UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MICROSOFT CORPORATION,
Petitioner

v.

INTERDIGITAL PATENT HOLDINGS, INC.,
Patent Owner

IPR2024-00306

DECLARATION OF GEORGE EDWARDS

IN REGARD TO THE PETITIONS FOR *INTER PARTES* REVIEW OF

U.S. PATENT NO. 9,173,054

1. INTRODUCTION

1. I have been retained as an expert in computer science to provide analysis and opinions related to whether certain claims of U.S. Patent No. 8,737,933 ("the '933 Patent") and U.S. Patent No. 9,173,054 ("the '054 Patent") are obvious in light of evidence of secondary considerations. These patents will be hereby referred to as the "InterDigital Patents." I submit this declaration as a statement of the opinions I have formed and the factual basis for the opinions. I understand that this declaration is submitted in regards to InterDigital's Patent Owner Preliminary Response to: Petition for *Inter Partes* Review of U.S. Patent No. 8,737,933 (IPR2024-00305) and Petition for *Inter Partes* Review of U.S. Patent No. 9,173,054 (IPR2024-00306). I am prepared to testify as to the matters discussed here.

2. My employer, Quandary Peak Research, is paid a consulting fee for my time working on this matter. I have no personal interest in this matter, and my compensation does not depend in any way on the opinions I express or the outcome.

2. SUMMARY OF QUALIFICATIONS

3. A detailed list of my qualifications is set forth in my *curriculum vitae*, a copy of which is attached as Exhibit A. Within the broad field of computer science, my specific areas of expertise encompass software engineering, distributed systems, software architecture, software analysis, computer programming, mobile device software, Internet software, and embedded software. I have direct experience building and analyzing web applications, desktop applications, mobile apps, and databases. Therefore, I believe I am qualified to express expert opinions related to the '054 patent and Apple AirDrop.

2.1. Educational Qualifications

4. I graduated summa *cum laude* with a Bachelor of Science degree in computer science from Vanderbilt University in 2003. As an undergraduate, I was awarded the Vanderbilt School of Engineering Merit Scholarship. I spent one year in the MS program in computer science at Vanderbilt. During this time, I conducted research on application servers and code generators for distributed, real-time, and embedded ("DRE") systems, and I published my findings in several peer-reviewed conference papers and journal articles.

5. I attended graduate school at the University of Southern California, where I was a USC Viterbi School of Engineering Dean's Doctoral Fellow and Annenberg Graduate Fellow. I received an MS in computer science in 2006 and a PhD in computer science in 2010 from USC. My MS research focused on DRE systems. My PhD research focused on the analysis of distributed systems and their architecture. My research was funded by several government agencies, such as the Department of Defense and the NSA, and large companies, such as Bosch and Infosys. I presented my work at numerous conferences and in academic journals, industry magazines, and other publications. In 2008, I received the USC Computer Science Department's award for outstanding graduate student research.

2.2. Professional Qualifications

6. I am the founder of Quandary Peak Research, Inc., where I hold the titles of President and Principal Computer Scientist. Quandary Peak is a software analysis company with offices and staff experts in the Los Angeles, Nashville, Chicago, Austin, San Francisco, and Washington, D.C, areas. Quandary Peak's software analysis services fall into three areas: (1) audits and compliance in highly regulated industries; (2) technical due diligence in mergers and acquisitions; and (3) litigation and intellectual property. In all three areas, Quandary Peak analyzes software and

computer systems to answer questions about the development, structure, behavior, and quality of those systems.

7. In my role as President, I oversee and manage the company's software analysis services. In my role as Principal Computer Scientist, I perform software analysis on behalf of clients. I have analyzed and reverse-engineered a broad variety of complex, real-world software systems, including web applications, desktop applications, mobile apps, and databases. I have conducted many investigations for various companies of the design and implementation of these distributed systems with respect to specific patent claims and other intellectual property considerations, such as copyright infringement and trade secret theft.

8. I was formerly employed as a Lecturer of Computer Science at the University of Southern California. In that capacity, I taught Requirements Engineering (CSCI 568), a graduate-level software engineering class, and Data Structures and Algorithms (CSCI 102), an undergraduate-level software design and programming class.

9. I also previously worked as a research scientist and software engineer at Blue Cell Software LLC, Intelligent Systems Technology, Inc., IBM, and The Boeing Company. During my time with Blue Cell, I built a simulation-based software design and modeling environment. While at IBM, I conducted research on next-generation mobile architectures, such as large-scale mobile device provisioning systems. At Boeing, I helped to design software for collecting and processing sensor data and geo-location data from military vehicles.

10. I have authored over thirty scholarly journal articles, magazine articles, conference papers, and book chapters on various topics related to software engineering and distributed systems. I have

co-authored many peer-reviewed papers specifically related to software design, source code analysis, web applications, mobile devices, and cloud computing.[1]

11. I have delivered numerous invited lectures, seminars, and technology demonstrations related to software design and analysis for university courses, research symposia, conferences, workshops, and industry events in the field of computer science. I have also served as a reviewer, committee member, or panelist for over a dozen computer science journals, magazines, and conferences.

2.3. Prior Testimony

12. On July 17, 2013, I testified by deposition in the matter of *Essociate, Inc. v. Neverblue Media, Inc.*, a patent case in the U.S. District Court for the Central District of California.

13. On November 25, 2013, I testified in U.S. District Court for the Eastern District of Virginia as an expert in mobile devices in a patent infringement matter, *Porto Technology Co., Ltd. and Porto Technology, LLC v. Cellco Partnership d/b/a Verizon Wireless and Verizon Services Corp*.

14. On June 9, 2014, I testified by deposition in the matter of *SecurityBase.com v. Jeffrey Essick, et al.*, a breach-of-contract suit brought in the Superior Court of California for the County of Orange.

15. I testified both by deposition (on June 17, 2014) and in U.S. District Court for the District of Kansas (on June 24, 2014) in the matter of *AgJunction, LLC v. Agrian, Inc. et al.*, a copyright and trade secret case.

16. I testified both by deposition (on October 12, 2015) and in U.S. District Court for the Southern District of California (on December 7 and 8, 2015) in the matter of *Anthony Johnson v. Storix, Inc.*, a copyright infringement matter.

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[1] *See* my *curriculum vitae*. (Exhibit A)

17. On August 15, 2016, I testified by deposition in the matter of *Backflip Software, Inc. v. Cisco Systems, Inc. et al.*, a breach-of-contract suit brought in the Superior Court of California for the County of Santa Clara.

18. On July 12, 2017, I testified by deposition in the matter of *Implicit, LLC v. Trend Micro, Inc.*, a patent case in the U.S. District Court for the Eastern District of Texas.

19. On December 8, 2017, I testified by deposition in the matter of *Farmers Edge Inc., Farmers Edge (US) Inc., and Farmers Edge (US) LLC v. Farmobile, LLC, Jason G. Tatge, Heath Garrett Gerlock, and Randall Thomas Nuss*, a trade secret misappropriation case in the U.S. District Court for the District of Nebraska.

20. On December 14, 2017, I testified by deposition in the matter of *Vesta Corporation v. Amdocs Management Limited, et al.*, a trade secret misappropriation case in the U.S. District Court for the District of Oregon.

21. On December 18, 2017, I testified by deposition in the matter of *eBay, Inc.* V. *MasterObjects, Inc.*, an *inter partes review* proceeding before the Patent Trial and Appeal Board of the United States Patent and Trademark Office.

22. On May 23, 2018, I testified in U.S. District Court for the District of Nebraska in the matter of *Farmers Edge Inc., Farmers Edge (US) Inc., and Farmers Edge (US) LLC v. Farmobile, LLC, Jason G. Tatge, Heath Garrett Gerlock, and Randall Thomas Nuss*.

23. On June 28, 2018, and May 25, 2021, I testified by deposition in the matter of *Bryndon Fisher v. The United States of America*, a class action lawsuit in the U.S. Court of Federal Claims.

24. On December 5-6, 2019, I testified by deposition in the matter of *American National Manufacturing, Inc. v. Sleep Number Corporation*, an *inter partes* review proceeding before the Patent Trial and Appeal Board of the United States Patent and Trademark Office.

25. On August 9, 10, and 11, 2022, I testified in the matter of *Farmobile, LLC v. Farmers Edge, Inc.*, a patent case in the Federal Court of Canada.

26. On August 11, 2023, January 19, 2024, and January 29, 2024, I testified by deposition in the matter of AGI SureTrack LLC v. Farmers Edge Inc. and Farmers Edge (US) Inc., a patent case in the U.S. District Court for the District of Nebraska.

3. INFORMATION CONSIDERED

27. In forming my opinions, I have considered:

- The 8,737,933 and 9,173,054 patents and their file histories.
- Microsoft's Petition for *Inter Partes* Review of U.S. Patent No. 8,737,933 (IPR2024-00305) and the materials cited therein.
- Microsoft's Petition for *Inter Partes* Review of U.S. Patent No. 9,173,054 (IPR2024-00306) and the materials cited therein.
- Exhibits 2002 – 2054.
- My education, training, and experience in the field.
- Other materials cited in this declaration.

4. LEGAL STANDARDS

4.1. Overview

28. I am not an attorney or a legal expert. The legal standards I applied in reaching the conclusions expressed throughout this declaration were provided to me by counsel. In preparing

this declaration, I have endeavored to faithfully apply these legal standards. I do not intend to offer opinions on the law. Below, I describe the law I applied in considering whether the claims of the ’054 Patent valid.

29. I have been informed that an issued patent is presumed valid and that the challenger of the patent’s validity bears the burden of proving invalidity of the patent.

4.2. Patent Claims

30. Patent claims describe the invention made by the inventors and describe what the patent owner owns and what the owner may prevent others from doing. Claims may describe products, such as machines or chemical compounds, or processes for making or using a product. Claims are usually divided into parts or steps called limitations.

31. There are two types of claims: independent claims and dependent claims. An independent claim sets forth all the requirements that must be met in order to be covered by that claim. Thus, it is not necessary to look at any other claim to determine what an independent claim covers. A dependent claim does not itself recite all of the requirements of the claim, but refers to another claim for some of its requirements. In this way, the claim depends on another claim. The law considers a dependent claim to incorporate all of the requirements of the claims to which it refers. The dependent claim then adds its own additional requirements. To determine what a dependent claim covers, it is necessary to look at both the dependent claim and any other claims to which it refers.

32. In that case, the dependent claims incorporate the limitations of the independent claim upon which they depend and, if a reference fails to disclose any of the limitations of an independent claim, the claims which depend on that claim cannot be made invalid by that reference. As a result, any of the references at issue in this proceeding that fail to disclose all of the limitations of an

independent claim necessarily also fail to disclose all of the limitations of claims which depend on that claim.

4.3. Burden of Proof for Invalidity

33. I understand that the party challenging the validity of an issued United States patent in an IPR bears the burden of proving invalidity through facts supported by a preponderance of the evidence. I understand that a "preponderance of the evidence" means evidence sufficient to prove that a fact is more likely true that it is not.

4.4. Claim Construction

34. I understand that the first step in determining validity is to properly construe the claims. I further understand that, in this proceeding, the Board must determine the scope of the claims by using the same claim construction standard that United States District Courts use. Under this standard, words of a claim are given their "ordinary" and "customary" meaning as understood by a person of skill in the art at the time of the invention. I understand that such a person looks to the claims, specification, and file history in understanding the meaning of the claim terms. I have applied this understanding in this declaration.

4.5. Person of Ordinary Skill in the Art

35. I understand that a person having ordinary skill in the art may be defined by factors such as: (a) the levels of education and experience of the inventor and other persons actively involved in the field; (b) the types of problems encountered in the field; (c) prior art solutions to those problems; (d) rapidity with which innovations are made; and (e) the sophistication of the technology.

4.6. Prior Art

36. I understand that a patent cannot be invalidated based on one person's testimony alone without corroborating evidence, particularly documentary evidence. Moreover, I understand that corroboration is required of any witness whose testimony alone is asserted to invalidate a patent, regardless of his or her level of interest in relation to that patent. Accordingly, even if the testifying individual has no interest in the litigation, I understand that that corroboration is still required.

37. In this declaration, I may use the phrase "prior art" when describing specific references. However, my use of this phrase should not be interpreted as agreement that the item(s) described qualify as prior art under the patent laws. I merely use this phrase to address the items labeled as "prior art" by Petitioner and its expert.

4.7. Anticipation

38. I understand that a patent claim can be found invalid as anticipated if each and every element of the claim, as properly construed, is found either explicitly or inherently in a single prior art reference. If the single prior art reference does not disclose any one claim limitation, then that claim is not anticipated. I further understand that the single prior art reference cannot merely disclose each element; rather, it must disclose all of the elements as arranged in the claim. I have been informed that for a prior art reference to "inherently" disclose something, the reference must necessarily function in accordance with, or include the claimed limitations, to anticipate. The missing descriptive matter cannot merely probably or possibly include the claimed limitations. I further understand that, with respect to an anticipation analysis, it is improper to combine separate, distinct embodiments of a single prior art reference.

39. I understand that for a claim to be anticipated, each claim limitation must be disclosed in a single prior art reference, and the claimed arrangement or combination of those limitations must

also be disclosed in that same prior art reference. I understand that for a reference to be anticipatory, the reference must contain an enabling disclosure. I understand that merely naming or describing the subject matter is insufficient if it cannot be produced without undue experimentation.

4.8. Obviousness

40. I understand that a patent claim can be found invalid as obvious if the differences between the claim and the prior art references would have been obvious to a person of ordinary skill in the art at the time of the invention, taking into account (1) the scope and content of the prior art, (2) the differences between the prior art and the claims, (3) the level of ordinary skill in the art, and (4) any objective indicia of non-obviousness. I further understand that a claim can be found to be obvious in light of either a single prior art reference or multiple prior art references. I understand that references qualify as prior art for an obviousness determination only when they are analogous to the claimed invention. Two separate tests define the scope of analogous prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed; and (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved.

41. To be obvious in light of a single prior art reference or multiple prior art references, there must be a reason either to modify either the single prior art reference or to combine the two or more prior art references to achieve the claimed invention. I understand that this reason may come from a teaching, suggestion, or motivation to combine or may come from the reference or references themselves, the knowledge or "common sense" of one skilled in the art, or from the nature of the problem to be solved, and may be explicit or implicit from the prior art as a whole.

The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.

42. I further understand that there is no suggestion to combine, however, if a reference teaches away from its combination with another source. A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant, or if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant. If when combined, the references would produce a seemingly inoperative device, then they teach away from their combination. I understand that it is improper to combine references where the references teach away from their combination.

43. I understand that the degree of teaching away will depend on the particular facts; in general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant. I understand that a reference teaches away, for example, if (1) the combination would produce a seemingly inoperative device, or (2) the references leave the impression that the product would not have the property sought by the applicant.

44. I understand that if the teachings of a prior art reference would lead one skilled in the art to make a modification that would render another prior art device inoperable, then such a modification would generally not be obvious. I understand that if a proposed modification would render the prior art device unsatisfactory for its intended purpose, then the proposed modification would generally not be obvious.

45. I understand that it is improper to use hindsight in making the obviousness determination.

46. I understand that some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness must be made. For example, I understand that there may be no rational underpinning to support the legal conclusion of obviousness where systems are already complete and the party challenging validity seeks to mix and match components, which each exist in the separate systems, from these complete systems.

4.9. Objective Indicia

47. I understand that objective indicia of non-obviousness must be taken into account in a proper obviousness analysis and that these objective indicia of non-obviousness may include the following: (1) failure of others; (2) long-felt but unmet need for the claimed invention; (3) commercial success attributable to the claimed invention; (4) unexpected results of the claimed invention; (5) initial skepticism; (6) prior art teaching away from the claimed invention; (7) professional approval; (8) licensing; (9) acquiescence to the patent's validity; (10) copying of the claimed invention by others, and (11) progress through the Patent Office. I further understand that a so-called nexus between the merits of the claimed invention and evidence of objective indicia of non-obviousness is required in order for the evidence to be given substantial weight in an obviousness determination. As an example, I understand that nexus can be established if there was commercial success and if the invention disclosed in the patent was that which was commercially successful.

4.10. Indefiniteness and Written Description

48. I understand that a patent claim can be found invalid for not meeting the definiteness and/or written description requirements, both of which are found in section 112 of the patent laws. Determining whether a claim is invalid as indefinite requires assessing whether the claims, when viewed in light of the specification and the prosecution history, inform those skilled in the art about

the scope of the invention with reasonable certainty. I understand that the definiteness requirement mandates clarity but recognizes that absolute precision is unattainable.

49. I further understand that when a term has an established meaning in the art, it informs those skilled in the art with reasonable certainty. Similarly, I understand that if the court concludes that a person of ordinary skill in the art, with the aid of the specification, would understand what is claimed, the claim is not indefinite. The amount of detail that must be included in the specification depends on the subject matter that is described and its role in the invention as a whole, in view of the existing knowledge in the field of the invention. I understand that section 112 does not require the drafter to encumber the specification with information known to a person of skill in the field of the invention; nor does section 112 require that the specification reproduce information routinely possessed by persons in the field of the invention.

