of Software Engineering Research at USC.* Computer Science Department Annual Research Review, Los Angeles, CA, March 2012.

P100 *A Framework for Maintaining a Distributed Software System's QoS.* Computer Science Department Annual Research Review, USC, Los Angeles, March 2010.

P101 *Academic Career Work-Life Balance - A View from the Trenches.* University of Southern California, April 2011.

P102 *Overview of Software Engineering Research at USC.* University of Southern California, Computer Science Research Day, March 2011.

P103 *A Framework for Early Estimation of Software System Reliability.* University of California, San Diego, February 2011.

P104 *Software Architecture and Mobility: A Perfect Marriage or an Uneasy Alliance?* University College, London, UK, October 2010.

P105 A Framework for Early Estimation of Software System Reliability. University of Zurich, Switzerland, September 2010.

P106 *The Future of Software Architecture: Challenges and Opportunities.* Federal University of Bahia, Salvador, Brazil, August 2010.

P107 *Software Architecture and Mobility: A Perfect Marriage or an Uneasy Alliance?* Federal University of Rio de Janeiro, Brazil, August 2010.

P108 Software Architecture and Mobility: A Perfect Marriage or an Uneasy Alliance? Pontifícia Universidade Católica do Rio de Janeiro, August 2010.

P109 *A Framework for Early Estimation of Software System Reliability.* Georgia Institute of Technology, Atlanta, GA, April 2010.

P110 *Software Architecture and Mobility: A Perfect Marriage or an Uneasy Alliance.* Institute for Software Research, Distinguished Speaker Series, University of California, Irvine, February 2010.

P111 *Improving a Distributed Software System's Quality of Service via Architecture-Driven Dynamic Redeployment.* Institute for Software Research Forum, University of California, Irvine, June 2007.

P112 *Dynamic Software Architectures*. Jesper Andersson Dissertation Defense Opponent, Linkoping University, Sweden, April 2007.

P113 *From Dependable Architectures to Dependable Systems*. USC-CSE Annual Research Review, Los Angeles, CA, February 2007.

P114 *Moving Architectural Description from Under the Technology Lamppost*. USC Center for Systems and Software Engineering Convocation, October 2006.

P115 *Endowing Legacy Applications with Software Architectural Capabilities*. University of Southern California - Information Sciences Institute, Marina del Rey, CA, October 2006.

P116 *The Prism Project: Software Architectural Support for Highly Distributed Environments*. Bosch Research and Technology Center, Palo Alto, CA, January 2006.

P117 *Coupling Architectural Discovery and Recovery to Stem Architectural Erosion*. USC-CSE Annual Research Review, Los Angeles, CA, March 2003.

P118 *Exploiting Architectural Style, Connectors, and Types in Large-Scale Software Development and Evolution.* University of Texas, Austin, TX, April 2001.

P119 *An Architecture-Based Approach to Developing Heterogeneous, Highly Distributed Software Systems.* University of Southern California - Information Sciences Institute, Marina del Rey, CA, February 2001.

P120 *Programming in the Many: Software Engineering Paradigm for the 21st Century.* USC-CSE Annual Research Review, Los Angeles, CA, February 2001.

P121 *An Architecture-Based Approach to Developing Heterogeneous, Highly Distributed Software Systems.* University of Washington, Seattle, WA, January 2001.

P122 *From Programming in the Large to Programming in the Small and Many.* University of California, Santa Cruz, CA, October 2000.

P123 *Exploiting Architectural Style, Connectors, and Types in Large-Scale Software Development and Evolution.* Rice University, Houston, TX, September 2000.

P124 *SAAGE — An Environment for Software Architecture, Analysis, Generation, and Evolution*. USC-CSE Annual Research Review, Los Angeles, CA, February 2000.

P125 *A Style-Based Approach to the Design and Evolution of Adaptable Software.* University of Texas, Austin, TX, November 1997.

Professional Organization, Industry, and Funding Agency Presentations

P126 *On Selecting Datasets for DL-based Vulnerability* Detection. 68th Meeting of the IFIP Working Group 2.4, online, November 2023.

P127 *On Automated Mobile-App Test Generation and Transfer*. 66th Meeting of the IFIP Working Group 2.4, Salzburg, Austria, July 2022.

P128 *Protection of Intellectual Property Through the Prism of Software Engineering*. Logate Institute Live Meetup, Podgorica Montenegro, online, May 2022.

P129 *Classifying and Identifying Noise in Software Patches*. 64th Meeting of IFIP Working Group 2.4, online, May 2021.

P130 *Events in Mobile Systems: A Blessing and a Curse*. 62nd Meeting of IFIP Working Group 2.4, Port Elizabeth, South Africa, January 2020.

P131 *Architectural Decay in Open-Source Software*, Google, Irvine, CA, October 2019.

P132 E*nsuring Security of Android Software via Tailorable Multi-Layer Customization*. Office of Naval Research (ONR) Total Platform Cyber Protection (TPCP) Program Annual Review, Boston, MA, June 2019.

P133 *Mining Architectural Information to Stem Technical Debt*. Google, Los Angeles, CA, June 2019.

P134 *Architectural Decay in Large Software Systems*. Google, Los Angeles, CA, November 2017.

P135 *Correlating Implementation Issues with Architectural Decay in Large Software Systems*. Huawei Vision Forum, Santa Clara, CA, October 2017.

P136 *Using Architecture Recovery to Stem Software System Decay*. Huawei Vision Forum, Santa Clara, CA, October 2016.

P137 *Software Architecture Recovery, Event-Based App Analysis, and Mobile Security*. Huawei Technologies Site Visit, University of Southern California, Los Angeles, CA, June 2016.

P138 *Correctness, Security, and Adaptation in Distributed Event-Based Systems*. Army Research Laboratories Site Visit, University of Southern California, Los Angeles, CA, April 2016.

P139 *The Flame Project*. Infosys Site Visit, University of Southern California, Los Angeles, CA, February 2016.

P140 *Architectural Decay in Software Systems: Symptoms, Causes, and Remedies*. United Technologies Research Center, Hartford, CT, October 2013.

P141 *sTile: Securing the Insecure Cloud*. DARPA Site Visit, Information Sciences Institute, Marina del Rey, CA, May 2012.

P142 *CoDesign - A Collaborative Software Design Environment*. Infosys Site Visit, Los Angeles, CA, May 2012.

P143 *Software Architecture Challenges & Opportunities for the 21st Century: Dynamism, Mobility, Autonomy, Services, Grids & Clouds*. Infosys, Mysore, India, March 2012.

P144 *The Anatomy and Physiology of the Grid Revisited*. Infosys, Bangalore, India, March 2012.