50. In addition, the written description requirement implements the principle that a patent must describe the technology that is sought to be patented. To satisfy the written description requirement, a patent specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor had possession of the claimed invention. Possession of the claimed invention can be shown by describing the claimed invention with all of its limitations using such descriptive means as words, structures, figures, diagrams, and formulas that fully set forth the claimed invention. Compliance with the written description requirement is essentially a fact-based inquiry that will necessarily vary depending on the nature of the invention claimed.

51. A question as to whether a specification provides an adequate written description may arise in the context of determining whether an original claim is described sufficiently, or whether new or amended claims are supported by the description of the invention in the application as filed.

While there is no *in haec verba* (i.e., exact language) requirement, newly added claims or claim limitations must be supported in the specification through express, implicit, or inherent disclosure. The fundamental factual inquiry is whether the specification conveys with reasonable clarity to those skilled in the art that, as of the filing date sought, the applicant was in possession of the invention as claimed.

5. LEVEL OF ORDINARY SKILL IN THE ART

52. I understand that Microsoft has described a POSITA as follows: "The person of ordinary skill in the art in December 2008 ("POSITA") would have held a bachelor's degree in computer science, electrical engineering, computer engineering, or a closely related field, and one to three years of experience working with wirelessly connected mobile devices that used common wireless communications protocols such as Bluetooth and 802.11 / Wi-Fi. More education, e.g., a Master's or Ph.D., would compensate for less work experience and vice versa." For the sake of this declaration I have adopted that level of skill, which I meet. I reserve the right to modify this level of skill at a later date.

6. THE '054 PATENT

53. Claims 1 and 23 of the '054 patent describe a method and apparatus for wirelessly transferring data from a wireless transmit/receive unit, such as a mobile device or smartphone. The method of the patent describes that a user can provide an input to a touch display to select media in an application, at which point the mobile device and processor uses Bluetooth to detect another mobile device that the user may select for transmission. The user then sends a message to the target mobile device, at which point a user of the target mobile device can choose to accept or reject the transmission. If the transmission is accepted, the media is transmitted over Wi-Fi.

54. Claim 1 of the ’054 Patent is representative and is shown below.[2]

> 1. A method performed by a wireless transmit/receive unit (WTRU), the method comprising:
>
> processing, by the WTRU from a touch display, an input to select media in an application;
>
> detecting, by the WTRU over bluetooth, another WTRU;
>
> processing, by the WTRU, another input from the touch display to select the another WTRU;
>
> sending, by the WTRU to the selected another WTRU, a message to transfer the selected media;
>
> receiving, by the WTRU, an acceptance to transfer the selected media; and
>
> transferring, by the WTRU to the selected another WTRU over WiFi, the selected media.

55. Claim 1 describes the WTRU as a device with wireless communications technology, a processor, and a touch display.[3] The first WTRU allows a user to provide a touchscreen input indicating media from an application that is meant to be transmitted to a second WTRU. Upon the touch input from the user, the WTRU uses wireless communications technology to detect a target WTRU in proximity to the first WTRU. The wireless communications technology includes "technologies such as a third generation partnership (3GPP) second or third generation standards (2G/3G) modem, Bluetooth© or WiFi©.”[4]

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[2] Ex-1001, 10:53-65.
[3] Ex-1001, 10:53-65, Figure 1; 2:42-45.
[4] Ex-1001, 2:60-63.

56. In one embodiment, a transmitting WTRU can gather environment information about target WTRUs "via a service discovery protocol (SDP) such as currently available protocols such as Bluetooth© …."[5] With the information collected on target WTRUs, the transmitting WTRU prepares "instructions for implementing the transfer process through specific components in the communication peripheral."[6]

57. Once the transmitting WTRU has gathered information on nearby target WTRUs, the user can select a target WTRU for transmission of a media element.[7] The transmitting WTRU sends a message to the target WTRU, at which point the user of the target WTRU can choose to accept or reject the transmission.[8] If the user of the target WTRU accepts the transmission, the media element is then transmitted to the target WTRU using Bluetooth and Wi-Fi.[9]

7. APPLE AIRDROP

58. Apple AirDrop is a file-sharing feature that uses a combination of Bluetooth and Wi-Fi to discover nearby devices, establish a peer-to-peer connection, and transmit files quickly, while maintaining a secure connection independent of any internet connection. This feature can be used to share files or other media such a photos, videos, or other data to other Apple devices.[10]

7.1. How AirDrop works

59. AirDrop can be accessed using Apple's Control Center, allowing the user to control their AirDrop settings such as discoverability. To send files using AirDrop, a user can open the share menu and select the AirDrop icon, which will show nearby devices with AirDrop capability and are discoverable to the user's device. The user selects a device from this list to share with, which

[5] Ex-1001, 5:38-40.
[6] Ex-1001, 5:38-6:17; 6:50-7:6.
[7] Ex-1001, 7:7-22.
[8] Ex-1001, Abstract; Claim 1; Claim 23.
[9] Ex-1001, 2:45-49; 2:55-65; 4:53-65; 6:50-7:6; Claim 1; Claim 23.
[10] Ex-2007, 8-9; Ex-2008, 1-3.

will prompt the user of the target device with a message asking the user if they want to reject or accept the transfer. If the user of the target device accepts the transfer, then the file will be transmitted wirelessly to the target device and stored to a supported app or the Downloads folder on Mac.[11] AirDrop utilizes Bluetooth to discover nearby devices within 30 feet, and Wi-Fi to establish a secure peer-to-peer connection for transferring data at high speeds.[12] Since AirDrop establishes a secure encrypted connection separately from any internet connection, devices do not need to be on the same cellular or Wi-Fi network to be able to share files via AirDrop. The encryption on the peer-to-peer connection also prevents unauthorized access or interception of shared files.[13]

60. Apple created user guides for AirDrop that make the process smooth and painless for new users of AirDrop. These step-by-step instructions are shown below, both for iOS as well as OS X. Each guide mentions the prerequisite features that must be enabled, including Wi-Fi and Bluetooth. They show the UI for each type of device, including the usage of control center on iOS to access AirDrop. The guide details the ability to choose nearby users to share photos or other files with, as well as the ability to limit access to a user's AirDrop whether based on contacts, open to everyone, or completely disabled. These guides also show that the user receiving a file via AirDrop will have the option to accept or reject the file being sent. See below the user guide for iOS[14].

[11] Ex-2009, 1-4; Ex-2011, 1-2.
[12] Ex 2008, 3.
[13] Ex-2011, 1; Ex-2012, 3.
[14] Ex 2009, 2-6.

How to use AirDrop on your iPhone or iPad

Use AirDrop to share and receive photos, documents, and more with other Apple devices that are nearby.

Before you begin

- Make sure that the person you're sending to is nearby and within Bluetooth and Wi-Fi range.
- Check that you and the person you're sending to have Wi-Fi and Bluetooth turned on. If either of you have Personal Hotspot on, turn it off.
- Check if the person you're sending to has their AirDrop set to receive from Contacts Only. If they do, and you're in their Contacts, they need to have your Apple ID's email address or mobile number in your contact card for AirDrop to work.
- If you're not in their Contacts, have them set their AirDrop receiving setting to Everyone in order to receive the file.

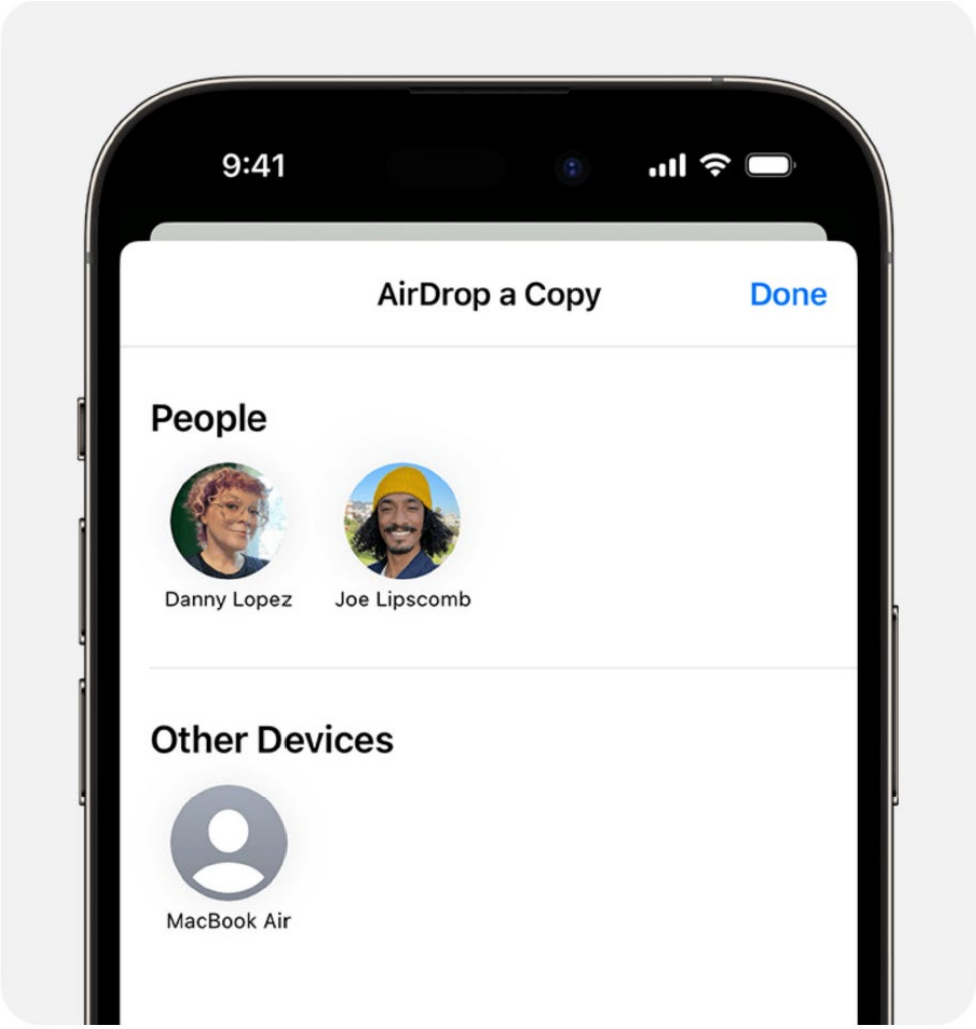
You can put your AirDrop receiving setting to Contacts Only or Receiving Off at any time to control who can see your device and send you content in AirDrop.

How to use AirDrop

1. Open an app, then tap Share or the Share button

. If you share a photo from the Photos app, you can swipe left or right and select multiple photos.
2. Tap the AirDrop button.

3. Tap the AirDrop user[1] that you want to share with. Or you can use AirDrop between your own Apple devices.



If you see a red numbered badge on the AirDrop button, there are multiple devices nearby that you can share with. Tap the AirDrop button, then tap the user that you want to share with. Learn what to do if you don't see the AirDrop user or your other device.

If you're near someone in your Contacts, you can share by opening the content that you want to share, then bringing your devices together.[2]

1. If the person you're sharing content with is in your Contacts, you'll see an image with their name. If they're not in your Contacts, you'll see just their name without an image.

2. Only available if both you and your contact are using an iPhone with iOS 17.

How to accept AirDrop

When someone shares something with you using AirDrop, you see an alert. You can tap Accept or Decline.

For most apps, if you tap Accept, the AirDrop will come through within the same app it was sent from. For example, photos appear in the Photos app and websites open in Safari. App links open in the App Store so you can download or purchase the app.

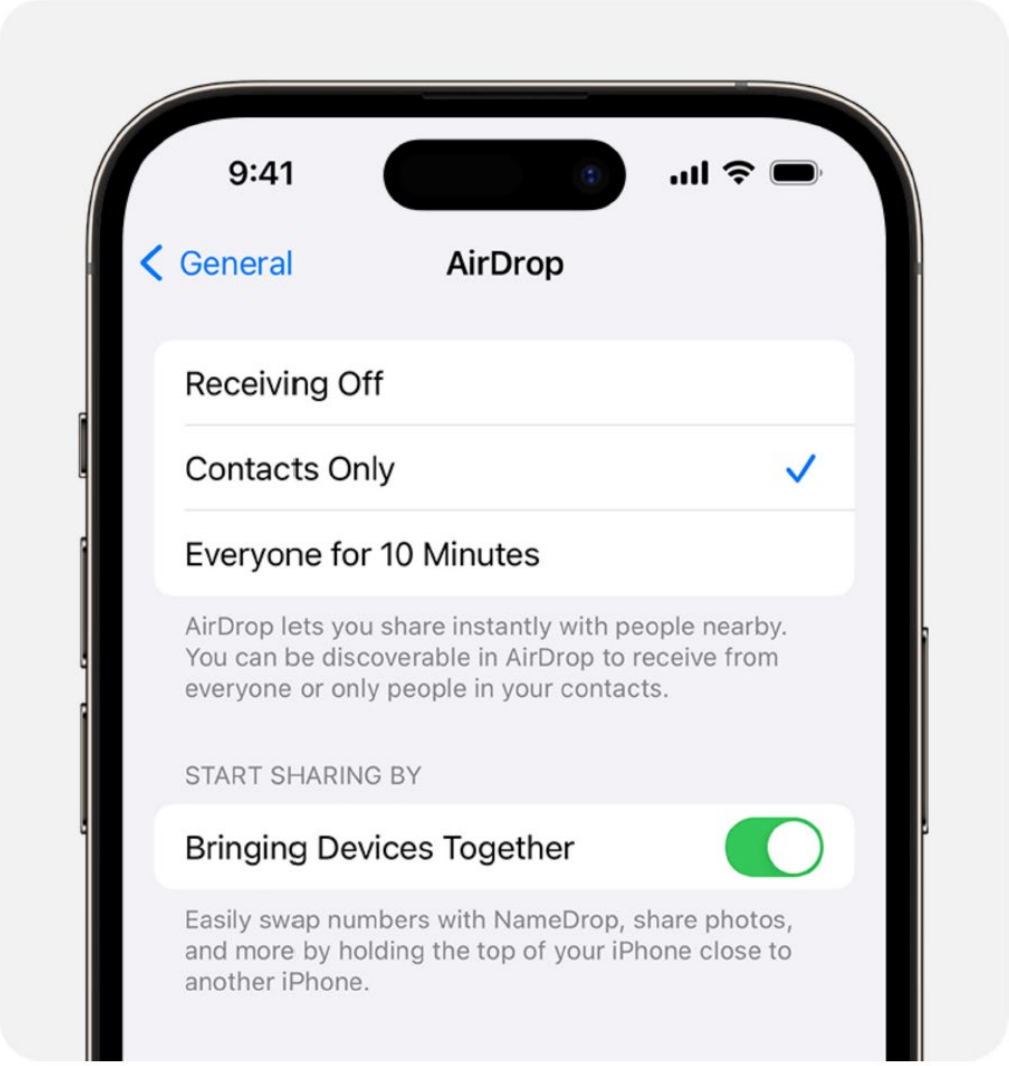
If you AirDrop something to yourself, like a photo from your iPhone to your Mac, you won't see an option to Accept or Decline—it'll automatically get sent to your device. Just make sure that both devices are signed in with the same Apple ID.

How to adjust AirDrop settings

To choose who can see your device and send you content in AirDrop:

1. Go to Settings, then tap General.

2. Tap AirDrop, then choose an option.



You can also set your AirDrop options in Control Center:

1. On iPhone X or later, swipe down from the upper-right corner of the screen to open Control Center. Or follow the same motion to open Control Center on your iPad with iOS 12 or later or iPadOS. On your iPhone 8 or earlier, swipe up from the bottom of the screen.
2. Press firmly or touch and hold the network settings card in the upper-left corner.
3. Touch and hold the AirDrop button , then choose one of these options:
    - Receiving Off: You won't receive AirDrop requests.
    - Contacts Only: Only your contacts can see your device.
    - Everyone: All nearby Apple devices using AirDrop can see your device. When you set your AirDrop option to Everyone for 10 Minutes in iOS 16.2 or later, your option reverts to Contacts Only[3] after 10 minutes.

If you see Receiving Off and can't tap to change it:

1. Go to Settings > Screen Time.
2. Tap Content & Privacy Restrictions.
3. Tap Allowed Apps and make sure that AirDrop is turned on.

3. If you're not signed in with your Apple ID on your device, this setting reverts to Receiving Off after 10 minutes.

The Contacts Only option is available on devices that support iOS 10 and later, iPadOS, or macOS Sierra 10.12 and later. If AirDrop is set to Contacts Only on your device with an earlier software version, you'll need to adjust AirDrop settings to the Everyone option in Settings or from Control Center. You can select the Everyone option while using AirDrop and disable it when not in use.