P145 P136 *Software Architecture Challenges & Opportunities for the 21st Century: Dynamism, Mobility, Autonomy, Services, Grids & Clouds*. IBM Research, Delhi, India, February 2012.

P146 *sTile: Securing the Insecure Cloud*. CIA, Washington, DC, November 2011.

P147 *sTile: Securing the Insecure Cloud*. DARPA, Arlington, VA, June 2011.

P148 *Desiderata and Challenges in Globally-Distributed Software Development*. Infosys Aurora, Las Vegas, NV, August 2011.

P149 *Modern Software Architectural Challenges: Dynamism, Mobility, Services, Grids, and Clouds*. Aerospace Corporation, El Segundo, CA, November 2010.

P150 *Software Architecture and Mobility: A Perfect Marriage or an Uneasy Alliance?* Northrop Grumman, Los Angeles, CA, September 2010.

P151 *Software Architecture and Mobility: A Perfect Marriage or an Uneasy Alliance*? Infosys, Bangalore, India, December 2009.

P152 *Software Architecture Support for PATFrame*. PATFrame project kick-off meeting, Ft. Hood, TX, August 2009.

P153 *An Extensible Infrastructure for Collaborative Architecture-Based Development of Distributed Software-Intensive Systems*. Infosys site visit, April 2009.

P154 *Architecture and Hardware/Software/System Engineering Integration*. Lockheed Martin Site Visit, Los Angeles, CA, December 2008.

P155 *An Extensible Infrastructure for Collaborative Architecture-Based Development of Distributed Software-Intensive Systems*. Infosys project progress meeting, August 2008.

P156 *An Extensible Infrastructure for Collaborative Architecture-Based Development of Distributed Software-Intensive Systems*. Infosys project kick-off meeting, August 2008.

P157 *Architecture-Based Modeling and Simulation*. Boeing Professor Day, Seal Beach, CA, February 2008.

P158 *Overview of Software Architecture Research at USC*. Bosch Research and Technology Center, Palo Alto, CA, January 2007.

P159 *Identifying and Addressing Uncertainty in Architecture-Level Software Reliability Modeling*. NSF Next Generation Software Program (NSFNGS) Workshop, Long Beach, CA, February 2007.

P160 *Multi-Framework Programming via Software Architecture and Architectural Middleware*. DARPA Multi-Framework Programming Workshop, Menlo Park, CA, August 2007.

P161 *Overview of Software Architecture Research at USC*. USC Computer Science Department Industrial Advisory Board Meeting, Los Angeles, CA, April 2006.

P162 *Overview of Software Architecture Research at USC*. General Electric Site Visit, Los Angeles, CA, February 2006.

P163 *Software Architecture for DREAM Environments*. Jet Propulsion Laboratory, Pasadena, CA, January 2005.

P164 *DeSi - An Environment for Modeling, Analyzing, and Simulating Deployment Architectures*. Boeing, Anaheim, November 2004.

P165 *Overview of Software Architecture Research at USC*. Northrop Grumman Site Visit, Los Angeles, CA, April 2004.

P166 *Overview of Software Architecture Research at USC*. Microsoft Site Visit, Los Angeles, CA, March 2004.

P167 *Overview of Software Architecture Research at USC*. Airbus Site Visit, Los Angeles, CA, February 2004.

P168 *DeSi - A Tailorable Environment for Assessing the Quality of Distributed Software Architectures*. Jet Propulsion Laboratory, Pasadena, CA, January 2004.

P169 *Overview of Software Engineering Research at USC*. Boeing Site Visit, Los Angeles, CA, November 2003.

P170 *Software Architecture Research at USC-CSE: An Overview.* Jet Propulsion Laboratory Site Visit, Los Angeles, CA, September 2003.

P171 *Software Architectures and Self-Healing Systems.* Boeing, Anaheim, CA, May 2003.

P172 *Software Architectures and Self-Healing Systems.* Boeing-DARPA Future Combat Systems Meeting, Boeing, Anaheim, CA, September 2002.

P173 *Software Connectors for Programming-in-the-Many.* Boeing, Seattle, WA, November 2001.

P174 Software Architecture Collaboration between JPL and USC. Jet Propulsion Laboratory, Pasadena, CA, September 2001.

P175 *Relating State-Based and Component/Connector-Based Architectural Styles: Technical Project Review.* Jet Propulsion Laboratory, Pasadena, CA, August 2001.

P176 *Architectural Support for Programming-in-the-Many.* U.S. Army Tank-Automotive and Armaments Command (TACOM), Detroit, MI, July 2001.

P177 *Software Architecture Research at USC: Programming in the Large and Many.* Xerox Corporation, El Segundo, CA, January 2001.

P178 *From Programming in the Large to Programming in the Small and Many.* Microsoft USC Site Visit, Los Angeles, December 2000.

P179 *Software Architecture at USC and JPL.* Jet Propulsion Laboratory, Pasadena, CA, October 2000.

P180 *Programming in the Small, Large, and Many.* Xerox Corporation, El Segundo, CA, October 2000.

P181 *Programming in the Small, Large, and Many.* Schlumberger Corporation, Houston, TX, September 2000.

P182 *Dynamic Assembly, Assessment, Assurance, and Adaptation via Heterogeneous Software Connectors.* DARPA/ISO DASADA Project Kick-off Meeting, Santa Fe, NM, September 2000.

P183 *UML and Software Architectures.* DARPA/ISO DASADA Project Kick-off Meeting, Santa Fe, NM, September 2000.

P184 *An Approach to Architecture-Based Software Development and Evolution.* Jet Propulsion Laboratory, Pasadena, CA, May 2000.

P185 *SAAGE — An Environment for Software Architecture, Analysis, Generation, and Evolution.* Lockheed Martin USC Site Visit, Los Angeles, CA, May 2000.

P186 *On the Role of UML in Modeling Software Architectures.* Southern California Software Process Improvement Network, Long Beach, CA, April 2000.

P187 *Software Architecture Research and Practice.* Jet Propulsion Laboratory, Pasadena, CA, April 2000.

P188 *Architecture-Centric Dynamic Adaptation of Deeply Networked Embedded Systems.* DARPA/ITO RENES Project Kick-off Meeting, Arlington, VA, November 1999.

P189 *Software Architecture Research and Practice.* NSF Software Engineering Strategies Workshop Briefing, National Science Foundation, Arlington, VA, September 1999.

P190 *Assessing the Suitability of UML for Modeling Software Architectures.* Bay Area Round Table (BART), Palo Alto, CA, July 1999.

P191 *A Classification and Comparison Framework for Software Architecture Description Languages.* Second DARPA EDCS Architecture/Generation Workshop, Santa Fe, NM, April 1997.

P192 *Component-Based GUI Architecture.* Hughes Aircraft Corp., El Segundo, CA, January 1997.

P193 *What's New with C2?* Arcadia Research Meeting, Portland, OR, August 1996.

P194 *Chiron-2: A Component- and Message-Based Architectural Style for GUI Software.* Sun Microsystems Laboratories, Palo Alto, CA, June 1995.

P195 *Chiron-2: A Component- and Message-Based Architectural Style for GUI Software.* Bay Area Round Table (BART), Palo Alto, CA, June 1995.

12 Professional Service

Professional Organization and Journal Leadership

S1 Editor-in-Chief, IEEE Transactions on Software Engineering (1/18 - 12/22)

S2 Chair, ACM Software System Award Committee (7/21 - 6/22)

S3 Deputy Chair, ACM Software System Award Committee (7/20 - 6/21)

S4 Chair, Editor-in-Chief Search Committee, ACM Transactions on Autonomous and Adaptive Systems (6/20 - 9/20)

S5 Chair, ACM Publications Board Task Force on Improving Peer-Review Incentives (1/19 - 7/20)

S6 Chair, ACM SIGSOFT (7/15 - 6/18)

S7 Chair, Committee on Capture/Streaming at ACM Conferences, ACM SIG Governing Board (10/16 - 6/18)

S8 Chair, Steering Committee, ACM SIGSOFT Symposium on the Foundations of Software Engineering (7/15 - 9/17)

S9 Chair, Steering Committee, International Conference on Software Engineering (11/13 - 10/15)

Editorial Boards and Steering Committee Membership

S10 Member, Joint ICSE/FSE/ASE Conference Consolidation Committee (7/20 - present)

S11 Member, Executive Committee, ACM Special Interest Group on Software Engineering (SIGSOFT) (7/18 – 6/24)

S12 Member, Steering Committee, International Conference on Software Engineering (5/08 - present)

S13 Member, Steering Committee, ACM International Conference on the Foundations of Software Engineering (FSE) (5/17 – 6/24)

S14 Member, ICSE Journal-First Task Force (5/16 - 12/23)

S15 Member, ACM SIG Governing Board (7/15 - 6/20)

S16 Member, ACM Publications Board (7/18 - 6/20)

S17 Guest Editor, IEEE Software, 50th Anniversary of Software Engineering (6/17 - 10/18)

S18 Associate Editor, ACM Transactions on Software Engineering and Methodology (3/14 - 12/17)

S19 Associate Editor, Journal of Software Engineering for Robotics (12/08 - 12/17)

S20 Editorial Board Member, Journal of Software Engineering Research and Development (4/12 - 12/17)

S21 Editorial Board Member, Springer Computing Journal (2/11 - present)

S22 Editorial Board Member, Elsevier Journal of Systems and Software (1/11 - 12/17)

S23 Editorial Board Member, Elsevier Information and Software Technology Journal (1/08 - 12/17)

S24 Associate Editor, IEEE Transactions on Software Engineering (1/10 - 12/13)

S25 Guest Editor, Elsevier Journal of Systems and Software, The Future of Software Engineering FOR/IN the Cloud (7/11 - 7/13)

S26 Guest Editor, The Science of Computer Programming Journal Best Papers of the CompArch 2012 Conference (7/12 - 9/14)

S27 Member, Steering Committee, Working IEEE/IFIP Conference on Software Architecture (1/05 - 2/08)

Advisory Boards and Award Committees

S28 Member, Graduate Program Review Committee, Computer Science, University of California Riverside (2024 – 2025)

S29 Co-Chair, ICSE 2011 Most Influential Paper Award (3/19 - 5/21)

S30 Member, ACM Software System Award Committee (9/18 - 7/20)

S31 Member, Selection Committee, 2016 ACM SIGSOFT Impact Paper Award (12/16 - 5/17)

S32 Member, Selection Committee, 2015 ACM SIGSOFT Impact Paper Award (12/15 - 5/16)

S33 Member, Selection Committee, 2014 ACM SIGSOFT Outstanding Research Award (8/13 - 5/14)

S34 Member, International Selection Committee, Bower Award for Achievement in Science (8/13 - 11/13)

S35 Member, President's Advisory Board, Carnegie Mellon University - Silicon Valley (1/13 - 4/13)

Conference/Workshop Chairmanship

S36 General Co-Chair, 21st IEEE International Conference on Software Architecture (ICSA 2024), Hyderabad, India, 2024

S37 Chair, Barry Boehm Memorial Symposium, Los Angeles, CA, September 2014

S38 Co-Chair, ICSE Showcase, 45th International Conference on Software Engineering (ICSE 2023), Melbourne, Australia, May 2023

S39 Co-Chair, Doctoral Symposium, 44th International Conference on Software Engineering (ICSE 2022), Pittsburgh, PA, May 2022

S40 Co-Chair, 2nd International Workshop on Establishing the Community-Wide Infrastructure for Architecture-Based Software Engineering (ECASE 2019), Montreal, Canada, May 2019

S41 Co-Chair, 50 Years of Software Engineering Track, 40th International Conference on Software Engineering (ICSE 2018), Gothenburg, Sweden, May 2018

S42 Co-Chair, 2nd International Workshop on Infrastructures and Instruments For Software Architecture (REINFORCE), Urbana-Champaign, IL, November 2017

S43 Co-Chair, 1st International Workshop on Establishing the Community-Wide Infrastructure for Architecture-Based Software Engineering (ECASE 2017), Buenos Aires, Argentina, May 2017

S44 Program Co-Chair, Innovations in Software Engineering Conference (ISEC 2017), Jaipur, India, February 2017

S45 Co-Chair, 1st Workshop on Infrastructures and Instruments For Software Architecture (REINFORCE), Los Angeles, CA, January 2017

S46 Co-Chair, Workshops, 36th International Conference on Software Engineering (ICSE 2014), Hyderabad, India, June 2014

S47 Chair, International Symposium to Commemorate the 45th Anniversary of the First Software Engineering Conference (SE@45), University of Southern California, Los Angeles, CA, October 2013

S48 Program Co-Chair, 15th International ACM SIGSOFT Symposium on Component Based Software Engineering (CBSE-2012), Bertinoro, Italy, June 2012

S49 Program Co-Chair, 33rd International Conference on Software Engineering (ICSE 2011), Honolulu, HI, May 2011

S50 Program Co-Chair, Workshop on Software Engineering for Cloud Computing (SECLOUD 2011), Honolulu, HI, May 2011

S51 Program Co-Chair, 3rd IEEE International Conference on Self-Adaptive and Self-Organizing Systems (SASO 2009), San Francisco, CA, September 14-18, 2009