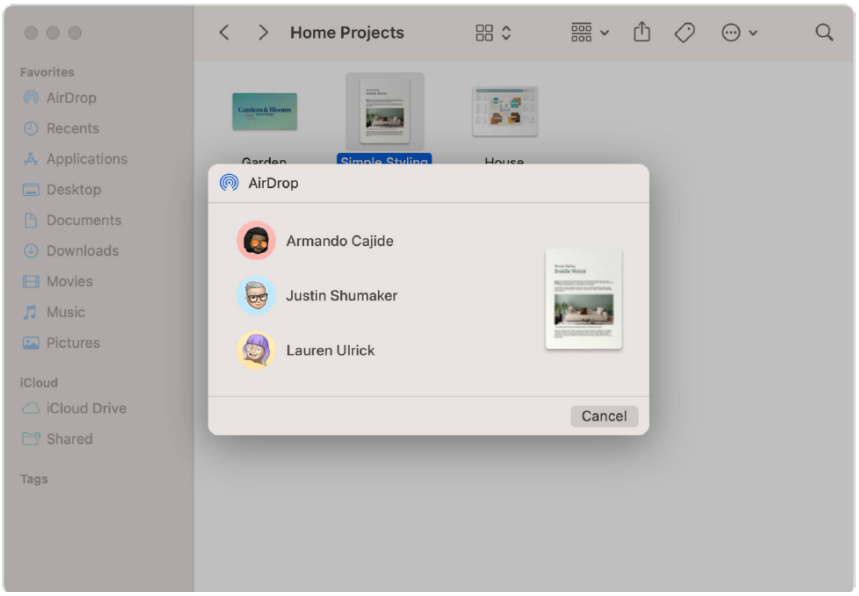
61. See below the user guide for OS X[15].

Use AirDrop on your Mac

With AirDrop, you can wirelessly send documents, photos, videos, websites, map locations, and more to a nearby Mac, iPhone, iPad, or Apple Vision Pro.

Share content with AirDrop

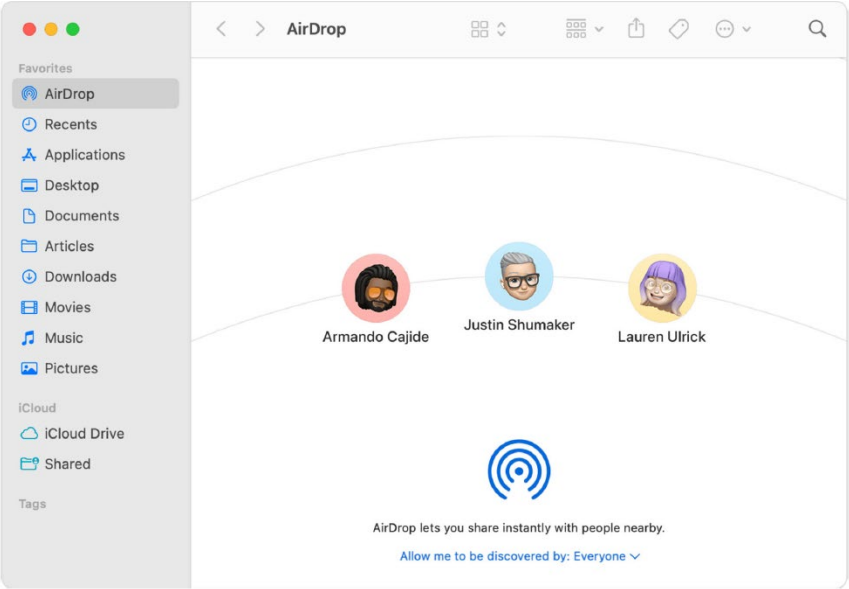
1. Open the file that you want to send, then click the Share button in the app window. For files in the Finder, you can also Control-click the file, then choose Share from the shortcut menu.
2. Choose AirDrop from the sharing options listed.
3. Choose a recipient from the AirDrop sheet:



Or open an AirDrop window, then drag files to the recipient:

1. Select AirDrop in the sidebar of a Finder window. Or choose Go > AirDrop from the menu bar.
2. The AirDrop window shows nearby AirDrop users. Drag one or more documents, photos, or other files to the recipient shown in the window.

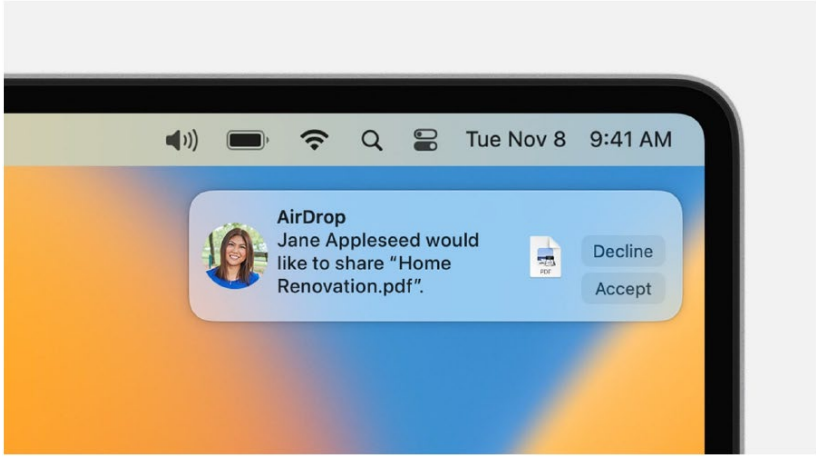
[15] Ex 2008, 1-3.



You can also share content from your iPhone, iPad, or iPod touch.

Receive content with AirDrop

When someone nearby attempts to send you a file using AirDrop, you see their request as a notification, or as a message in the AirDrop window. Click Accept to save the file to your Downloads folder.



If you can't see the other device in AirDrop

Make sure that both devices are within 30 feet (9 meters) of each other and have Wi-Fi and Bluetooth turned on.

Choose Go > AirDrop from the menu bar in the Finder, then check the "Allow me to be discovered by" setting in the AirDrop window. A similar setting is available on Phone and iPad and on Apple Vision Pro. If set to receive from Contacts Only, both devices must be signed in to iCloud, and the email address or phone number associated with the sender's Apple ID must be in the Contacts app of the receiving device.

Install the latest software updates for your Mac and other devices.

Make sure that incoming connections aren't blocked in firewall settings:

- macOS Ventura or later: Choose Apple menu > System Settings. Click Network in the sidebar, then click Firewall on the right. Click the Options button, then make sure that "Block all incoming connections" is turned off.
- Earlier versions of macOS: Choose Apple menu > System Preferences, then click Security & Privacy. Click the Firewall tab, click the lock button and enter your administrator password when prompted. Click Firewall Options, then make sure that "Block all incoming connections" is deselected.

62. One of the most important qualities of AirDrop is robust security. Apple assured consumers that they could control their privacy with the new networking capabilities, including by showing users how to take advantage of the security features.[16]

AirDrop security

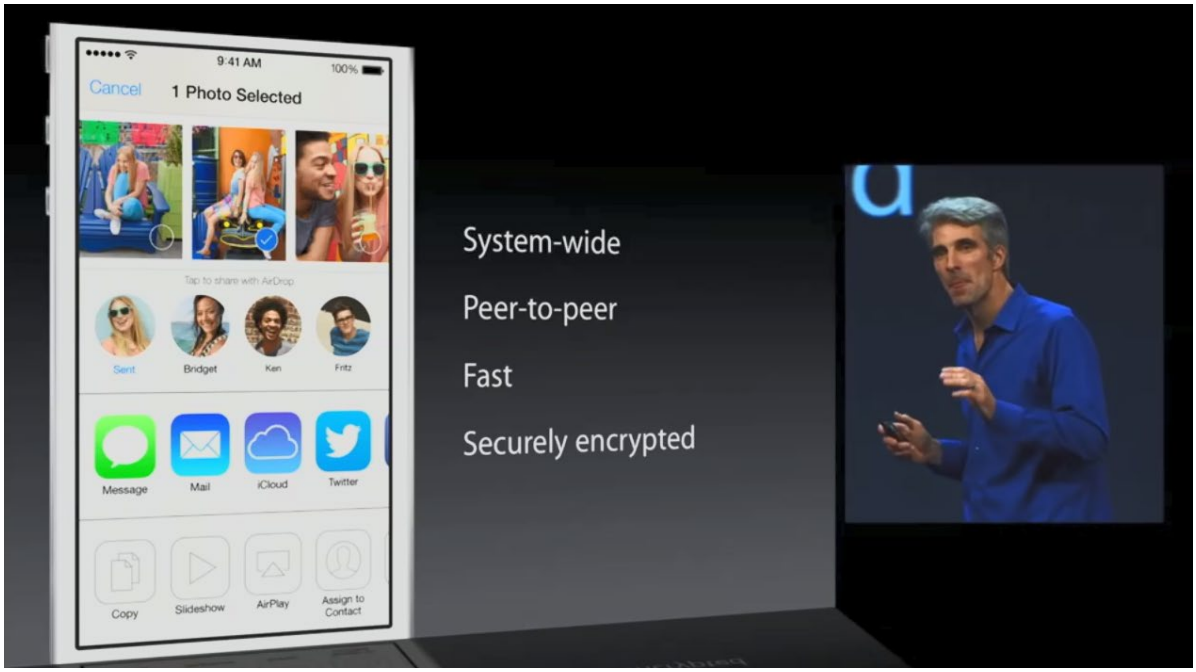
Apple devices that support AirDrop use Bluetooth Low Energy (BLE) and Apple-created peer-to-peer Wi-Fi technology to send files and information to nearby devices, including AirDrop-capable iOS devices and iPad devices running iOS 7 or later and Mac computers running OS X 10.11 or later. The Wi-Fi radio is used to communicate directly between devices without using any internet connection or wireless access point (AP). This connection is encrypted with TLS.

AirDrop is set to share with Contacts Only by default. Users can also choose to use AirDrop to share with everyone, or turn off the feature entirely. Organizations can restrict the use of AirDrop for devices or apps being managed by using a mobile device management (MDM) solution.

[16] Ex 2014, 2; AirDrop Security: https://support.apple.com/guide/security/airdrop-security-sec2261183f4/web#:~:text=This%20connection%20is%20encrypted%20with,device%20management%20(MDM)%20solution

7.2. Release of AirDrop with iOS 7

63. AirDrop was first introduced in Max OS X Lion in 2011[17], and later added to iOS 7 in 2013 with the redesigned Apple Control Center. [18] In its iOS 7 Announcement, Apple touted that "AirDrop is absolutely the easiest way to share with the people that are right around you…" and highlighted the capability for system-wide, peer-to-peer, fast, and securely encrypted file transfer between devices. [19]



64. In a press release, Apple pointed to AirDrop as one of the most important new features in iOS 7[20], as shown below:

[17] Mac OS X Lion With 250 New Features Available in July From Mac App Store: https://www.apple.com/newsroom/2011/06/06Mac-OS-X-Lion-With-250-New-Features-Available-in-July-From-Mac-App-Store/
[18] https://www.youtube.com/watch?v=gmn4ve4oTL8, 22:03
[19] https://www.youtube.com/watch?v=gmn4ve4oTL8, 22:03
[20] Ex-2020, 2.

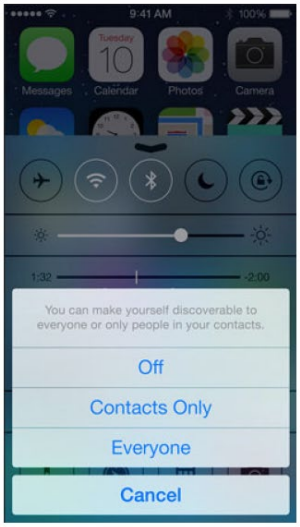
AirDrop is an entirely new way to quickly and easily share content with people nearby. When you've got something you want to share, AirDrop shows you your contacts close by. Just select who you want to share with and AirDrop does the rest. AirDrop transfers are peer-to-peer so you can use it anywhere, without any network or set up required, and transfers are fully encrypted so your content is protected and private.

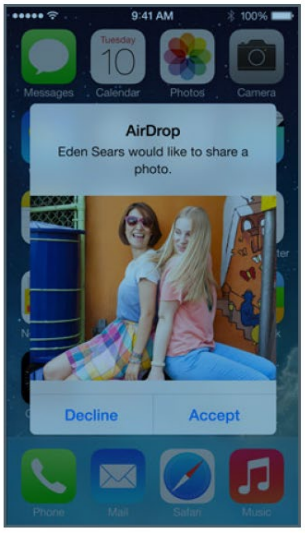
65. Similarly, in Apple's "What's New" page for iOS 7[21], they detail the new feature and its benefits as shown below.

AirDrop. Drop everything.

Sending a photo or a document to someone via text or email is fine. But if that someone is right next to you, a text or an email suddenly feels like too many steps. Enter AirDrop for iOS. It lets you quickly and easily share photos, videos, contacts — and anything else from any app with a Share button. Just tap Share, then select the person you want to share with. AirDrop does the rest using Wi-Fi and Bluetooth. No setup required. And transfers are encrypted, so what you share is highly secure.[5]

[21] Ex-2007, 8-9





Share one to one. Or one to many.
With AirDrop, you can share, say, a photo or a video with a specific person or multiple people. Just tap the Share icon, select who you want to share with, and let AirDrop do its thing.

Make yourself available. Or not.
You're automatically visible in AirDrop to your contacts running iOS 7. But you can also make yourself visible to anyone nearby using iOS 7 or to no one at all. One tap in Control Center is all it takes.

File received.
Recipients can choose to save whatever you send. When they do, the content is saved right where it should be — a photo in Photos, a pass in Passbook, a contact in Contacts, and so on.

66. Discourse around the iOS 7 update highlighted AirDrop as one of the major developments for the iOS 7 operating system as shown below.[22]

[22] Apple announces iOS 7: https://www.theverge.com/2013/6/10/4407630/apple-announces-ios-7

> AIRDROP
>
> AirDrop is a new feature in iOS 7 that lets you share content with other iOS users through the Control Center. It lets you share with other users who are close by, and tells you who you can send content to right within Control Center. This is Apple's answer to Samsung's group sharing features and the tap-based NFC sharing supported by other platforms. It works on the iPhone 5, fifth-generation iPod touch, fourth-generation iPad, and iPad mini.

67. As AirDrop gained popularity, it was recognized by observers as providing "one-tap access to share items with other iOS 7 users, including photos with friends."[23]

> And a new feature called AirDrop provides one-tap access to share items with other iOS 7 users, including photos with friends.

8. ANALYSIS

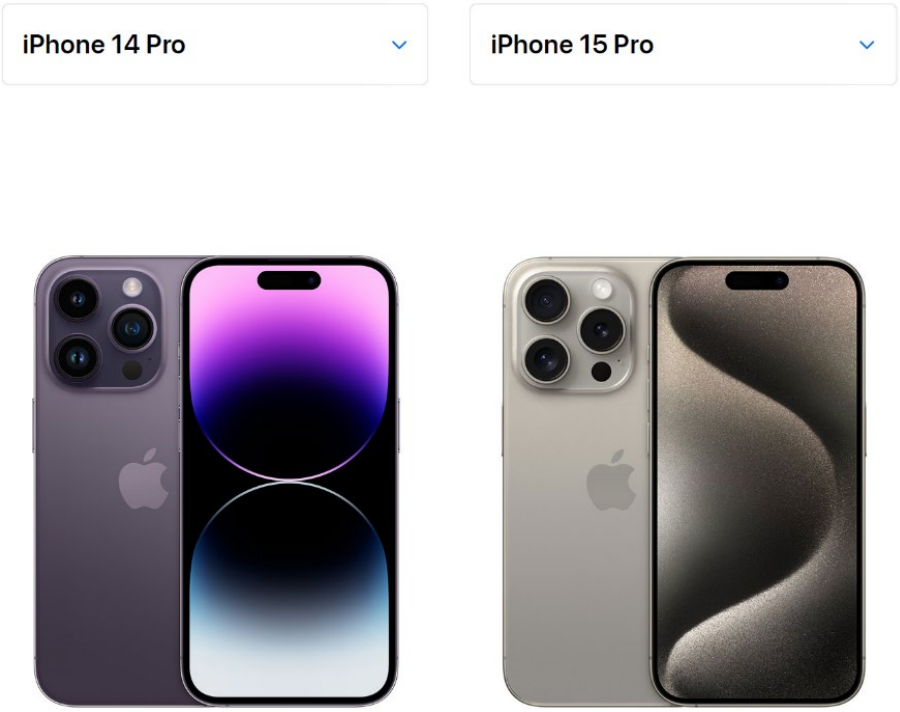
8.1. The Independent Claims of the '054 Patent Cover AirDrop

68. The following sections are reproduced from claim charts provided by counsel and that will be included in the POPR, and I have reviewed them and believe them to be correct and am including them in my report for completeness. Apple's licensed AirDrop products include the functionality recited in the Challenged Claims. These sections identify specific mappings of claim elements to AirDrop functionality and demonstrate nexus between the merits of the claimed invention and the commercial and licensed AirDrop products that are made and sold by Apple.