S52 Workshop Co-Chair, IEEE/CSSE/ISE Workshop on Software Architecture Challenges for the 21st Century, Los Angeles, CA, June 2009

S53 Program Co-Chair, 2nd International ICSE Warm-up Workshop (WUP 2009), Cape Town, South Africa, April 2009

S54 Workshop Chair, USC-CSSE Annual Research Review and Executive Workshop, Los Angeles, CA, March 2009

S55 Program Chair, Doctoral Symposium, 16th ACM SIGSOFT International Symposium on the Foundations of Software Engineering (FSE 16), Atlanta, GA, November 2008

S56 Program Chair, Special Session on Software Architecture for Pervasive Systems (SAPS), 34th Euromicro Conference in Parma, Italy, September 3-5, 2008

S57 Program Co-Chair, 2005 Working IEEE/IFIP Conference on Software Architecture (WICSA 2005), Pittsburgh, PA, November 2005

S58 Chair, Executive Workshop on Model-Driven Architecture, Annual Research Review, Center for Software Engineering, University of Southern California, Los Angeles, CA, March 2005

S59 Chair, Workshops, 26th International Conference on Software Engineering (ICSE 2004), Edinburgh, UK, May 2004

S60 Co-Chair, Tutorials, 9th European Software Engineering Conference and 11th ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE 2003), Helsinki, Finland, September 2003

S61 Chair, State-of-the-Art Track, 24th International Conference on Software Engineering (ICSE 2002), Orlando, FL, May 2002

S62 Co-Chair, First International Workshop on Evaluating Software Architecture Solutions (WESAS), Irvine, CA, May 2000

Conference/Workshop Organization

S63 Organizing Committee Member, First International Workshop on Bringing Architecture Design Thinking into Developers' Daily Activities (Bridge 2016), Austin, TX, May 2016

S64 Organizing Committee Member, 39th International Conference on Software Engineering (ICSE 2017) Warm-up Workshop, Maceio, Brazil, October 2014

S65 Technical Paper Session Chair, 22nd ACM SIGSOFT Symposium on the Foundations of Software Engineering (FSE 2014), Hong Kong, November 2014

S66 Workshops Selection Committee Member, 8th Joint meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE 2011), Szeged, Hungary, September 2011

S67 Technical Paper Session Chair, 12th European Software Engineering Conference and 17th ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE 2009), Amsterdam, the Netherlands, August 2009

S68 Student Volunteer Coordinator, 30th International Conference on Software Engineering (ICSE 2008), Leipzig, Germany, May 2008

S69 Technical Paper Session Chair, Working IEEE/IFIP Conference on Software Architecture (WICSA 2008), Vancouver, Canada, February 2008

S70 E-Publicity Chair, 29th International Conference on Software Engineering (ICSE 2007), Minneapolis, MN, May 2007

S71 Session Chair, USC Center for Systems and Software Engineering Convocation, Los Angeles, CA, October 2006

S72 Panelist, New Software Engineering Faculty Symposium (NSEFS 05), 27th International Conference on Software Engineering (ICSE 2005), St. Louis, MO, May 2005

S73 Technical Paper Session Chair, 19th IEEE International Conference on Automated Software Engineering (ASE 2004), Linz, Austria, September 2004

S74 Session Organizer and Chair, Annual Research Review, Center for Software Engineering, University of Southern California, Los Angeles, CA, March 2004

S75 Session Organizer and Chair, Annual Research Review, Center for Software Engineering, University of Southern California, Los Angeles, CA, March 2003

S76 Session Chair, Dagstuhl Workshop on Software Architecture Recovery and Modeling (SWARM), Dagstuhl, Germany, February 2003

S77 Chair, Tutorials, The Third Working IEEE/IFIP Conference on Software Architecture (WICSA-3), Montreal, Canada, August 2002

S78 Technical Paper Session Chair, The Working IEEE/IFIP Conference on Software Architecture (WICSA-3), Montreal, Canada, August 2002

S79 Technical Paper Session Chair, 24th International Conference on Software Engineering (ICSE 2002), Orlando, FL, May 2002

S80 Session Organizer and Chair, Annual Research Review, Center for Software Engineering, University of Southern California, Los Angeles, CA, March 2002

S81 Technical Paper Session Chair, Eighth European Software Engineering Conference and Ninth ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/ FSE 2001), Vienna, Austria, September 2001

S82 Technical Paper Session Chair, 23rd International Conference on Software Engineering (ICSE 2001), Toronto, Canada, May 2001

S83 Session Organizer and Chair, Annual Research Review, Center for Software Engineering, University of Southern California, Los Angeles, CA, March 2001

S84 Technical Paper Session Chair, Eighth ACM SIGSOFT Symposium on the Foundations of Software Engineering (FSE8), San Diego, CA, November 2000

S85 Session Organizer and Chair, Annual Research Review, Center for Software Engineering, University of Southern California, Los Angeles, CA, March 2000

S86 Organizing Committee Member, NSF Workshop on Software Engineering Research Strategies, Los Angeles, CA, August 1999

S87 Student Volunteer Coordinator, 21st International Conference on Software Engineering (ICSE'99), Los Angeles, CA, May 1999

S88 Co-Chair, DARPA/ITO EDCS Workshop on Architecture Description Language Toolkits, San Diego, CA, October 1998

S89 Chair, DARPA/ITO EDCS Workshop on the UML, Austin, TX, November 1997

S90 Webmaster, 1997 International Conference on Software Engineering (ICSE'97), Boston, MA, May 1997

Program Committee Membership

S91 Program Committee Member, 45th International Conference on Software Engineering (ICSE 2023), Melbourne, Australia, May 2023

S92 Program Committee Member, 44th International Conference on Software Engineering (ICSE 2022), Pittsburgh, PA, May 2022

S93 Program Committee Member, 5th IEEE International Conference on Software Architecture (ICSA 2021), Stuttgart, Germany, March 2021

S94 Program Committee Member, Journal-First Track, International Conference on Software Engineering (ICSE 2020), Seoul, South Korea, May 2020

S95 Program Committee Member, 4th IEEE International Conference on Software Architecture (ICSA 2020), Salvador, Brazil, March 2020

S96 Program Committee Member, ACM SIGSOFT Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE 2019), Tallinn, Estonia, August 2019

S97 Program Committee Member, Journal-First Track, International Conference on Software Engineering (ICSE 2019), Montreal, Canada, May 2019

S98 Program Committee Member, ACM SIGSOFT Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE 2018), Lake Buena Vista, FL, November 2018

S99 Program Committee Member, 40th International Conference on Software Engineering (ICSE 2018), Gothenburg, Sweden, May 2018

S100 Program Committee Member, International Workshop on Software Fairness (FairWare 2018), Gothenburg, Sweden, May 2018

S101 Program Committee Member, 2nd IEEE International Conference on Software Architecture (ICSA 2018), Seattle, WA, April 2018

S102 Program Committee Member, Innovations in Software Engineering Conference (ISEC 2018), Hyderabad, India, February 2018

S103 Symposium Committee Member, Doctoral Symposium, 11th joint meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE 2017), Paderborn, Germany, September 2017

S104 Symposium Committee Member, Doctoral Symposium, 39th International Conference on Software Engineering (ICSE 2017), Buenos Aires, Argentina, May 2017

S105 Program Board Member, 39th International Conference on Software Engineering (ICSE 2017), Buenos Aires, Argentina, May 2017

S106 Symposium Committee Member, Doctoral Symposium, 39th International Conference on Software Engineering (ICSE 2017), Buenos Aires, Argentina, May 2017

S107 Program Committee Member, 1st IEEE International Conference on Software Architecture (ICSA 2017), Gothenburg, Sweden, April 2017

S108 Mentoring Committee Member, 24th ACM SIGSOFT Symposium on the Foundations of Software Engineering (FSE 2016), Seattle, WA, November 2016

S109 Program Committee Member, 11th International Symposium on Software Engineering for Adaptive and Self-Managing Systems (SEAMS 2016), Austin, TX, May 2016

S110 Program Committee Member, Joint 13th Working IEEE/IFIP Conference on Software Architecture (WICSA), 19th International ACM SIGSOFT Symposium on Component-Based Software Engineering (CBSE), and 12th International ACM SIGSOFT Conference on the Quality of Software Architectures (QoSA), Venice, Italy, April 2016

S111 Program Committee Member, 9th Annual India Software Engineering Conference (ISEC 2016), Goa, India, February 2016

S112 Program Board Member, 38th International Conference on Software Engineering (ICSE 2016), Austin, TX, May 2016

S113 Program Committee Member, 5th International Workshop on the Twin Peaks of Requirements and Architecture, Florence, Italy, May 2015

S114 Symposium Committee Member, Doctoral Symposium, 37th International Conference on Software Engineering (ICSE 2015), Florence, Italy, May 2015

S115 Program Committee Member, Technical Briefings, 37th International Conference on Software Engineering (ICSE 2015), Florence, Italy, May 2015

S116 Program Committee Member, 22nd ACM SIGSOFT Symposium on the Foundations of Software Engineering (FSE 2014), Hong Kong, November 2014

S117 Program Committee Member, 8th European Conference on Software Architecture (ECSA 2014), Vienna, Austria, August 2014

S118 Expert Reviewer Panel Member, 28th IEEE/ACM International Conference on Automated Software Engineering (ASE 2013), Palo Alto, CA, November 2013

S119 Program Committee Member, 9th joint meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE 2013), Saint Petersburg, Russia, August 2013

S120 Symposium Committee Member, Doctoral Symposium, 9th joint meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE 2013), Saint Petersburg, Russia, August 2013

S121 Program Committee Member, 7th European Conference on Software Architecture (ECSA 2013), Montpelier, France, July 2013

S122 Program Committee Member, 7th ACM International Conference on Distributed Event-Based Systems (DEBS 2013), Arlington, TX, June-July 2013

S123 Program Committee Member, 16th International ACM SIGSOFT Symposium on Component-Based Software Engineering, Vancouver, Canada, June 2013

S124 Program Committee Member, 4th International ACM SIGSOFT Symposium on Architecting Critical Systems (ISARCS), Vancouver, Canada, June 2013

S125 Program Committee Member, 33rd International Conference on Software Engineering - New Ideas and Emerging Results Track, San Francisco, CA, May 2013

S126 Program Committee Member, 2nd International Workshop on the Twin Peaks of Requirements and Architecture, San Francisco, CA, May 2013

S127 Program Committee Member, 1st International Workshop on the Twin Peaks of Requirements and Architecture, Chicago, IL, September 2012

S128 Program Committee Member, 6th ACM International Conference on Distributed Event-Based Systems, Berlin, Germany, July 2012

S129 Program Committee Member, 7th International Symposium on Software Engineering for Adaptive and Self-Managing Systems (SEAMS 2012), Zurich, Switzerland, June 2012

S130 Program Committee Member, 3rd International Workshop on Software Engineering for Sensor Network Applications, Zurich, Switzerland, June 2012

S131 Mentoring Committee Member, 34th International Conference on Software Engineering (ICSE 2012), Zurich, Switzerland, June 2012

S132 Program Committee Member, 22nd IEEE International Symposium on Software Reliability Engineering, Hiroshima, Japan, November-December 2011

S133 Program Committee Member, 9th IEEE International Conference on Software Engineering and Formal Methods, Montevideo, Uruguay, November 2011

S134 Expert Reviewer Panel Member, 26th IEEE/ACM International Conference on Automated Software Engineering (ASE 2011), Lawrence, KS, November 2011

S135 Workshops Committee Member, The joint meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE 2011), Szeged, Hungary, September 2011

S136 Program Committee Member, 5th Brazilian Symposium on Software Components, Architectures, and Reuse (SBCARS), Sao Paulo, Brazil, September 2011

S137 Program Committee Member, 9th IEEE/IFIP Working Conference on Software Architecture (WICSA), Boulder, CO, June 2011

S138 Program Committee Member, 6th International Symposium on Software Engineering for Adaptive and Self-Managing Systems (SEAMS), Honolulu, HI, May 2011

S139 Program Committee Member, IEEE Globecom 2010 Workshop on Pervasive Group Communications (PerGroup), Miami, FL, December 2010

S140 Program Committee Member, 18th ACM SIGSOFT Symposium on the Foundations of Software Engineering (FSE 2010), Santa Fe, NM, November 2010

S141 Program Committee Member, International Symposium on Architecting Critical Systems (ISARCS 2010), Prague, Czech Republic, June 2010

S142 Program Committee Member, 32nd International Conference on Software Engineering, Cape Town, South Africa, May 2010

S143 Program Committee Member, 5th International Workshop on Software Engineering for Adaptive and Self-Managing Systems (SEAMS), Cape Town, South Africa, May 2010

S144 Program Committee Member, Workshop on Flexible Modeling Tools (FlexiTools), Cape Town, South Africa, May 2010

S145 Program Committee Member, Workshop on Quantitative Stochastic Models in the Verification and Design of Software Systems (QUOVADIS), Cape Town, South Africa, May 2010

S146 Expert Panel Member, 24th IEEE/ACM International Conference on Automated Software Engineering (ASE 2008), Auckland, New Zealand, November 2009

S147 Program Committee Member, 8th Working IEEE/IFIP Conference on Software Architecture (WICSA) and 3rd European Conference on Software Architecture (ECSA), Cambridge, UK, September 2009