[23] Apple unveils iOS 7 in biggest update ever: https://money.cnn.com/2013/06/10/technology/mobile/apple-ios7-event/index.html

8.1.1. 1[pre] A method performed by a wireless transmit/receive unit (WTRU), the method comprising:

69. Apple AirDrop products are wireless transmit/receive units that perform the claimed method. For example, Apple AirDrop devices can be Apple iPhones or iPads, which are wireless transmit/receive units.



Ex-2013, 1.

70. For example, Apple AirDrop products with iOS 7 or later are touchscreen, Wi-Fi-enabled devices that are pre-installed with AirDrop. See Ex-2020, 2 ("AirDrop is an entirely new way to quickly and easily share content with people nearby.").

71. More specifically, and as shown below, "AirDrop-capable iOS devices and iPad devices running iOS 7 or later" are able to "use Bluetooth Low Energy (BLE) and Apple-created peer-to-peer Wi-Fi technology to send files and information to nearby devices." Ex-2014, 2.

AirDrop security

Apple devices that support AirDrop use Bluetooth Low Energy (BLE) and Apple-created peer-to-peer Wi-Fi technology to send files and information to nearby devices, including AirDrop-capable iOS devices and iPad devices running iOS 7 or later and Mac computers running OS X 10.11 or later. The Wi-Fi radio is used to communicate directly between devices without using any internet connection or wireless access point (AP). This connection is encrypted with TLS.

AirDrop is set to share with Contacts Only by default. Users can also choose to use AirDrop to share with everyone, or turn off the feature entirely. Organizations can restrict the use of AirDrop for devices or apps being managed by using a mobile device management (MDM) solution.

Ex-2014, 2.

72. As shown below, Apple AirDrop devices have Wi-Fi capabilities.

iPhone 14 Pro	iPhone 15 Pro
Cellular and Wireless	
GSM/EDGE	GSM/EDGE
UMTS/HSPA+	UMTS/HSPA+
DC-HSDPA	DC-HSDPA
5G (sub-6 GHz and mmWave) with 4x4 MIMO[6]	5G (sub-6 GHz and mmWave) with 4x4 MIMO[6]
Gigabit LTE[6]	Gigabit LTE[6]
Wi-Fi 6	Wi-Fi 6E[10]
Bluetooth 5.3	Bluetooth 5.3
Ultra Wideband chip[11]	Second-generation Ultra Wideband chip[11]

Ex-2013, 9.

73. Apple AirDrop devices have a 6.1 inch OLED display with haptic touch capabilities. See, e.g., Ex-2013, 4-5.

How to use AirDrop on your iPhone or iPad

Use AirDrop to share and receive photos, documents, and more with other Apple devices that are nearby.

- Before you begin
- How to use AirDrop
- How to accept AirDrop
- How to adjust AirDrop settings

Ex-2015, 1.

8.1.2. 1[a] processing, by the WTRU from a touch display, an input to select media in an application;

74. Apple AirDrop products comprise a WTRU that processes from a touch display an input to select media in an application, either literally or under the doctrine of equivalents.

75. For example, as shown below, the iPhone 15 Pro contains an A17 Pro chip. The iPhone 14 Pro contains an A16 Bionic Chip.

iPhone 14 Pro	iPhone 15 Pro
A16	A17 PRO
A16 Bionic chip	A17 Pro chip
6-core CPU	6-core CPU
5-core GPU	6-core GPU
16-core Neural Engine	16-core Neural Engine
Pro camera system 48MP Main | Ultra Wide | Telephoto	Pro camera system 48MP Main | Ultra Wide | Telephoto
Super-high-resolution photos (48MP)	Super-high-resolution photos (24MP and 48MP)
Portrait mode with Focus and Depth Control	Next-generation portraits with Focus and Depth Control

Ex-2013, 2.

76. Further, the Apple AirDrop products have a 6.1 inch OLED display with haptic touch that is capable of receiving touchscreen input. See, e.g., Ex-2013, 4-5.

77. As another example, when using AirDrop, users must "[o]pen an app, then tap Share or the Share button," such as when "shar[ing] a photo from the Photos app." Ex-2015, 1. "If you share a photo from the Photos app, you can swipe left or right and select multiple photos." *Id*.

How to use AirDrop

1. Open an app, then tap Share or the Share button. If you share a photo from the Photos app, you can swipe left or right and select multiple photos.
2. Tap the AirDrop button.

Ex-2015, 1.

8.1.3. 1[b] detecting, by the WTRU over Bluetooth, another WTRU;

78. Apple AirDrop products comprise WTRUs that detect over Bluetooth another WTRU.

79. Each Apple AirDrop product has Bluetooth 5.3 capability that detects devices in their proximity.

iPhone 14 Pro	iPhone 15 Pro
Cellular and Wireless	
GSM/EDGE	GSM/EDGE
UMTS/HSPA+	UMTS/HSPA+
DC-HSDPA	DC-HSDPA
5G (sub-6 GHz and mmWave) with 4x4 MIMO[6]	5G (sub-6 GHz and mmWave) with 4x4 MIMO[6]
Gigabit LTE[6]	Gigabit LTE[6]
Wi-Fi 6	Wi-Fi 6E[10]
Bluetooth 5.3	Bluetooth 5.3
Ultra Wideband chip[11]	Second-generation Ultra Wideband chip[11]

Ex-2013, 9.

80. As shown below, when a user selects AirDrop as the method for sharing an item, the user's device emits a Bluetooth signal. "Other Apple devices that are awake, in close proximity, and have AirDrop turned on, detect the signal and respond using peer-to-peer Wi-Fi, so that the sending device can discover the identity of any responding devices." Ex-2014, 2; Ex-2020, 2 ("When you've got something you want to share, AirDrop shows you your contacts close by.").

AirDrop operation

AirDrop uses iCloud services to help users authenticate. When a user signs in to iCloud, a 2048-bit RSA identity is stored on the device, and when the user turns on AirDrop, an AirDrop short identity hash is created based on the email addresses and phone numbers associated with the user's Apple ID.

When a user chooses AirDrop as the method for sharing an item, the sending device emits an AirDrop signal over BLE that includes the user's AirDrop short identity hash. Other Apple devices that are awake, in close proximity, and have AirDrop turned on, detect the signal and respond using peer-to-peer Wi-Fi, so that the sending device can discover the identity of any responding devices.

Ex-2014, 2.

81. See also documentation instructing users to "[c]heck that you and the person you're sending to have Wi-Fi and Bluetooth turned on."

How to use AirDrop on your iPhone or iPad

Use AirDrop to share and receive photos, documents, and more with other Apple devices that are nearby.

Before you begin

- Make sure that the person you're sending to is nearby and within Bluetooth and Wi-Fi range.
- Check that you and the person you're sending to have Wi-Fi and Bluetooth turned on. If either of you have Personal Hotspot on, turn it off.
- Check if the person you're sending to has their AirDrop set to receive from Contacts Only. If they do, and you're in their Contacts, they need to have your Apple ID's email address or mobile number in your contact card for AirDrop to work.
- If you're not in their Contacts, have them set their AirDrop receiving setting to Everyone in order to receive the file.

You can put your AirDrop receiving setting to Contacts Only or Receiving Off at any time to control who can see your device and send you content in AirDrop.

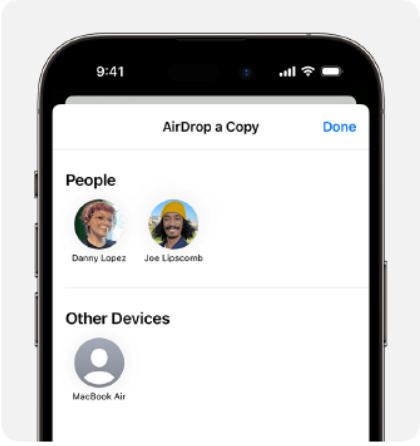
Ex-2016, 2 (How to use your iPhone or iPad) (annotated).

8.1.4. 1[c] processing, by the WTRU, another input from the touch display to select the another WTRU;

82. For example, once potential AirDrop recipients are displayed on the user's device a user can select the AirDrop recipient with whom they want to share media. Ex-2020 IDG1373_0024231 at -24232 ("Just select who you want to share with and AirDrop does the rest.").

83. As shown below, Apple users are instructed to "[t]ap the AirDrop user that you want to share with."

3. Tap the AirDrop user[1] that you want to share with. Or you can use AirDrop between your own Apple devices.



If you see a red numbered badge on the AirDrop button, there are multiple devices nearby that you can share with. Tap the AirDrop button, then tap the user that you want to share with. Learn what to do if you don't see the AirDrop user or your other device.

Ex-2015, 2.

8.1.5. 1[d] sending, by the WTRU to the selected another WTRU, a message to transfer the selected media;

84. Apple AirDrop products comprise a WTRU that sends to the selected another WTRU a message to transfer the selected media.

85. For example, as shown below, "[w]hen someone shares something with you using AirDrop, you see an alert" showing the proposed transfer, which the user can "tap [to] Accept or Decline."

How to accept AirDrop

When someone shares something with you using AirDrop, you see an alert. You can tap Accept or Decline.

Ex-2015, 2.

8.1.6. 1[e] receiving, by the WTRU, an acceptance to transfer the selected media; and

86. Apple AirDrop products comprise a WTRU that receives an acceptance to transfer the selected media.

87. For example, as shown below, "[w]hen someone shares something with you using AirDrop, you see an alert," which the user can "tap [to] Accept or Decline." Then, "if you tap Accept, the AirDrop will come through within the same app it was sent from."

How to accept AirDrop

When someone shares something with you using AirDrop, you see an alert. You can tap Accept or Decline.

For most apps, if you tap Accept, the AirDrop will come through within the same app it was sent from. For example, photos appear in the Photos app and websites open in Safari. App links open in the App Store so you can download or purchase the app.

Ex-2015, 2.

8.1.7. 1[f] transferring, by the WTRU to the selected another WTRU over WiFi, the selected media.

88. Apple AirDrop productscomprise a WTRU that transfers to the selected another WTRU over WiFi the selected media.

89. For example, as shown below, AirDrop uses "Apple-created peer-to-peer Wi-Fi technology to send files and information to nearby devices, including AirDrop-capable iOS devices."

AirDrop security

Apple devices that support AirDrop use Bluetooth Low Energy (BLE) and Apple-created peer-to-peer Wi-Fi technology to send files and information to nearby devices, including AirDrop-capable iOS devices and iPad devices running iOS 7 or later and Mac computers running OS X 10.11 or later. The Wi-Fi radio is used to communicate directly between devices without using any internet connection or wireless access point (AP). This connection is encrypted with TLS.

Ex-2014, 2 (Apple Platform Security) (annotated).

90. Apple AirDrop products have at least Wi-Fi 6 capability.

iPhone 14 Pro	iPhone 15 Pro	iPhone 15
Cellular and Wireless		
GSM/EDGE	GSM/EDGE	GSM/EDGE
UMTS/HSPA+	UMTS/HSPA+	UMTS/HSPA+
DC-HSDPA	DC-HSDPA	DC-HSDPA
5G (sub-6 GHz and mmWave) with 4x4 MIMO[6]	5G (sub-6 GHz and mmWave) with 4x4 MIMO[6]	5G (sub-6 GHz and mmWave) with 4x4 MIMO[6]
Gigabit LTE[6]	Gigabit LTE[6]	Gigabit LTE[6]
Wi-Fi 6	Wi-Fi 6E[10]	Wi-Fi 6
Bluetooth 5.3	Bluetooth 5.3	Bluetooth 5.3
Ultra Wideband chip[11]	Second-generation Ultra Wideband chip[11]	Second-generation Ultra Wideband chip[11]

Ex-2013, 9.

8.1.8. 23[pre] A wireless transmit/receive unit (WTRU) comprising:

91. As noted above, Apple AirDrop products are wireless transmit/receive units.

iPhone 14 Pro | iPhone 15 Pro

Ex-2013, 1.

92. For example, Apple devices with iOS 7 or later are touchscreen, Wi-Fi-enabled WTRUs that are pre-installed with AirDrop. "AirDrop is an entirely new way to quickly and easily share content with people nearby." Ex-2014, 2.

93. As shown below, the Apple AirDrop have Wi-Fi capabilities.

iPhone 14 Pro	iPhone 15 Pro
Cellular and Wireless	
GSM/EDGE	GSM/EDGE
UMTS/HSPA+	UMTS/HSPA+
DC-HSDPA	DC-HSDPA
5G (sub-6 GHz and mmWave) with 4x4 MIMO[6]	5G (sub-6 GHz and mmWave) with 4x4 MIMO[6]
Gigabit LTE[6]	Gigabit LTE[6]
Wi-Fi 6	Wi-Fi 6E[10]
Bluetooth 5.3	Bluetooth 5.3
Ultra Wideband chip[11]	Second-generation Ultra Wideband chip[11]

Ex-2013, 9.

94. More specifically, and as shown below, "AirDrop-capable iOS devices and iPad devices running iOS 7 or later" are able to "use Bluetooth Low Energy (BLE) and Apple-created peer-to-peer Wi-Fi technology to send files and information to nearby devices."

AirDrop security

Apple devices that support AirDrop use Bluetooth Low Energy (BLE) and Apple-created peer-to-peer Wi-Fi technology to send files and information to nearby devices, including AirDrop-capable iOS devices and iPad devices running iOS 7 or later and Mac computers running OS X 10.11 or later. The Wi-Fi radio is used to communicate directly between devices without using any internet connection or wireless access point (AP). This connection is encrypted with TLS.

AirDrop is set to share with Contacts Only by default. Users can also choose to use AirDrop to share with everyone, or turn off the feature entirely. Organizations can restrict the use of AirDrop for devices or apps being managed by using a mobile device management (MDM) solution.

Ex-2014, 2.

How to use AirDrop on your iPhone or iPad

Use AirDrop to share and receive photos, documents, and more with other Apple devices that are nearby.

- Before you begin
- How to use AirDrop
- How to accept AirDrop
- How to adjust AirDrop settings

Ex-2015, 1.

8.1.9. 23[a] circuitry configured to process, from a touch display, an input to select media in an application;

95. Apple AirDrop products comprise circuitry configured to process, from a touch display, an input to select media in an application.

96. Each Apple AirDrop product comprises circuitry configured to process, from a touch display, an input to select media in an application. The iPhone 14 Pro and iPhone 15 Pro contain an A16 Bionic chip and A17 Bionic chip, respectively.

iPhone 14 Pro	iPhone 15 Pro
A16	A17 PRO
A16 Bionic chip	A17 Pro chip
6-core CPU	6-core CPU
5-core GPU	6-core GPU
16-core Neural Engine	16-core Neural Engine
Pro camera system 48MP Main | Ultra Wide | Telephoto	Pro camera system 48MP Main | Ultra Wide | Telephoto
Super-high-resolution photos (48MP)	Super-high-resolution photos (24MP and 48MP)
Portrait mode with Focus and Depth Control	Next-generation portraits with Focus and Depth Control

Ex-2013, 2.

97. Further, the Apple AirDrop products have a 6.1 inch OLED display with haptic touch capabilities. *See, e.g.*, Ex-2013, 4-5.

98. As another example, when using AirDrop, users must "[o]pen an app, then tap Share or the Share button," such as when "shar[ing] a photo from the Photos app." Ex-2015, 1. "If you share a photo from the Photos app, you can swipe left or right and select multiple photos." *Id.*

How to use AirDrop

1. Open an app, then tap Share or the Share button. If you share a photo from the Photos app, you can swipe left or right and select multiple photos.
2. Tap the AirDrop button.

Ex-2015, 1.

8.1.10. 23[b] circuitry configured to detect, by the WTRU over bluetooth, another WTRU;

99. Apple AirDrop products comprise circuitry configured to detect, by the WTRU over bluetooth, another WTRU.

100. The Apple AirDrop products have Bluetooth 5.3 capability that detects devices in their proximity. Ex-2013, 9.

iPhone 14 Pro	iPhone 15 Pro
Cellular and Wireless	
GSM/EDGE	GSM/EDGE
UMTS/HSPA+	UMTS/HSPA+
DC-HSDPA	DC-HSDPA
5G (sub-6 GHz and mmWave) with 4x4 MIMO[6]	5G (sub-6 GHz and mmWave) with 4x4 MIMO[6]
Gigabit LTE[6]	Gigabit LTE[6]
Wi-Fi 6	Wi-Fi 6E[10]
Bluetooth 5.3	Bluetooth 5.3
Ultra Wideband chip[11]	Second-generation Ultra Wideband chip[11]

Ex-2013, 9.

101. As shown below, when a user selects AirDrop as the method for sharing an item, the user's device emits a Bluetooth signal. "Other Apple devices that are awake, in close proximity, and have AirDrop turned on, detect the signal and respond using peer-to-peer Wi-Fi, so that the sending device can discover the identity of any responding devices." Ex-2014, 2; Ex-2020, 2 ("When you've got something you want to share, AirDrop shows you your contacts close by.").

AirDrop operation

AirDrop uses iCloud services to help users authenticate. When a user signs in to iCloud, a 2048-bit RSA identity is stored on the device, and when the user turns on AirDrop, an AirDrop short identity hash is created based on the email addresses and phone numbers associated with the user's Apple ID.