S148 Program Committee Member, 12th European Software Engineering Conference and 17th ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE 2009), Amsterdam, the Netherlands, August 2009

S149 Program Committee Member, 8th International Workshop on the Foundations of Coordination Languages and Software Architectures (FOCLASA'09), Rhodes, Grece, July 2009

S150 Program Committee Member, DSN 2009 Workshop on Architecting Dependable Systems (WADS 2007), Lisbon, Portugal, June 2009

S151 Program Committee Member, 5th International Conference on the Quality of Software Architecture (QoSA 2009), East Stroudsburg, PA, June 2009

S152 Program Committee Member, 6th International Conference on Autonomic Computing (ICAC), Barcelona, Spain, June 2009

S153 Program Committee Member, 4th International Workshop on UML and AADL, Potsdam, Germany, June 2009

S154 Program Committee Member, 31st International Conference on Software Engineering, Vancouver, Canada, May 2009

S155 Program Committee Member, 4th International Conference on the Quality of Software Architectures (QoSA 2008), Karlsruhe, Germany, October 2008

S156 Program Committee Member, 11th International Symposium on Component-Based Software Engineering (CBSE 2008), Karlsruhe, Germany, October 2008

S157 Program Committee Member, 23rd IEEE/ACM International Conference on Automated Software Engineering (ASE 2008), L'Aquila, Italy, September 2008

S158 Program Committee Member, 2nd Brazilian Symposium on Software Components, Architectures, and Reuse (SBCARS 2008), Porto Alegre, Brazil, August 2008

S159 Program Committee Member, 7th International Workshop on the Foundations of Coordination Languages and Software Architectures (FOCLASA'08), Reykjavik, Iceland, July 2008

S160 Program Committee Member, DSN 2008 Workshop on Architecting Dependable Systems (WADS 2007), Anchorage, AK, June 2008

S161 Program Committee Member, 30th International Conference on Software Engineering, Leipzig, Germany, May 2008

S162 Symposium Committee Member, Doctoral Symposium, 30th International Conference on Software Engineering, Leipzig, Germany, May 2008

S163 Program Committee Member, 3rd International Workshop on Software Engineering for Adaptive and Self-Managing Systems (SEAMS 2008), Leipzig, Germany, May 2008

S164 Program Committee Member, International Workshop on Software Architectures and Mobility (SAM 2008), Leipzig, Germany, May 2008

S165 Program Committee Member, 22nd IEEE/ACM International Conference on Automated Software Engineering, Atlanta, GA, November 2007

S166 Program Committee Member, International Workshop on the Engineering of Software Services for Pervasive Environments (ESSPE), Dubrovnik, Croatia, September 2007

S167 Program Committee Member, 10th International Symposium on Component-Based Software Engineering (CBSE 2007), Boston, MA, July 2007

S168 Program Committee Member, 3rd International Conference on the Quality of Software Architectures (QoSA 2007), Boston, MA, July 2007

S169 Program Committee Member, First IEEE International Conference on Self-Adaptive and Self-Organizing Systems (SASO 2007), Boston, MA, July 2007

S170 Program Committee Member, DSN 2007 Workshop on Architecting Dependable Systems (WADS 2007), Edinburgh, UK, June 2007

S171 Program Committee Member, 2nd International Workshop on Software Engineering for Adaptive and Self-Managing Systems (SEAMS 2007), Minneapolis, MN, May 2007

S172 Program Committee Member, 2nd Workshop on Sharing and Reusing Architectural Knowledge - Architecture Rationale and Design Intent (SHARK/ADI), Minneapolis, MN, May 2007

S173 Tutorials Committee Member, 29th International Conference on Software Engineering (ICSE 2007), Minneapolis, MN, May 2007

S174 Program Committee Member, Workshop on Tools, Operating Systems and Programming Models for Developing Reliable Systems (TOPMoDelS), Long Beach, CA, March 2007

S175 Program Committee Member, 6th International Workshop on Software and Performance (WOSP 2007), Buenos Aires, Argentina, February 2007

S176 Program Committee Member, 6th Working IEEE/IFIP Conference on Software Architecture, Mumbai, India, January 2007

S177 Program Committee Member, 14th ACM SIGSOFT Symposium on the Foundations of Software Engineering (FSE 14), Portland, OR, November 2006

S178 Symposium Committee Member, Doctoral Symposium, 14th ACM SIGSOFT Symposium on the Foundations of Software Engineering (FSE 14), Portland, OR, November 2006

S179 Expert Reviewer Panel Member, 21st IEEE/ACM International Conference on Automated Software Engineering (ASE 2006), Tokyo, Japan, September 2006

S180 Doctoral Symposium Committee Member, 21st IEEE/ACM International Conference on Automated Software Engineering (ASE 2006), Tokyo, Japan, September 2006

S181 Program Committee Member, 9th International Symposium on Component-Based Software Engineering (CBSE 2006), Västerås, Sweden, June/July 2006

S182 Program Committee Member, ICSE 2006 Workshop on Software Engineering for Adaptive and Self-Managing Systems (SEAMS), Shanghai, China, May 2006

S183 Tutorials Committee Member, 28th International Conference on Software Engineering (ICSE 2006), Shanghai, China, May 2006

S184 Program Committee Member, 20th IEEE International Conference on Automated Software Engineering (ASE 2005), Long Beach, CA, November 2005

S185 Program Committee Member, 10th European Software Engineering Conference and 13th ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE 2005), Lisbon, Portugal, September 2005

S186 Program Committee Member, 9th International Software Product Line Conference (SPLC- EUROPE 2005), Rennes, France, September 2005

S187 Program Committee Member, 5th International Workshop on Software Engineering and Middleware (SEM 2005), Lisbon, Portugal, 5-6 September 2005

S188 Program Committee Member, Workshop on Architecture-Centric Evolution (ACE 2005), Glasgow, UK, July 2005

S189 Program Committee Member, 4th International Workshop on Architecting Dependable Systems (WADS 2004), St. Louis, MO, May 2005

S190 Program Committee Member, 8th International Symposium on Component-Based Software Engineering (CBSE8), St. Louis, MO, May 2005

S191 Program Committee Member, Workshop on Software Composition (SC 2005), Edinburgh, UK, April 2005

S192 Program Committee Member, Hawaii International Conference on System Sciences, Mini- Track on Strategic Software Engineering, Hawaii, January 2005

S193 Program Committee Member, 2004 Workshop on Self-Managed Systems, Newport Beach, CA, November 2004

S194 Program Co-Chair, Workshop on Software Architecture Description & UML, Lisbon, Portugal, October 2004