When a user chooses AirDrop as the method for sharing an item, the sending device emits an AirDrop signal over BLE that includes the user's AirDrop short identity hash. Other Apple devices that are awake, in close proximity, and have AirDrop turned on, detect the signal and respond using peer-to-peer Wi-Fi, so that the sending device can discover the identity of any responding devices.

Ex-2014, 2.

102. The documentation below describes to users to "[c]heck that you and the person you're sending to have Wi-Fi and Bluetooth turned on."

How to use AirDrop on your iPhone or iPad

Use AirDrop to share and receive photos, documents, and more with other Apple devices that are nearby.

Before you begin

- Make sure that the person you're sending to is nearby and within Bluetooth and Wi-Fi range.
- Check that you and the person you're sending to have Wi-Fi and Bluetooth turned on. If either of you have Personal Hotspot on, turn it off.
- Check if the person you're sending to has their AirDrop set to receive from Contacts Only. If they do, and you're in their Contacts, they need to have your Apple ID's email address or mobile number in your contact card for AirDrop to work.
- If you're not in their Contacts, have them set their AirDrop receiving setting to Everyone in order to receive the file.

You can put your AirDrop receiving setting to Contacts Only or Receiving Off at any time to control who can see your device and send you content in AirDrop.

Ex-2016, 2 (How to use your iPhone or iPad) (annotated).

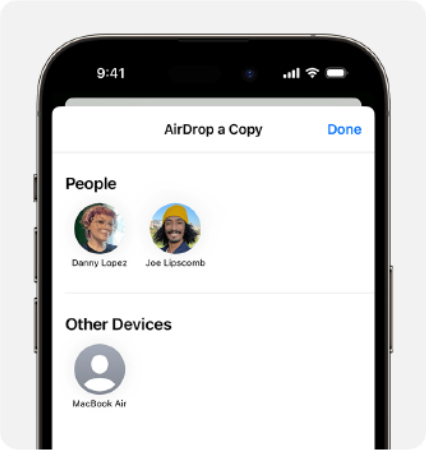
8.1.11. 23[c] the circuitry further configured to process another input from the touch display to select the another WTRU;

103. Apple AirDrop products comprise circuitry further configured to process another input from the touch display to select the another WTRU.

104. For example, once potential AirDrop recipients are displayed on the user's device, a user can select the AirDrop recipient with whom they want to share media. Ex-2020 IDG1373_0024231 at -24232 ("Just select who you want to share with and AirDrop does the rest.").

105. As shown below, Apple users are instructed to "[t]ap the AirDrop user that you want to share with."

3. Tap the AirDrop user[1] that you want to share with. Or you can use AirDrop between your own Apple devices.



If you see a red numbered badge on the AirDrop button, there are multiple devices nearby that you can share with. Tap the AirDrop button, then tap the user that you want to share with. Learn what to do if you don't see the AirDrop user or your other device.

Ex-2015, 2.

8.1.12. 23[d] circuitry configured to send, by the WTRU to the selected another WTRU, a message to transfer the selected media;

106. Apple AirDrop products comprise circuitry configured to send, by the WTRU to the selected another WTRU, a message to transfer the selected media.

107. For example, as shown below, "[w]hen someone shares something with you using AirDrop, you see an alert" showing the proposed transfer, which the user can "tap [to] Accept or Decline."

How to accept AirDrop

When someone shares something with you using AirDrop, you see an alert. You can tap Accept or Decline.

Ex-2015, 2.

8.1.13. 23[e] circuitry configured to receive, by the WTRU, an acceptance to transfer the selected media; and

108. Apple AirDrop products comprise circuitry configured to receive, by the WTRU, an acceptance to transfer the selected media element to the selected WTRU.

109. For example, as shown below, "[w]hen someone shares something with you using AirDrop, you see an alert," which the user can "tap [to] Accept or Decline." Then, "if you tap Accept, the AirDrop will come through within the same app it was sent from."

How to accept AirDrop

When someone shares something with you using AirDrop, you see an alert. You can tap Accept or Decline.

For most apps, if you tap Accept, the AirDrop will come through within the same app it was sent from. For example, photos appear in the Photos app and websites open in Safari. App links open in the App Store so you can download or purchase the app.

Ex-2015, 2.

8.1.14. circuitry configured to receive, by the WTRU.

110. Apple AirDrop products comprise circuitry configured to transfer, by the WTRU to the selected another WTRU over WiFi, the selected media.

111. For example, as shown below, AirDrop uses "Apple-created peer-to-peer Wi-Fi technology to send files and information to nearby devices, including AirDrop-capable iOS devices."

AirDrop security

Apple devices that support AirDrop use Bluetooth Low Energy (BLE) and Apple-created peer-to-peer Wi-Fi technology to send files and information to nearby devices, including AirDrop-capable iOS devices and iPad devices running iOS 7 or later and Mac computers running OS X 10.11 or later. The Wi-Fi radio is used to communicate directly between devices without using any internet connection or wireless access point (AP). This connection is encrypted with TLS.

Ex-2014, 2 (Apple Platform Security) (annotated).

112. The documentation below describes that the AirDrop Products have at least Wi-Fi 6 capability.

iPhone 14 Pro	iPhone 15 Pro	iPhone 15
Cellular and Wireless		
GSM/EDGE	GSM/EDGE	GSM/EDGE
UMTS/HSPA+	UMTS/HSPA+	UMTS/HSPA+
DC-HSDPA	DC-HSDPA	DC-HSDPA
5G (sub-6 GHz and mmWave) with 4x4 MIMO[6]	5G (sub-6 GHz and mmWave) with 4x4 MIMO[6]	5G (sub-6 GHz and mmWave) with 4x4 MIMO[6]
Gigabit LTE[6]	Gigabit LTE[6]	Gigabit LTE[6]
Wi-Fi 6	Wi-Fi 6E[10]	Wi-Fi 6
Bluetooth 5.3	Bluetooth 5.3	Bluetooth 5.3
Ultra Wideband chip[11]	Second-generation Ultra Wideband chip[11]	Second-generation Ultra Wideband chip[11]

Ex-2013, 9.

9. SECONDARY CONSIDERATIONS OF NON-OBVIOUSNESS

9.1. Commercial Success and Industry Praise of AirDrop

113. The following sections include evidence of commercial success and industry praise of Apple AirDrop which can be presented as secondary evidence of non-obviousness. The commercial success of Apple's AirDrop feature and products including that feature demonstrate that the patented features recited in the Challenged Claims are not obvious.

114. Apple AirDrop is a feature embedded within Apple devices including iPhones, iPads, and Mac desktop/laptop computers. Apple has not publicly released financial figures directly attributed to AirDrop. Industry commentary can be presented as evidence of commercial success.

115. When AirDrop was released on iOS 7 in 2013, commentators in the industry wrote articles reacting to the new feature. One article describes "How iOS 7's AirDrop Could Transform the Way We Share," and told of how "AirDrop possesses the potential to spur new forms of sharing digital content and thus, potential new applications and even new businesses could spring from

AirDrop."[24] Reviewers described AirDrop as "a fantastic technological implementation of frictionless file sharing,"[25] and a "great way to share files between systems, even big ones like video files or Photoshop files."[26] Reviewers commented on the ease of use for the feature, one saying "[w]e've never encountered any system that makes it so easy to pass a file from one device to another."[27]

116. After AirDrop's inception in Macs with OS X 10.7 Lion, commentators marked the impact the feature would have on file sharing[28], recognizing it as "a convenient option for sharing data with people in close proximity" and marking it as "one of the highlights of iOS 7."[29] The "no setup," "useful, robust, and simple file sharing feature"[30] had made an impact.

> With AirDrop, Apple has implemented a useful, robust and simple file sharing feature that has, until iOS 7, been largely the domain of third-party apps.
>
> *Editor's Note: This is the first in a series of features focusing on iOS 7's new and notable features. AppleInsider will be publishing additional articles highlighting brand new additions such as App Store auto-updates and individual caller blocking, as well as enhancements like the revised Camera app.*
>
> As one of the highlights of iOS 7, AirDrop brings "no setup" file sharing functionality first seen in OS X to Apple's mobile platform, offering users an easy and seamless way to transfer digital assets between compatible devices. Importantly, the protocol uses a hybrid Bluetooth and Wi-Fi communications solution that provides for both speed and security.

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[24] Ex-2023, 1, 5.
[25] Ex-2024, 4.
[26] Ex-2025, 1.
[27] Ex-2024, 4.
[28] Macworld article reacting to release in OSX Lion: https://www.macworld.com/article/213423/lion_airdop_screen_sharing.html
[29] Macworld addresses AirDrop release on iPhone: https://www.macworld.com/article/221893/get-to-know-ios-7-airdrop.html
[30] Apple Insider article "AirDrop simplifies speedy local file transfer": https://appleinsider.com/articles/13/09/18/ios-7-feature-focus-airdrop-simplifies-speedy-local-file-transfer

9.2. AirDrop Solved a Long Felt But Unresolved Need in the Industry

117. The following sections include evidence of a long felt but unresolved need. Apple implemented AirDrop in iOS 7, which launched on September 18th, 2013. This was potentially the first commercial embodiment of the claims of the '054 patent. Up until that time, no one implemented products which utilized the method and apparatus described by the '054 patent, demonstrating a long felt but unresolved need for the claimed invention.

118. AirDrop differentiated itself from other file sharing solutions by utilizing a combination of Bluetooth and Wi-Fi to establish secure connections between devices, taking advantage of the benefits of each technology. Bluetooth was used for easy discovery of nearby devices, while Wi-Fi was used for secure and speedy transmission of media between devices. AirDrop became a "staple iOS feature that iPhone users love,"[31] because "[u]nlike similar Android and Windows Phone solutions that require back-to-back NFC contact of your phones, AirDrop works entirely wirelessly over Bluetooth."[32] Apple capitalized on the lack of file sharing solutions which were both fast and convenient, as the closest file sharing solutions of the time were limited by transfer rate and ease of use.

119. For example, Bump was one of the leading file sharing solutions of the time "which let users tap phones together to share contacts and other files."[33] Commentators acknowledged that this service was not ideal, noting that "[t]o be honest, nobody taps two smartphones together anymore."[34] A review of iOS 7 by CNET compared AirDrop to Samsung's version of the NFC

[31] Ex-2026, 1.
[32] Ex-2027, 1.
[33] Ex-2028, 1.
[34] Ex-2029, 1.

tap-to-share feature, commenting that "iOS users will be happy to finally get a similar feature, and they won't even have to bump phones to make it work."[35]

120. Looking further backward, commentators also recognized that AirDrop would be a useful alternative to the typical "sneakernet" workarounds of using a physical USB or some other physical or network-based file transfer method.[36] With AirDrop's release on OS X Lion, Macworld recognized that "moving a file from one computer to another remains as big a pain today as it was decades ago when network file-sharing first became common… Lion's AirDrop feature is supposed to cut through all that nonsense and make moving one or more files between two computers a breeze."[37] AirDrop allowed users to instead use a method that "requires fewer steps than sending an email."[38]

121. Apple developed Apple AirDrop as an alternative to the clunky workarounds including "bump," "sneakernet", and Apple's own iMessage or third-party app workarounds. Apple made these workarounds "a thing of the past"[39], a lead which has been followed by competitors in the wireless industry.

> Like many Apple inventions, AirDrop streamlines a process already in wide use, in this case file sharing. Previously, iOS users had to swap photos, video, and other data via email, iMessage or apps that supported larger file transfers. Adoption of AirDrop may make these workarounds a thing of the past.

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[35] Apple iOS 7 review: Massive makeover makes iOS feel new again: https://www.cnet.com/reviews/apple-ios-7-review/

[36] Macworld article reacting to release in OSX Lion: https://www.macworld.com/article/213423/lion_airdop_screen_sharing.html

[37] Macworld touts Airdrop as making file-sharing simple: https://www.macworld.com/article/213814/how-airdrop-makes-file-sharing-simple.html

[38] Apple iOS 7 Review: A Major Makeover That Delivers, But Takes Some Getting Used To: https://techcrunch.com/2013/09/17/ios-7-review-apple/

[39] Apple Insider article "AirDrop simplifies speedy local file transfer": https://appleinsider.com/articles/13/09/18/ios-7-feature-focus-airdrop-simplifies-speedy-local-file-transfer

122. AirDrop was successful enough to be praised as "robust and reliable, almost a second nature for sharing content among Apple device users." Commentators recognized that competitors were "experimenting with something similar for decades," and that "competition has proven to improve the market for everyone involved." [40]

9.2.1. Google

123. Google decided to purchase Bump in September of 2013, [41] very shortly after Apple released AirDrop on iOS 7. An article from the Guardian speculated that Google's "decision to buy Bump seems to have been partly driven by the impending release of Apple's iOS 7 . . . [which] introduces a technology called AirDrop." [42] Still, Bump would struggle to compete with AirDrop, with commentators noting that "AirDrop on iOS 7 could make Bump unnecessary on its own platform," [43] and "Bump must feel bumped by AirDrop." [44] Bump would eventually fall short, as it "failed to monetize successfully as other easy, mobile-friendly ways to share information were developed, most notably Apple's AirDrop for iOS 7," and Bump was shut down not long after in December of 2013. [45]

124. In late 2017, Google began "working on a new app called Files Go that'll work as a way to manage, clean up, and share files" with "a feature that works a lot like Apple's AirDrop, letting you easily send files to nearby Android phones over Bluetooth." [46] Despite incorporating a similar feature, reviewers said Google's "file-transfer feature doesn't appear to work quite as smoothly as AirDrop" due to limitations of Files Go: "Both people need to have the Files Go app open, whereas AirDrop lets you send files from any app to any nearby contact, even if they don't

[40] Ex-2030, 1.
[41] Ex-2031, 1.
[42] Ex-2032, 1.
[43] Ex-2032, 1.
[44] Ex-2033, 2.
[45] Ex-2028, 1.
[46] Ex-2035, 1

have the same app. Still, it'd be a nice addition to Android if Google began shipping this as a stock app. Right now, the best way to send a file to a nearby phone is by using Android Beam, which requires tapping the two phones together to make an NFC connection. It works, but it's an odd interaction that a lot of people don't seem to know about." [47] Android Beam would then also be deprecated in December of 2018, illustrating its failure to meet the industry need that AirDrop had solved. [48] Ultimately, these NFC-based methods were limited both by the awkward "bumping" required as well as the nuances of the Android ecosystem, since "the interface between smartphones from different manufacturers does not lend itself to a common experience." [49]

125. In 2019, Google began developing another file sharing service, "which looks like . . . a competitor to Apple's AirDrop." [50] In "the absence of a true Airdrop competitor on Android," Google began "working on its own solution in the form of Fast Share." [51] Accordingly, Fast Share functioned almost identically to AirDrop: "Rather than NFC, the service uses Bluetooth to initiate a handshake and then subsequently transfers files over a direct Wi-Fi connection," which enabled Fast Share to "allow for larger files to be transferred much more quickly than Android Beam. Fast Share even allows you to give your device 'Preferred Visibility' to nearby devices, which lets those devices 'always see your device when you're nearby, even if you're not using Fast Share.'" [52]

126. Google and Samsung partnered to develop a file sharing service "similar to Apple's AirDrop." [53] "Google's new AirDrop clone [Nearby Share]," Window's AirDrop clone Nearby Sharing, and Samsung's AirDrop clone Quick Share continued to be refined to achieve what

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[47] Ex-2035, 1
[48] Ex-2029, 1.
[49] Ex 2023, 4.
[50] Ex-2037, 1.
[51] Ex-2038, 1
[52] Ex-2038, 1
[53] Google releases Nearby Share, its Android AirDrop clone for Windows: https://www.pcworld.com/article/2000589/google-releases-its-android-airdrop-windows-nearby-share.html#:~:text=As%20the%20name%20suggests%2C%20Nearby,rather%20than%20iPhones%20and%20Macs

AirDrop had already accomplished: "[i]t's easy to send files to and from Apple devices, thanks to AirDrop."[54] Still, a comparison by Digital Trends asserted that the competitors' alternatives "just can't compete with Airdrop."[55]

> AirDrop has long been the easiest way for Apple users to share files, photos, and other data between their own devices, and with friends and family. Along with other features like iMessage, AirDrop has been hailed as one of the biggest advantages of sticking within the Apple ecosystem.
>
> But others are at least trying to catch up. After years of Apple standing alone, Google *finally* launched what looked to be an answer to AirDrop, in the form of Android Nearby Share. The name isn't as catchy, but the idea is the same: You can use it to share files and photos with your own nearby devices, or those of your friends and family.
> Recommended Videos
>
> Turns out, however, Google *still* has some catching up to do — and there may be nothing it can do about it.

127. Later on January 9, 2024, another attempt was made by Google and Samsung to streamline their file sharing service: "Google announced … at CES that it has collaborated with Samsung to combine their sharing solutions into a singular cross-Android solution under the Quick Share name."[56] "Apple's AirDrop feature has been popular for a long time due to its ease of sharing contacts, images, files, etc," and this created an unresolved need to "bring a similar feature" to competitive mobile devices which would make "transferring files easy from one Android device to another."[57]

9.2.2. Microsoft

128. Microsoft's first attempt at developing a competitive file sharing service was based around the "My Phone app on Windows, allowing users to mirror their Android phones and

[54] Ex-2045, 1.
[55] Ex 2034, 1.
[56] Ex-2046, 1.
[57] Ex-2047, 1

transfer files wirelessly… The implementation, however, was far from the magical experience that Apple's AirDrop has provided for Mac-iPhone users."[58].

Microsoft then developed its own competitive file sharing service in late 2017 called "Near Share," where "[l]ike AirDrop, Near Share [] let Windows 10 PCs share documents or photos to PCs nearby via Bluetooth."[59] This service adopted a similar model to AirDrop, allowing users of Windows 10 or Windows 11 operating systems to share documents, photos, links to websites, and more with nearby devices by using Bluetooth or Wi-Fi."[60] This was considered their "Windows 10 take on Apple's AirDrop"[61] which resorted to the AirDrop model to meet the unresolved need created by Apple's AirDrop, which was developed years after AirDrop entered the market.

9.2.3. Samsung

129. As discussed in previous sections, Samsung had an NFC-based tap-to-share feature for file sharing that struggled to satisfy users as it functioned similarly to Bump, requiring the awkward "tapping" of phones against each other. As we discussed: "[t]o be honest, nobody taps two smartphones together anymore."[62] When AirDrop was released, a commentator comparing the feature to Samsung's solution highlighted that they won't even have to bump phones to make it work."[63]

130. Samsung later began working on their own "AirDrop-like file sharing service for Galaxy smartphones," called "Quick Share" in 2020.[64] Quick Share adopted the AirDrop model to "fill a gap [for easily sharing files between Samsung devices] in Samsung's lineup that the

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[58] AirDrop Vs Nearby Share Vs Quick Share: Which Is The Best File Transferring Service For Devices?: https://www.augustman.com/in/gear/tech/airdrop-vs-nearby-share/
[59] Ex-2036, 1.
[60] Ex-2049, 1.
[61] Ex-2053, 1.
[62] Ex-2029, 1.
[63] Apple iOS 7 review: Massive makeover makes iOS feel new again: https://www.cnet.com/reviews/apple-ios-7-review/
[64] Ex-2041, 1.

iPhone has offered for years."[65] Samsung, too, had to resort to the AirDrop model to remain competitive in the industry.

9.3. Competitors Efforts Have Failed Until Resorting to the AirDrop Template

131. As discussed in previous sections, the alternatives to AirDrop for competitive mobile devices before adopting the AirDrop model were insufficient, as described by a comparison of AirDrop against competitive services Nearby Share and Quick Share: "For years, Android phone users had to resort to archaic ways of sharing files and media with other Android and Microsoft Windows devices. Using data transfer cables was the only option to do so and it was only in recent years that Microsoft even made any attempts to bridge the gap with its My Phone app on Windows… The implementation, however, was far from the magical experience that Apple's AirDrop has provided for Mac-iPhone users."[66]. As another example, Google tried filling the niche with Bump but it "failed to monetize successfully as other easy, mobile-friendly ways to share information were developed, most notably Apple's AirDrop for iOS 7."[67] Android Beam also failed, eventually being deprecated in December 2018.[68] It wasn't until these competitors gave in to the AirDrop model that their sharing features were able to gain traction, largely due to the inclusion of features users appreciated about AirDrop.

9.3.1. All competitive products use Bluetooth detection of nearby device

132. One of the biggest advantages of AirDrop was the ability to avoid "tapping" your devices together to make a connection by virtue of using Bluetooth for discovery. The successful AirDrop clones used Bluetooth for discovery at close range, even if Wi-Fi would eventually be

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[65] Ex-2042, 2.
[66] AirDrop Vs Nearby Share Vs Quick Share: Which Is The Best File Transferring Service For Devices?: https://www.augustman.com/in/gear/tech/airdrop-vs-nearby-share/
[67] Ex-2028, 1.
[68] Ex-2029, 1.

used for the file transfer. Google's Fast Share utilized Bluetooth for discovery: "Rather than NFC, the service uses Bluetooth to initiate a handshake and then subsequently transfers files over a direct Wi-Fi connection."[69]

133. The predecessor of Fast Share, Nearby Share first adopted this model, utilizing both Bluetooth and Wi-Fi: "the actual tech behind Android Nearby Share is a little different from AirDrop, but the concept is the same."[70]

> The actual tech behind Android Nearby Share is a little different from AirDrop, but the concept is the same. It uses Bluetooth, Wi-Fi, or NFC to transfer files between devices, and it determines which method is best on the fly. AirDrop, on the other hand, sticks to using Wi-Fi and Bluetooth, establishing a connection with the other device through Bluetooth, and then sharing files over a walled-off and private Wi-Fi network.
>
> *Image used with permission by copyright holder*
>
> To use both systems, you need to have Wi-Fi and Bluetooth enabled, but don't need an active data connection. Assuming all the settings are turned on, which they are by default, they both work pretty easily.
>
> With both AirDrop and Nearby Share, once you hit the share button on a file or photo, potential targets should pop right up. Tap on their profile image, and off flies the file, hopefully without interruption. Transfer times are low, and ease-of-use is high.

134. Similarly, Nearby Share in Windows required Bluetooth 4.0 support, as when "Nearby Sharing, Bluetooth is turned on."[71]

[69] Ex-2038, 1.
[70] Ex-2034, 1.
[71] Ex 2050, 1-2.

I don't see the device I'm looking for

Make sure both PCs—the PC you're sharing from and the one you're sharing to—support nearby sharing. Nearby sharing requires the following:

- Windows 11. Check your version of Windows
- Bluetooth 4.0 (or later) with Low Energy (LE) support. To find out if Bluetooth LE is supported, on each PC, select the **Start** button, type **device manager** and select **Device Manager** from the list of results, expand **Bluetooth**, and then select the name of your Bluetooth radio adapter. Right-click it, select **Properties**, select **Details**, and then select **Bluetooth radio supports Low Energy Central Role** under Property. Make sure the value is listed as True.

Make sure that both devices are set up for nearby sharing. On each device, select the **Start** button > **Settings** > **System** > **Nearby sharing**. Under **Nearby sharing** at the top, make sure **Everyone nearby** is selected.

The files are sent slowly

This likely means that the files are being sent over Bluetooth, not Wi-Fi. Files are sent much faster if you connect to Wi-fi and make sure that:

- Both devices are connected to the same Wi-Fi network.
- The network connection profile is set to **Private** on both devices. To check the network connection profile, select the **Start** button > **Settings** > **Network & internet**. Select **Properties** at the top for the Wi-Fi network you are connected to, and ensure **Network profile type** is set to **Private**.

Notes:

- To use nearby sharing, you don't need to pair both PCs over Bluetooth first. Both PCs just need to have nearby sharing turned on. (When nearby sharing is turned on, Bluetooth is turned on.)
- In general, it takes more time for files to be transferred over Bluetooth compared to Wi-Fi. When sharing files over Bluetooth using nearby sharing, make sure large amounts of data aren't already being sent over Bluetooth, such as streaming audio over a Bluetooth speaker.

135. Like AirDrop and Nearby Share, Samsung's Quick Share functioned similarly, allowing users to "share everything with your friends instantly."[72] Eventually the two major players combined their efforts: "Google… has collaborated with Samsung to combine their sharing solutions into a singular cross-Android solution under the Quick Share name."[73] Seeing Google's success with Nearby Share, "Samsung… banked on the Google partnership and merged [Nearby Share] with what they name 'Quick Share.'"[74]

9.3.2. All competitive products allow a user to accept/reject data transfer

136. As shown in previous sections, the AirDrop clones from competitors worked to include the quintessential features of AirDrop, such as the ability to accept or reject a data transfer. Apple had long touted its robust security with AirDrop, forcing competitors to follow suit. This was present in Nearby Share,[75]

> To initiate file sharing, you'll simply opt to right-click and share the file. Under *Looking for nearby devices*, simply select the device to share with. You'll receive a notification if someone wishes to share a file with you, which you'll have to accept. You also may be asked to turn on file sharing. If you wish to accept the file, you can click *Accept*; otherwise, you can turn down the request.

137. Device visibility was also important to give users the sense that they could still control their privacy. The ability to control visibility based on contacts, friends, or complete privacy was present in the successful AirDrop clones. For example, Nearby Share included this

[72] Ex-2044, 2.
[73] Ex-2046, 1.
[74] Ex 2030, 1.
[75] Google releases Nearby Share, its Android AirDrop clone for Windows: https://www.pcworld.com/article/2000589/google-releases-its-android-airdrop-windows-nearby-share.html#:~:text=As%20the%20name%20suggests%2C%20Nearby,rather%20than%20iPhones%20and%20Macs

feature, and Google recommended that users take advantage of their Device Visibility preferences. 76

> After downloading and installing the app, Googe recommends that you sign in to your Google account and check your Device Visibility preferences. You'll be able to limit Nearby Sharing to friends, contacts, anyone, or just turn it off entirely.

138. Like AirDrop and Nearby Share, Fast share was also praised for this feature: "Fast Share even allows you to give your device 'Preferred Visibility' to nearby devices, which lets those devices 'always see your device when you're nearby, even if you're not using Fast Share."[77]

139. Samsung's Quick Share functioned similarly, allowing users to "share everything with your friends instantly."[78] Eventually the two major players combined their efforts: "Google… has collaborated with Samsung to combine their sharing solutions into a singular cross-Android solution under the Quick Share name."[79] Seeing Google's success with Nearby Share, "Samsung… banked on the Google partnership and merged [Nearby Share] with what they name 'Quick Share.'"[80]

9.3.3. All competitive products include Wi-Fi data transfer

140. The last piece of the puzzle for ideal file sharing was speedy file transfer. Naturally, Wi-Fi would allow for a much higher transfer rate than Bluetooth, and the AirDrop clones took advantage of this to improve transfer times. Google's Fast Share adopted an identical model to AirDrop: "Rather than NFC, the service uses Bluetooth to initiate a handshake and then

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[76] Google releases Nearby Share, its Android AirDrop clone for Windows: https://www.pcworld.com/article/2000589/google-releases-its-android-airdrop-windows-nearby-share.html#:~:text=As%20the%20name%20suggests%2C%20Nearby,rather%20than%20iPhones%20and%20Macs
[77] Ex-2038, 1.
[78] Ex-2044, 2.
[79] Ex-2046, 1.
[80] Ex 2030, 1.

subsequently transfers files over a direct Wi-Fi connection."[81] ("This will allow for larger files to be transferred much more quickly than Android Beam. Fast Share even allows you to give your device 'Preferred Visibility' to nearby devices, which lets those devices 'always see your device when you're nearby, even if you're not using Fast Share.'").

141. The predecessor of Fast Share, Nearby Share first adopted this model, utilizing both Bluetooth and Wi-Fi: "the actual tech behind Android Nearby Share is a little different from AirDrop, but the concept is the same."[82]

> The actual tech behind Android Nearby Share is a little different from AirDrop, but the concept is the same. It uses Bluetooth, Wi-Fi, or NFC to transfer files between devices, and it determines which method is best on the fly. AirDrop, on the other hand, sticks to using Wi-Fi and Bluetooth, establishing a connection with the other device through Bluetooth, and then sharing files over a walled-off and private Wi-Fi network.
>
> *Image used with permission by copyright holder*
>
> To use both systems, you need to have Wi-Fi and Bluetooth enabled, but don't need an active data connection. Assuming all the settings are turned on, which they are by default, they both work pretty easily.
>
> With both AirDrop and Nearby Share, once you hit the share button on a file or photo, potential targets should pop right up. Tap on their profile image, and off flies the file, hopefully without interruption. Transfer times are low, and ease-of-use is high.

142. Similarly, Nearby Share in Windows included Wi-Fi capability for file transfer, even going so far as to direct users to enable Wi-Fi to improve transfer times when encountering slow file transfers.[83]

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[81] Ex-2038, 1.
[82] Ex-2034, 1.
[83] Ex 2050, 1-2.

The files are sent slowly

This likely means that the files are being sent over Bluetooth, not Wi-Fi. Files are sent much faster if you connect to Wi-fi and make sure that:

- Both devices are connected to the same Wi-Fi network.
- The network connection profile is set to **Private** on both devices. To check the network connection profile, select the **Start** button > **Settings** > **Network & internet**. Select **Properties** at the top for the Wi-Fi network you are connected to, and ensure **Network profile type** is set to **Private**.

Notes:

- To use nearby sharing, you don't need to pair both PCs over Bluetooth first. Both PCs just need to have nearby sharing turned on. (When nearby sharing is turned on, Bluetooth is turned on.)
- In general, it takes more time for files to be transferred over Bluetooth compared to Wi-Fi. When sharing files over Bluetooth using nearby sharing, make sure large amounts of data aren't already being sent over Bluetooth, such as streaming audio over a Bluetooth speaker.

143. Like AirDrop and Nearby Share, Samsung's Quick Share functioned similarly, allowing users to "share everything with your friends instantly."[84] Eventually the two major players combined their efforts: "Google… has collaborated with Samsung to combine their sharing solutions into a singular cross-Android solution under the Quick Share name."[85] Seeing Google's success with Nearby Share, "Samsung… banked on the Google partnership and merged [Nearby Share] with what they name 'Quick Share.'"[86]

[84] Ex-2044, 2.
[85] Ex-2046, 1.
[86] Ex 2030, 1.

10. CONCLUSION

144. In conclusion, it is my opinion that the prior art that petitions IPR2024-00305 and IPR2024-00306 cite do not render the claims of the InterDigital Patents obvious due to the included secondary evidence of commercial success, industry praise, and a long-felt but unsatisfied need.

145. I hereby declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct, and that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true. I understand that willful false statements are punishable by fine or imprisonment or both. See 18 U.S.C. Section 1001.

Dated: March 28th, 2024

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M.S. in Computer Science
University of Southern California | May 2006

B.S. in Computer Science, Minor in Mathematics
Vanderbilt University | Aug 2003

Employment

President & Principal Computer Scientist

Quandary Peak Research | Los Angeles, CA | June 2012–Present

- Providing software analysis and expert witness testimony in software-related litigation, including patent and copyright infringement, theft of trade secrets, breach-of-contract, and other matters.
- Analyzing software intellectual property and patent portfolios for validity and infringement in the context of licensing and brokering negotiations, startup investments, and M&A.
- Investigating software failures to determine the root cause and help clients understand whether and how the failure could have been avoided.
- Applying advanced analytic techniques based on calibrated parametric models for valuation of software products and estimation of software development costs.
- Documenting the architecture of software systems to identify structural similarities and differences among competing products and services and deduce the origin of software designs and code.

Lecturer of Computer Science

Computer Science Department, University of Southern California | Jan 2012–May 2017

- Teaching a graduate-level software engineering course for M.S. and Ph.D. students and practicing software and aerospace engineers (CSCI 568).
- Previously taught an undergraduate-level course on programming fundamentals, algorithms, and data structures (CSCI 102).

Co-Founder and CEO

Blue Cell Software | Los Angeles, CA | Aug 2010–June 2012

- Led and managed the development of a next-generation modeling and analysis platform for complex software-intensive systems.

- Developed advanced model-based algorithms for reliability, efficiency, and risk analysis.
- Conceived and implemented the business development strategy and produced and presented investment proposals.

Post-Doctoral Researcher

Center for Systems and Software Engineering, University of Southern California | Feb 2011–Sept 2011

- Conducted research on enterprise integration mechanisms to support net-centric operations.
- Investigated methods, processes, and tools for decomposition and refinement of SoS capability needs into detailed requirements and integration architectures for an NSA-funded research project.
- Designed key components of PATFrame, a decision support system for planning test events of networks of unmanned and autonomous vehicles.
- Applied lessons learned from large-scale corporate mergers, including the HP-Compaq merger, to software and systems integration challenges faced by the DoD and NSA.

Graduate Fellow

Computer Science Department, University of Southern California | Aug 2004–Aug 2010

- Designed and implemented XTEAM — a model-driven software design, analysis, and code generation toolset. XTEAM allows software architects to create domain-specific software architecture models, evaluate those models with respect to quality metrics, and automatically synthesize custom code. XTEAM has been utilized by more than a dozen software engineering projects in academia and industry.
- Built key components of Prism-MW, a novel Java-based implementation platform for mobile and handheld devices that enables rapid development of event-based applications.
- Invented the adaptive layered style, an architectural style for autonomous systems, and designed the corresponding implementation support in Prism-MW.
- Developed iterative redundancy, an algorithm for reliably distributing and replicating computation on untrusted networks of faulty and malicious nodes.
- Contributed as an architect and developer to a diverse set of experimental software systems, such as computer simulations of volunteer computing networks and collaboration tools for geographically distributed teams of engineers.

Research Associate

Intelligent Systems Technology, Inc. | Los Angeles, CA | May 2009–Jan 2010

- Designed and implemented an instructional game for US Army vehicle maintenance technicians that teaches techniques for making decisions in the presence of uncertainty.
- Developed research grant proposals for DoD and DHS funding through the Small Business Innovation Research (SBIR) program and Broad Agency Announcements (BAAs).
- Briefed managers of research funding programs at DoD and DHS on critical research challenges and opportunities in computer science and software engineering.