S195 Program Committee Member, 19th IEEE International Conference on Automated Software Engineering (ASE 2004), Linz, Austria, September 2004

S196 Program Committee Member, 4th IEEE/IFIP Working Conference on Software Architecture (WICSA-4), Oslo, Norway, June 2004

S197 Program Committee Member, Workshop on Capturing Experience in Software Architecture Best Practices, Oslo, Norway, June 2004

S198 Program Committee Member, Twin Workshops on Architecting Dependable Systems (WADS 2004), Edinburgh, UK, May 2004 and Florence, Italy, June 2004

S199 Program Committee Member, 2nd International Working Conference on Component Deployment (CD 2004), Edinburgh, UK, May 2004

S200 Program Committee Member, 7th International Symposium on Component-Based Software Engineering (CBSE7), Edinburgh, UK, May 2004

S201 Program Committee Member, International Workshop on Incorporating COTS into Software Systems: Tools and Techniques (IWICSS), Redondo Beach, CA, February 2004

S202 Program Committee Member, 10th Working Conference on Reverse Engineering (WCRE 2003), Victoria, BC, Canada, November 2003

S203 Program Committee Member, 5th International Workshop on Product Family Engineering (PFE-5), Siena, Italy, November 2003

S204 Program Committee Member, 2nd International Workshop on Architecting Dependable Systems (WADS 2003), Portland, OR, May 2003

S205 Program Committee Member, Conference on Generative and Component-Based Software Engineering (GCSE), Pittsburgh, PA, October 2002

S206 Program Committee Member, The Working IEEE/IFIP Conference on Software Architecture (WICSA-3), Montreal, Canada, August 2002

S207 Program Committee Member, 2nd Software Product Line Conference (SPLC-2), San Diego, CA, August 2002

S208 Program Committee Member, International Workshop on Mobile Teamwork, Vienna, Austria, July 2002

S209 Program Committee Member, ECOOP 2002 Workshop on Concrete Communication Abstractions Of The Next 701 Distributed Object Systems, Malaga, Spain, June 2002

S210 Program Committee Member, 24th International Conference on Software Engineering (ICSE 2002), Orlando, FL, May 2002

S211 Symposium Committee Member, Doctoral Symposium, 24th International Conference on Software Engineering (ICSE 2002), Orlando, FL, May 2002

S212 Program Committee Member, 1st International Workshop on Architecting Dependable Systems (WADS 2002), Orlando, FL, May 2002

S213 Program Committee Member, 4th International Workshop on Product Family Engineering (PFE-4), Bilbao, Spain, October 2001

S214 Program Committee Member, 8th European Software Engineering Conference and 9th ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE 2001), Vienna, Austria, September 2001

S215 Program Committee Member, The Second Working IEEE/IFIP Conference on Software Architecture (WICSA-2), Amsterdam, The Netherlands, August 2001

S216 Program Committee Member, 23rd International Conference on Software Engineering (ICSE 2001), Toronto, Canada, May 2001

S217 Program Committee Member, Second International Workshop on Engineering Distributed Objects (EDO 2000), Davis, CA, November 2000

S218 Program Committee Member, Eighth ACM SIGSOFT Symposium on the Foundations of Software Engineering (FSE8), San Diego, CA, November 2000

S219 Program Committee Member, Fourth International Software Architecture Workshop (ISAW-4), Limerick, Ireland, June 2000

S220 Program Committee Member, Third International Workshop on Software Architectures for Product Families (IW-SAPF-3), Las Palmas de Gran Canaria, Spain, March 2000

Referee and Reviewer Service

S214 Journal of Empirical Software Engineering 2017

S221 National Science Foundation, Review Panel 1/2000, 10/2003, 11/2013, 1/2016, 3/2018, 10/2021, 10/2024

S222 ACM Transactions on Autonomous and Adaptive Systems 2015

S223 ACM Transactions on Software Engineering and Methodology

S224 1998, 1999, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013

S225 IEEE Transactions on Software Engineering 1997, 1998, 1999, 2000, 2001, 2003, 2004, 2005, 2006, 2007, 2008, 2009

S226 Elsevier Information and Software Technology Journal 2007, 2008, 2011, 2014, 2015, 2016

S227 Journal of Software Engineering for Robotics 2009

S228 Architecting Dependable Systems VI, LNCS, Springer Verlag 2009

S229 IEEE Software 2008

S230 IEEE Transactions on Industrial Informatics 2008

S231 Journal of Systems and Software 2005, 2006, 2007, 2008, 2011, 2015

S232 University of Wisconsin-Milwaukee, Research Growth Initiative 2006

S233 Journal of Automated Software Engineering 1999, 2000, 2005

S234 28th International Conference on Software Engineering, Outside Reviewer 2005

S235 Architecting Dependable Systems III, LNCS, Springer Verlag 2005

S236 Architecting Dependable Systems II, LNCS, Springer Verlag 2004

S237 IEEE Transactions on Parallel and Distributed Systems 2003, 2004

S238 National Science Foundation, Proposal Reviewer (PASI) 2/2011

S239 IEEE Computer, Special Issue on Handheld Computing 2003

S240 Architecting Dependable Systems, LNCS, Springer Verlag 2003

S241 International Journal on Software Maintenance and Evolution 2002

S242 Science Foundation Ireland 2002

S243 IEE Proceedings - Software Engineering 1998

S244 Conference on User Interface Software and Technology, Outside Reviewer 1996

S245 19th International Conference on Software Engineering, Outside Reviewer 1997

Other

S246 Member, IFIP Working Group 2.4 – Software Implementation Technologies (2020 - present)

S247 Participant, IFIP Working Group 2.10 - Software Architecture (2002 - 2007)

13 University Service

S248 Chair, Thomas Lord Department of Computer Science, USC (7/22 – present)

S249 Vice-Chair for Tenure Affairs, Department of Computer Science, USC (7/21 – 6/22)

S250 Chair, Diversity, Equity, and Inclusion (DEI) Committee, Computer Science Department, USC (2/21 – 6/22)

S251 Chair, Hiring Committee, Computer Science Department, USC (10/21 – 5/22)

S252 Chair, Hiring Committee, Computer Science Department, USC (10/20 - 5/21)

S253 Member, Ad-Hoc Promotion and Tenure Committee, Computer Science Department, USC (1/20 - 3/21)

S254 Appointments, Promotions, and Tenure (APT) Committee, Viterbi School of Engineering, USC (8/20 - 7/21)

S255 APT Executive Committee, Viterbi School of Engineering, USC (8/20 - 7/21)

S256 Area Lead, Computer Systems Area, Computer Science Department, USC (8/19 - 8/20)

S257 Member, Faculty Hiring Committee - Software Engineering, Computer Science Department, USC (12/19 - 5/20)