Graduate Research Intern

T.J. Watson Research Center, IBM | Yorktown Heights, NY | May 2008–Aug 2008

- Developed elements of BlueStar, a scalable mobile device management and provisioning system. BlueStar allows system administrators to easily manage the configuration of thousands of mobile devices.

- Co-designed Proxima, a context-aware search service for mobile devices. Proxima provides image based search capabilities for finding people in a large database by leveraging contextual information associated with an image, such as location, time, and the unique characteristics of the user.
- Developed requirements for a mobile application for insurance adjusters and managed a team of overseas programmers.

Software Engineer

The Boeing Company | Huntington Beach, CA | June 2005–Aug 2006

- Advised, coordinated, and assisted C4ISR software architecture modeling and analysis efforts leveraging state-of-the-art model-driven engineering technologies.
- Developed the architecture for a mobile (handheld) device for controlling unmanned autonomous air and ground robots.
- Integrated multiple independent simulations of interactions among military vehicles and networks to create test harnesses for subcontractor-supplied software components.
- Created and evaluated software architecture descriptions, guidance memoranda, requirements specifications, design models, trade studies, risk analyses, and development schedules.

Graduate Research Assistant

Computer Science Department, Vanderbilt University | Nashville, TN | Sept 2003–May 2004

- Developed a CORBA Component Model framework that supports application access to highly optimized and scalable event-based (publish-subscribe) communication services.
- Created a specification language and supporting toolset for configuring QoS policies in component based DRE systems.
- Designed regression tests and enhanced support for key capabilities in a real-time CORBA implementation.

Network Technician

CTC Networks | Nashville, TN | Oct 2002–Mar 2003

- Administered Windows-based small business networks and performed network and PC upgrades, troubleshooting, and repair.
- Advised business clients on software purchasing and technology infrastructure investment decisions.

e-Business Consultant

Nebraska e-Commerce Association | Lincoln, NE | May 2001–Aug 2001

- Advised small businesses on e-commerce development and implementation strategies.

Web Developer

Nebraska Educational Telecommunications | Lincoln, NE | May 1998–Aug 2000

- Developed front-end HTML and JavaScript and secure grade assessment software for CLASS, the first web-delivered, fully accredited high school.
- Implemented a multimedia publishing system for web-based distribution of television programs.

Litigation Consulting

- ***Inter Partes* Review of U.S. Patent No. 8,737,933 and Patent No. 9,173,054** | Mar 2024–Present
  Jurisdiction: U.S. Patent and Trademark Office (USPTO)
  Case Number: IPR2024-00305
  Counsel: McKool Smith, Alston & Bird LLP
  Nature of Suit: Patent
- **InQuisient Inc v. ServiceNow, Inc** | Mar 2024–Present
  Jurisdiction: US District Court for the District of Delaware
  Case Number: 1:22-cv-00900
  Counsel: Fish & Richardson P.C.
  Nature of Suit: Patent
- **Electronic Devices Including Smartphones, Computers, Tablet Computers, and Components Thereof**
  Dec 2023–Present
  Jurisdiction: International Trade Commission (ITC)
  Case Number: 337-TA-1373
  Counsel: Alston & Bird LLP
  Nature of Suit: Patent
- **Security First Innovations, LLC vs Google LLC** | Dec 2023–Present
  Jurisdiction: US District Court Eastern District of Virginia Alexandria Division
  Case Number: 2-23-cv-00097-EWH-RJK
  Counsel: Sullivan & Cromwell LLP
  Nature of Suit: Patent
- **Smart Mobile Technologies, LLC v. Samsung Electronics Co. Ltd.** | Oct 2023–Present
  Jurisdiction: Western District of Texas
  Case Number: 6:21-cv-00701
  Counsel: Graves & Shaw LLP
  Nature of Suit: Patent
- **AGI Suretrack, LLC v. Farmers Edge Inc** | Sept 2023–Present
  Jurisdiction: U.S. District Court for the District of Nebraska
  Case Number: 8:22-cv-00275-JFB-SMB
  Counsel: Irell & Manella LLP
  Nature of Suit: Patent
- **Club Speed, LLC v. K1 Speed, Inc.** | July 2023–Present
  Jurisdiction: Superior Court of California
  Case Number: 30-2022-01241507-CU-BC-CJC
  Counsel: Rutan & Tucker, LLP
  Nature of Suit: Breach of Contract
- **University of Victoria v. FreshWorks Studio Inc** | July 2023–Present
  Jurisdiction: BC Supreme Court
  Case Number: S-226081
  Counsel: Smart & Biggar LLP
  Nature of Suit: Patent

- **Entangled Media, LLC v. Dropbox, Inc.** | May 2023–Present
  Jurisdiction: Western District of Texas
  Case Number: 1:22-cv-01324
  Counsel: Skiermont Derby
  Nature of Suit: Patent
- **Multimodal Media LLC v. ZTE Corporation** | Mar 2023–Oct 2023
  Jurisdiction: U.S. District Court for the Eastern District of Texas
  Case Number: 2:21-cv-00437
  Counsel: McDermott Will & Emery
  Nature of Suit: Patent
- **Cutting Edge Vision, LLC v. TCL Technology Group Corporation, et al.** | Mar 2023–Aug 2023
  Jurisdiction: U.S. District Court for the Western District of Texas
  Case Number: 6:22-cv-00285
  Counsel: Law Offices of Lisa and Lesko
  Nature of Suit: Patent
- **Espíritu Santo Holdings, LP & L1bre Holding, LLC v. United Mexican States** | Dec 2022–Present
  Jurisdiction: ICSID
  Case Number: ARB/20/13 - 20417 (filed September 17, 2021)
  Counsel: Pillsbury Winthrop Shaw Pittman LLP
  Nature of Suit: International Investment Arbitration
  Technology: Mobile phone applications, ride hailing services
- **LQK Corporation v. Overall Parts Solutions** | Nov 2022–Present
  Jurisdiction: Court of Chancery of the State of Delaware
  Case Number: 2022-0036
  Counsel: Jones Day
  Nature of Suit: Breach of Contract
- **IPA Technologies, Inc. v. Microsoft Corp.** | Oct 2022–Present
  Jurisdiction: U.S. District Court for the District of Delaware
  Case Number: 1:18-cv-00001
  Counsel: Skiermont Derby LLP
  Nature of Suit: Patent
- **Multimodal Media LLC v. Guangdong OPPO Mobile Telecomm. Corp., Ltd.** | Sept 2022–Sept 2023
  Jurisdiction: U.S. District Court for the Eastern District of Texas
  Case Number: 2:21-cv-00436
  Counsel: Moore IP Law
  Nature of Suit: Patent
- **Ark Innovation Technology Inc., et al. v. Matidor Technologies Inc. et al.** | May 2022–Present
  Jurisdiction: Federal Court of Canada
  Case Number: 1163929
  Counsel: Gowling WLG
  Nature of Suit: Copyright
- **Farmobile, LLC v. Farmers Edge, Inc.** | May 2022–Sept 2023
  Jurisdiction: U.S. District Court for the District of Nebraska
  Case Number: 8:22-cv-00275
  Counsel: Irell & Manella LLP
  Nature of Suit: Patent

- **Artec Europe S.a.r.l. v. Schenzen Creality 3D Technology Co., Ltd., et al.** | Apr 2022– Present
  Jurisdiction: U.S. District Court for the Eastern District of New York
  Case Number: 1:22-cv-01676
  Counsel: Munck Wilson Mandala LLP
  Nature of Suit: Patent
- **Autoscan GmbH et al v. 5121175 Manitoba LTD d/b/a DCC Hail** | Nov 2020–Sept 2021
  Jurisdiction: Federal Court of Canada
  Case Number: T-359-20
  Counsel: Gowling WLG
  Nature of Suit: Copyright
- **Intellicad Technology Consortium v. Suzhou Gstarsoft Co. Ltd.** | July 2020–Oct 2020
  Jurisdiction: U.S. District Court for the District of Oregon
  Case Number: 3:19-cv-01963
  Counsel: Perkins Coie LLP
  Nature of Suit: Copyright
- **Denika Terry, et al. v. Wasatch Advantage Group, LLC et al.** | June 2020–July 2020
  Jurisdiction: Superior Court of California, County of Los Angeles
  Case Number: 34-2014-00158417
  Counsel: Goldstein, Borgen, Dardarian & Ho
  Nature of Suit: Class Action
- **American National Manufacturing, Inc. v. Sleep Number Corporation** | Sept 2019–July 2020
  Jurisdiction: United States Patent and Trademark Office
  Case Number: IPR2019-00497, IPR2019-00500, IPR2019-00514
  Counsel: Fox Rothschild LLP
  Nature of Suit: Patent
- **Bookman v. Resorts World Casino New York City, Genting New York LL and International Game Technology PLC** | Sept 2019–Oct 2019
  Jurisdiction: Supreme Court of the State of New York, Queens County
  Case Number: 0713839/2017
  Counsel: Proskauer Rose LLP
  Nature of Suit: Negligence and Breach of Contract
- **IPA Technologies, Inc. v. Google LLC** | May 2019–Present
  Jurisdiction: U.S. District Court for the District of Delaware
  Case Number: 18-cv-00318
  Counsel: Skiermont Derby LLP
  Nature of Suit: Patent
- **IPA Technologies, Inc. v. Amazon.com, Inc. et al.** | May 2019–Apr 2022
  Jurisdiction: U.S. District Court for the District of Delaware
  Case Number: 18-cv-00318
  Counsel: Skiermont Derby LLP
  Nature of Suit: Patent
- **Sequoia Technology LLC v. Dell, Inc., Dell Technologies Inc., Hewlett Packard Enterprise Co., Hitachi Ltd, and Super Micro Computer** | Oct 2018–Jan 2023
  Jurisdiction: U.S. District Court for the District of Delaware
  Case Number: 1:18-cv-01127
  Counsel: One LLP
  Nature of Suit: Patent

- **Lithography Machines and Systems, and Components Thereof** | Sept 2018–Apr 2019
  Jurisdiction: U.S. International Trade Commission
  Case Number: 337-TA-1128, 337-TA-1129
  Counsel: Morrison & Foerster LLP (Nikon Corporation)
  Nature of Suit: Patent
- **Sleep Number Corporation v. Sizewise Rentals, LLC and American National Manufacturing, Inc.** | Aug 2018–Dec 2020
  Jurisdiction: U.S. District Court for the Central District of California
  Case Number: 5:18-cv-00356
  Counsel: Fox Rothschild LLP
  Nature of Suit: Patent
- **Capstone Logistics Holdings, Inc., et al. v. Humano, LLC, et al.** | June 2018–Jan 2019
  Jurisdiction: U.S. District Court for the Southern District of New York
  Case Number: 1:17-cv-04819
  Counsel: Ferber Law
  Nature of Suit: Copyright and Trade Secret
- **Arlynn Whittaker v. Glaser Weil Fink Howard Avchen & Shapiro, LLP** | Mar 2018–Oct 2018
  Jurisdiction: Superior Court of California, County of Los Angeles
  Case Number: BC657065, BC664506
  Counsel: Baker Marquart
  Nature of Suit: Professional Negligence
- **CyWee Group Ltd. v. ZTE Corporation, ZTE (USA), Inc., and ZTE (TX), Inc.** | Feb 2018–Jan 2019
  Jurisdiction: U.S. District Court for the Southern District of California
  Case Number: 3:17-cv-02130
  Counsel: Pillsbury Winthrop Shaw Pittman LLP
  Nature of Suit: Patent
- **SEVEN Networks, LLC v. ZTE (USA) Inc. and ZTE Corporation** | Jan 2018–Aug 2019
  Jurisdiction: U.S. District Court for the Northern District of Texas
  Case Number: 3:17-cv-01495
  Counsel: Pillsbury Winthrop Shaw Pittman LLP
  Nature of Suit: Patent
- **Farmobile, LLC v. Farmers Edge Inc.** | Nov 2017–Present
  Jurisdiction: Federal Court of Canada
  Case Number: FC 915, FC 688, FC 915, FC 1269
  Counsel: Gowling WLG
  Nature of Suit: Patent
- **Space Data Corporation v. Alphabet Inc., Google LLC, and Loon, LLC** | July 2017–Sept 2019
  Jurisdiction: U.S. District Court for the Northern District of California
  Case Number: 5:16-cv-03260
  Counsel: Hosie Rice LLP
  Nature of Suit: Patent and Trade Secret
- **Hitachi Maxell, Ltd. v. ZTE Corp. and ZTE USA Inc.** | July 2017–June 2018
  Jurisdiction: U.S. District Court for the Eastern District of Texas
  Case Number: 16-cv-00179
  Counsel: Pillsbury Winthrop Shaw Pittman LLP
  Nature of Suit: Patent

- **Semcon IP Inc. v. ZTE Corporation, et al.** | May 2017–Mar 2018
  Jurisdiction: U.S. District Court for the Eastern District of Texas
  Case Number: 16-cv-00437
  Counsel: Pillsbury Winthrop Shaw Pittman LLP
  Nature of Suit: Patent
- **Vesta Corporation v. Amdocs Management Limited and Amdocs, Inc.** | Mar 2017–Nov 2018
  Jurisdiction: U.S. District Court for the District of Oregon
  Case Number: 3:14-cv-01142
  Counsel: Perkins Coie LLP
  Nature of Suit: Trade Secret
- **eBay, Inc. v. Masterobjects, Inc.** | Mar 2017–July 2018
  Jurisdiction: United States Patent and Trademark Office
  Case Number: IPR2017-00740
  Counsel: Carr & Ferrell LLP
  Nature of Suit: Patent
- **Implicit, LLC v. Trend Micro, Inc.** | Jan 2017–Oct 2017
  Jurisdiction: U.S. District Court for the Eastern District of Texas
  Case Number: 6:16-cv-00080, 6:17-cv-00183
  Counsel: DiNovo Price Ellwanger LLP
  Nature of Suit: Patent
- **Implicit, LLC v. Ericsson, Inc.** | Jan 2017–Mar 2017
  Jurisdiction: U.S. District Court for the Eastern District of Texas
  Case Number: 6:16-cv-00075, 6:17-cv-00181
  Counsel: DiNovo Price Ellwanger LLP
  Nature of Suit: Patent
- **Sound View Innovations, LLC v. Facebook, Inc.** | Aug 2016–Jan 2018
  Jurisdiction: U.S. District Court for the District of Delaware
  Case Number: 1:16-cv-00116
  Counsel: Desmarais LLP
  Nature of Suit: Patent
- **Farmers Edge, Inc., et al. v. Farmobile LLC, et al.** | July 2016–May 2018
  Jurisdiction: U.S. District Court for the District of Nebraska
  Case Number: 8:17-cv-00225
  Counsel: Husch Blackwell LLP
  Nature of Suit: Trade Secret and Breach of Contract
- **Certain Air Mattress Systems, Components Thereof, and Methods of Using the Same** | Apr 2016–May 2016
  Jurisdiction: U.S. International Trade Commission
  Case Number: 337-TA-971
  Counsel: Pillsbury Winthrop Shaw Pittman LLP (Sleep Number Corporation)
  Nature of Suit: Patent
- **Synca Direct Inc. v. Scil Animal Care Company and Vet Novations, Inc.** | Mar 2016–Dec 2016
  Jurisdiction: U.S. District Court for the Northern District of New York
  Case Number: 8:15-cv-00794
  Counsel: White and Williams LLP
  Nature of Suit: Breach of Contract

- **TiVo, Inc. v. Samsung Electronics Co., Ltd., et al.** | Mar 2016– Nov 2016
  Jurisdiction: U.S. District Court for the Eastern District of Texas
  Case Number: 2:15-cv-01503
  Counsel: Irell & Manella LLP
  Nature of Suit: Patent
- **Backflip Software, Inc. v. Cisco Systems, Inc.** | Feb 2016–Oct 2016
  Jurisdiction: Superior Court of California, County of Santa Clara
  Case Number: 2013-1-cv-242234
  Counsel: Hosie Rice LLP
  Nature of Suit: Breach of Contract
- **Cellular Communications Equipment, LLC v. HTC Corporation and ZTE Corp.** | Dec 2015–Aug 2018
  Jurisdiction: U.S. District Court for the Eastern District of Texas
  Case Number: 2:15-cv-00576
  Counsel: Pillsbury Winthrop Shaw Pittman LLP
  Nature of Suit: Patent
- **Ericsson Inc., et al. v. TCL Communication Technology Holdings, Ltd., et al.** | Sept 2015–Dec 2015
  Jurisdiction: U.S. District Court for the Eastern District of Texas
  Case Number: 2:15-cv-00011
  Counsel: Sheppard Mullin Richter & Hampton LLP
  Nature of Suit: Patent
- **Chipp'd Ltd. v. Crush & Lovely LLC** | July 2015–Sept 2015
  Jurisdiction: American Arbitration Association
  Counsel: White and Williams LLP
  Nature of Suit: Breach of Contract
- **Bryndon Fisher v. The United States of America** | Aug 2015–July 2023
  Jurisdiction: United States Court of Federal Claims
  Case Number: 13-608C
  Counsel: Schubert Jonckheer & Kolbe LLP
  Nature of Suit: Class Action
- **Seymore Levine v. The Boeing Company** | July 2015–Jan 2016
  Jurisdiction: U.S. District Court for the Central District of California
  Case Number: 2:14-cv-06859
  Counsel: Quinn Emanuel Urquhart & Sullivan LLP
  Nature of Suit: Patent
- **Global Cash Access, Inc. v. NRT Technology Corp. et al.** | July 2015–Mar 2016
  Jurisdiction: U.S. District Court for the District of Nevada
  Case Number: 2:15-cv-00822
  Counsel: Pillsbury Winthrop Shaw Pittman LLP
  Nature of Suit: Patent
- **Anthony Johnson v. Storix, Inc.** | June 2015–Dec 2015
  Jurisdiction: U.S. District Court for the Southern District of California
  Case Number: 3:14-cv-01873
  Counsel: Eastman & McCartney LLP
  Nature of Suit: Copyright