S258 Member, Faculty Hiring Committee - Programming Languages, Computer Science Department, USC (12/19 - 5/20)

S259 Chair, Ad-Hoc Promotion and Tenure Committee, Computer Science Department, USC (12/19 - 3/20)

S260 Member, Research Ethics Committee, University of Southern California (2/19 - 5/20)

S261 Committee on Academic Policies and Procedures, University of Southern California (8/17 - 8/21)

S262 Chair, Ad-Hoc Promotion and Tenure Committee, Computer Science Department, USC (8/19 - 1/20)

S263 Member, Hiring Committee, Computer Science Department, USC (10/18 - 5/19)

S264 Member, Ad-Hoc Promotion and Tenure Committee, Computer Science Department, USC (12/18 - 5/19)

S265 Chair, Teaching Faculty Merit Review Committee, Computer Science Department, USC (1/18 - 5/18)

S266 Chair, Ad-Hoc Promotion and Tenure Committee, Computer Science Department, USC (8/17 - 12/17)

S267 Member, Joint-Appointment Review Committee, Computer Science Department, USC (9/17 - 11/17)

S268 Member, Ad-Hoc Promotion and Tenure Committee, Computer Science Department, USC (3/17 - 5/17)

S269 Chair, Faculty Hiring Committee - Programming Languages, Computer Science Department, USC (12/16 - 5/17)

S270 Member, Merit Review Committee, Computer Science Department, USC (2/17 - 3/17)

S271 Chair, Merit Review Process Committee, Computer Science Department, USC (8/16 - 2/17)

S272 Chair, Merit Review Committee, Computer Science Department, USC (2/16 - 3/16)

S273 Chair, Research Faculty Promotion Committee Computer Science Department, USC (1/16 – present)

S274 Chair, Research Faculty Promotion Committee, Computer Science Department, USC (11/15 - 11/16)

S275 Chair, Faculty Hiring Committee - Software Engineering, Computer Science Department, USC (12/15 - 5/16)

S276 Chair, Faculty Hiring Committee - Programming Languages, Computer Science Department, USC (12/15 - 5/16)

S277 Chair, Ad-Hoc Promotion and Tenure Committee, Computer Science Department USC (3/15 - 5/16)

S278 Ad-Hoc Promotion Committee, Computer Science Department, USC (5/15 - 5/16)

S279 Associate Chair for Ph.D. Affairs, Computer Science Department, USC (7/11 - 6/15)

S280 Chair, PhD Program Reboot Committee, Computer Science Department, USC (8/13 - 6/15)

S281 Chair, Ph.D. Admissions Committee, Computer Science Department, USC (7/11 - 6/15)

S282 Ph.D. Council, Viterbi School of Engineering, USC (1/12 - 6/15)

S283 Research Committee, Viterbi School of Engineering, USC (7/12 - 8/13)

S284 Transformative Faculty Hiring Committee, Computer Science Department, USC (6/12 - 5/13)

S285 Director, Center for Systems & Software Engineering, Viterbi School of Engineering USC (1/09 - 2/13)

S286 Joint Faculty Appointment Committee, Computer Science Department, USC (11/12 - 12/12)

S287 Department Chair Search Committee, Computer Science Department, USC (9/11 - 5/12)

S288 Chair Performance Evaluation Committee, Computer Science Department, USC (3/12 - 5/12)

S289 Department Ranking Committee, Computer Science Department (2/12 - 5/12)

S290 Engineering Faculty Council (EFC), Viterbi School of Engineering, USC (1/02 - 5/05, 8/06 - 5/10)

S291 New Building Faculty Advisory Committee, Viterbi School of Engineering, USC (1/10 - 3/14)

S292 EFC Academic Senate Alternate, USC (8/08 - 8/09)

S293 Appointments, Promotions, and Tenure (APT) Committee, Viterbi School of Engineering, USC (8/08 - 5/10)

S294 Ph.D. Admissions Committee, Computer Science Department, USC (8/04 - 5/05, 8/07 - 8/15)

S295 Ph.D. Fellowships Committee, Computer Science Department, USC (8/07 - 8/15)

S296 Group Leader, Software Systems and Engineering, Computer Science Department, USC (8/08 - 8/10)

S297 Chair, Faculty Hiring Committee, Computer Science Department, USC (8/08 - 5/09)

S298 Department Chair's Advisory Committee, Computer Science Department, USC (8/07 - 7/08)

S299 Merit Review Committee, Computer Science Department, USC (2000, 2004, 2008, 2010)

S300 Provost/Academic Senate Committee on Information Services, USC (8/06 - 5/08)

S301 Dean/EFC Standing Committee on Best Practices, USC (1/08 - 8/08)

S302 Dean/EFC Standing Committee on Faculty Recruitment and Retention, Viterbi School of Engineering, USC (8/07 - 8/08)

S303 EFC Research Committee, Viterbi School of Engineering, USC (1/07 - 8/07, 1/10 - 5/10)

S304 Chair, Interaction Group, Computer Science Department, USC (8/06 - 8/07)

S305 Chair, EFC Merit Review Committee, Viterbi School of Engineering, USC (8/06 - 8/08)

S306 Qualifying Exam Timeline Committee, Computer Science Department, USC (4/06 - 5/07)

S307 M.S. Program Review Committee, Computer Science Department, USC (12/03 - 5/05)

S308 Research Faculty Hiring Committee, Computer Science Department, USC (2002, 2003, 2006, 2007, 2008)

S309 Dean's Evaluation Committee, School of Engineering, USC (11/04 - 1/05)

S310 M.S. Program Review Committee, School of Engineering, USC (9/03 - 12/03)

S311 Faculty Hiring Committee, Computer Science Department, USC (2001, 2004)

S312 Interview Panel, Trustee Scholarship, School of Engineering, USC (3/02, 3/04)

S313 EFC Committee on Research Faculty Rights and Responsibilities, School of Engineering, USC (11/02 - 5/03)

S314 Chair, Computer Systems Group, Computer Science Department, USC (12/99 - 5/02)

S315 College of Engineering Commencement Marshal, USC (2000, 2002)

S316 Industrial Liaison Committee, Computer Science Department, USC (2000)

14 Professional Associations

- Association for Computing Machinery (ACM)
- ACM Special Interest Group on Software Engineering (SIGSOFT)
- Institute of Electrical and Electronics Engineers (IEEE)
- IEEE Computer Society (CS)

15 Consulting

- 2010 - present   Expert witness in multiple legal matters involving software technology
- 2/11 - present   Aerospace Corporation, El Segundo, CA
- 6/00 - 6/03   Jet Propulsion Laboratory (JPL), Pasadena, CA