- **Custom Media Technologies LLC v. AT&T Services, Inc., et al.** | Apr 2015–June 2015
  Jurisdiction: U.S. District Court for the District of Delaware
  Case Number: 1:13-cv-01419
  Counsel: Freitas Angell & Weinberg LLP
  Nature of Suit: Patent
- **Huricks et al. v. Shopkick, Inc.** | Apr 2015–Aug 2015
  Jurisdiction: U.S. District Court for the Northern District of California
  Case Number: 4:14-cv-02464
  Counsel: Newman DuWors, LLP
  Nature of Suit: Telephone Consumer Protection Act (TCPA)
- **Fox Television Stations, Inc. v. FilmOn X, LLC, et al.** | Mar 2015–July 2015
  Jurisdiction: U.S. District Court for the District of Columbia
  Case Number: 1:13-cv-00758
  Counsel: Baker Marquart LLP
  Nature of Suit: Copyright
- **e-Watch, Inc. et al. v. ZTE Solutions, Inc., ZTE (USA) Inc. and ZTE Corp.** | Mar 2015–Jan 2017
  Jurisdiction: U.S. District Court for the Eastern District of Texas
  Case Number: 2:13-cv-01071
  Counsel: Pillsbury Winthrop Shaw Pittman LLP
  Nature of Suit: Patent
- **Novatel Wireless, Inc., et al. v. ZTE Corp. and ZTE (USA) Inc.** | Jan 2015–July 2015
  Jurisdiction: U.S. District Court for the Southern District of California
  Case Number: 3:12-cv-02576
  Counsel: Pillsbury Winthrop Shaw Pittman LLP
  Nature of Suit: Patent
- **Essociate, Inc. v. Clickbooth.com, LLC** | Oct 2014–Feb 2015
  Jurisdiction: U.S. District Court for the Central District of California
  Case Number: 8:13-cv-01886
  Counsel: Newman DuWors, LLP
  Nature of Suit: Patent
- **Adaptix, Inc. v. ZTE Corporation, ZTE Solutions, Inc., and ZTE (USA) Inc.** | Sept 2014–July 2016
  Jurisdiction: U.S. District Court for the Eastern District of Texas
  Case Number: 6:13-cv-00438
  Counsel: Pillsbury Winthrop Shaw Pittman LLP
  Nature of Suit: Patent
- **VStream Technologies, LLC v. ZTE Corporation and ZTE (USA) Inc., et al.** | Sept 2014–July 2015
  Jurisdiction: U.S. District Court for the Eastern District of Texas
  Case Number: 6:14-cv-00296
  Counsel: Pillsbury Winthrop Shaw Pittman LLP
  Nature of Suit: Patent
- **State of California v. Burlena King** | Aug 2014–Sept 2014
  Jurisdiction: Superior Court of California, County of Los Angeles
  Counsel: Law Offices of the Los Angeles County Public Defender
  Nature of Suit: Criminal

- **Hill-Rom Company, Inc., et al. v. General Electric Company** | July 2014–Sept 2014
  Jurisdiction: U.S. District Court for the Eastern District of Virginia
  Case Number: 2:14-cv-00187
  Counsel: Schiff Hardin LLP
  Nature of Suit: Patent
- **Personal Audio LLC v. ZTE Corporation, et al.** | July 2014–May 2015
  Jurisdiction: U.S. District Court for the Eastern District of Texas
  Case Number: 1:14-cv-00008
  Counsel: Pillsbury Winthrop Shaw Pittman LLP
  Nature of Suit: Patent
- **Yardi Systems, Inc. v. Property Solutions International, Inc.** | May 2014–Sept 2019
  Jurisdiction: U.S. District Court for the Central District of California
  Case Number: 2:13-cv-07764
  Counsel: Morrison & Foerster, LLP
  Nature of Suit: Copyright and Trade Secret
- **AgJunction, LLC v. Agrian, Inc. et al.** | Apr 2014–Feb 2015
  Jurisdiction: U.S. District Court for the District of Kansas
  Case Number: 2:14-cv-02069
  Counsel: Husch Blackwell LLP
  Nature of Suit: Copyright and Trade Secret
- **Davies v. L.A. Checker Cab** | Apr 2014–June 2014
  Jurisdiction: Superior Court of California, County of Los Angeles
  Case Number: SC111290
  Counsel: Cheong, Denove, Rowell & Bennett
  Nature of Suit: Negligence
- ***Inter Partes* Review of U.S. Patent No. 8,466,795** | Feb 2014–July 2014
  Jurisdiction: U.S. Patent and Trademark Office
  Case Number: IPR2014-00670
  Counsel: Pillsbury Winthrop Shaw Pittman LLP (ZTE Corporation)
  Nature of Suit: Patent
- **Certain Wireless Devices, Including Mobile Phones And Tablets II** | Feb 2014–July 2014
  Jurisdiction: U.S. International Trade Commission
  Case Number: 337-TA-905
  Counsel: Pillsbury Winthrop Shaw Pittman LLP (ZTE Corporation)
  Nature of Suit: Patent
- **Pragmatus Mobile, LLC v. ZTE Corporation** | Feb 2014–July 2014
  Jurisdiction: U.S. District Court for the District of Delaware
  Case Number: 1:14-cv-00443
  Counsel: Pillsbury Winthrop Shaw Pittman LLP
  Nature of Suit: Patent

- **Intellectual Ventures, LLC v. AT&T Mobility, LLC, et al.**
  Intellectual Ventures, LLC v. T-Mobile USA, Inc., et al.
  Intellectual Ventures, LLC v. Nextel Operations, Inc., et al.
  Intellectual Ventures, LLC v. United States Cellular Corporation | Oct 2013–May 2015
  Jurisdiction: U.S. District Court for the District of Delaware
  Case Number: 1:12-cv-00193, 1:13-cv-01631, 1:13-cv-01636, 1:13-cv-01637, 1:13-cv-01634, 1:13-cv-01635, 1:13-cv-01632, 1:13-cv-01633
  Counsel: Dechert LLP
  Nature of Suit: Patent
- **Front Row Technologies, LLC v. NBA Media Ventures, LLC, et al.** | Oct 2013–July 2016
  Jurisdiction: U.S. District Court for the District of New Mexico
  Case Number: 1:13-cv-01153
  Counsel: Shore Chan DePumpo LLP
  Nature of Suit: Patent
- **Nokia Corporation and Nokia Inc. v. HTC Corporation and HTC America, Inc.** | Dec 2013–Feb 2014
  Jurisdiction: U.S. District Court for the District of Delaware
  Case Number: 1:12-cv-00549, 1:12-cv-00550, 1:12-cv-00551
  Counsel: Desmarais LLP
  Nature of Suit: Patent
- **Certain Portable Electronic Communications Devices, Including Mobile Phones and Components Thereof** | Aug 2013–Feb 2014
  Jurisdiction: U.S. International Trade Commission
  Case Number: 337-TA-885
  Counsel: Desmarais LLP (Nokia Corp.)
  Nature of Suit: Patent
- **SecurityBase.com v. Jeffrey Essick, et al.** | Aug 2013–June 2015
  Jurisdiction: Superior Court of California, County of Orange
  Case Number: 30-2012-00546106
  Counsel: Younesi & Yoss, LLP
  Nature of Suit: Copyright and Trade Secret
- **Nokia Corp. and Intellisync Corp. v. HTC America, Inc., and Exedea, Inc.** | Feb 2013–May 2013
  Jurisdiction: U.S. District Court for the District of Delaware
  Case Number: 1:12-cv-00549, 1:12-cv-00550
  Counsel: Desmarais LLP
  Nature of Suit: Patent
- **Certain Electronic Devices, Including Mobile Phones and Tablet Computers, and Components Thereof** | Feb 2013–May 2013
  Jurisdiction: U.S. International Trade Commission
  Case Number: 337-TA-847
  Counsel: Desmarais LLP (Nokia Corp.)
  Nature of Suit: Patent
- **Essociate, Inc. v. Azoogle.com, Inc. and Epic Media Group, Inc.** | Nov 2012–Oct 2013
  Jurisdiction: U.S. District Court for the Western District of Wisconsin
  Case Number: 3:11-cv-00727
  Counsel: Newman DuWors, LLP
  Nature of Suit: Patent

- **John Doe v. Passageway School** | Oct 2012–Dec 2012
  Jurisdiction: Superior Court of California, County of Ventura
  Case Number: 2012-00418623
  Counsel: Stone & Hiles, LLP
  Nature of Suit: Negligence
- **Essociate, Inc. v. Neverblue Media, Inc.** | Sept 2012–July 2013
  Jurisdiction: U.S. District Court for the Central District of California
  Case Number: 2:12-cv-08455
  Counsel: Newman DuWors, LLP
  Nature of Suit: Patent
- **Porto Technology Co., Ltd. v. Cellco Partnership d/b/a Verizon Wireless** | Sept 2012–Feb 2014
  Jurisdiction: U.S. District Court for the Eastern District of Virginia
  Case Number: 3:12-cv-00678, 3:13-cv-00265
  Counsel: Fox Rothschild LLP
  Nature of Suit: Patent
- **Flashpoint Technology, Inc. v. ZTE Corporation** | Aug 2012–Mar 2013
  Jurisdiction: U.S District Court for the District of Delaware
  Case Number: 12-cv-00649
  Counsel: Goodwin Procter LLP
  Nature of Suit: Patent
- **Certain Electronic Imaging Devices** | Aug 2012–Mar 2013
  Jurisdiction: U.S International Trade Commission
  Case Number: 337-TA-850 (ZTE Corporation)
  Counsel: Goodwin Procter LLP
  Nature of Suit: Patent
- **MobileMedia Ideas, LLC v. HTC Corporation and HTC America, Inc.** | July 2012–May 2013
  Jurisdiction: U.S. District Court for the Eastern District of Texas
  Case Number: 2:10-cv-00112
  Counsel: Desmarais LLP
  Nature of Suit: Patent
- **Golden Archer Investments, LLC v. SkyNet Financial Systems, LLC** | July 2012–Dec 2012
  Jurisdiction: U.S. District Court for the Southern District of New York
  Case Number: 1:11-cv-03673
  Counsel: Goldman Ismail Tomaselli Brennan & Baum LLP
  Nature of Suit: Breach of Contract
- ***Inter Partes* Reexamination of U.S. Patent No. 7,702,669** | May 2012–July 2012
  Jurisdiction: U.S. Patent and Trademark Office
  Case Number: 95/001,844
  Counsel: Hickman Palermo Truong Becker Bingham Wong LLP (RingCentral, Inc.)
  Nature of Suit: Patent
- **Denise Black v. Prowess, Inc.** | Mar 2012–May 2012
  Jurisdiction: State of New York, Supreme Court, County of Ontario
  Case Number: 0102070/2009
  Counsel: Smith, Sovik, Kendrick & Sugnet, PC
  Nature of Suit: Breach of Contract

- **Essociate, Inc. v. Direct ROI, LLC** | Mar 2012–June 2012
  Jurisdiction: U.S. District Court for the Central District of California
  Case Number: 2:10-cv-02107, 8:12-cv-00444
  Counsel: Newman DuWors, LLP
  Nature of Suit: Patent
- **EchoStar Technologies, Corp. v. TiVo Inc. and Humax USA, Inc.** | Mar 2011–Apr 2011
  Jurisdiction: U.S. District Court for the Eastern District of Texas
  Case Number: 5:05-cv-00081
  Counsel: Morrison & Foerster, LLP
  Nature of Suit: Patent

Journal and Magazine Articles

- Mahdi Eslamimehr, George Edwards, and Mohsen Lesani | 2017
  Efficient Detection and Validation of Atomicity Violations in Concurrent Programs – Journal of Systems & Software
- Yuriy Brun, Jae young Bang, George Edwards, and Nenad Medvidovic | 2015
  Self-Adapting Reliability in Distributed Software Systems – IEEE Transactions on Software Engineering
- Chris A. Mattmann, Nenad Medvidovic, Sam Malek, George Edwards and Somo Banerjee | 2012
  A Middleware Platform for Providing Mobile and Embedded Computing Instruction to Software Engineering Students – IEEE Transactions on Education
- Nenad Medvidovic, Hossein Tajalli, Joshua Garcia, Yuriy Brun, Ivo Krka, and George Edwards | 2011
  Engineering Heterogeneous Robotics Systems: A Software Architecture-Based Approach – IEEE Computer
- Nenad Medvidovic and George Edwards | 2010
  Software Architecture and Mobility: A Roadmap – Journal of Systems and Software (JSS): Special Issue on Software Architecture and Mobility
- Nenad Medvidovic, Hossein Tajalli, Joshua Garcia, Yuriy Brun, Ivo Krka, George Edwards, Marija Mikic Rakic, Sam Malek, and Gaurav Sukhatme | 2010
  An Architecture-Driven Software Mobility Framework – Journal of Systems and Software (JSS): Special Issue on Software Architecture and Mobility
- George Edwards, Chiyoung Seo, and Nenad Medvidovic | 2008
  Model Interpreter Frameworks: A Foundation for the Analysis of Domain-Specific Software Architectures – Journal of Universal Computer Science (JUCS): Special Issue on Software Components, Architectures and Reuse
- Aniruddha Gokhale, Krishnakumar Balasubramanian, Jaiganesh Balasubramanian, Arvind Krishna, George T. Edwards, Gan Deng, Emre Turkay, Jeffrey Parsons, and Douglas C. Schmidt | 2005
  Model-Driven Middleware: A New Paradigm for Deploying and Provisioning Distributed Real-time and Embedded Applications – Elsevier Journal of the Science of Computer Programming: Special Issue on Model Driven Architecture

Conference Papers

- Mahdi Eslamimehr, George Edwards | December 2015
  End-to-End Cross-Language Test Case Generation for Web Applications
  Proceedings of the 9th EAI International Conference on Performance Evaluation Methodologies and Tools
- Christoph Dorn, George Edwards, Nenad Medvidovic | September 2012
  Analyzing Design Tradeoffs in Large-scale Socio-Technical Systems through Simulation of Dynamic Collaboration Patterns
  Proceedings of the 20th International Conference on Cooperative Information Systems (CoopIS)
- George Edwards, Nenad Medvidovic, Yuriy Brun | August 2012
  Automated Analysis and Code Generation for Domain-Specific Models
  Proceedings of the Joint 10th Working IEEE/IFIP Conference on Software Architecture & 6th European Conference on Software Architecture (WICSA/ECSA)
- George Edwards, Yuriy Brun, Nenad Medvidovic | November 2011
  Isomorphism in Model Tools and Editors
  Proceedings of the 26th IEEE/ACM International Conference on Automated Software Engineering (ASE)
- Yuriy Brun, George Edwards, Jae Young Bang, Nenad Medvidovic | June 2011
  Smart Redundancy for Distributed Computation
  Proceedings of 31st International Conference on Distributed Computing Systems (ICDCS)
- Hossein Tajalli, Joshua Garcia, George Edwards, Nenad Medvidovic | September 2010
  PLASMA: A Plan-based Layered Architecture for Software Model-driven Adaptation
  Proceedings of the 25th IEEE/ACM International Conference on Automated Software Engineering (ASE)
- Jae Young Bang, Daniel Popescu, George Edwards, Nenad Medvidovic, Naveen Kulkarni, Girish M. Rama, Srinivas Padmanabhuni | May 2010
  CoDesign - A Highly Extensible Collaborative Software Modeling Framework
  Research Demonstrations Track, Proceedings of the ACM/IEEE 32nd International Conference on Software Engineering (ICSE)
- Ivo Krka, George Edwards, Yuriy Brun, Nenad Medvidovic | August 2009
  Synthesizing Partial Component-Level Behavior Models from System Specifications
  Proceedings of the 7th Joint Meeting of the European Software Engineering Conference and ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE)
- Joshua Garcia, Daniel Popescu, George Edwards, and Nenad Medvidovic | June 2009
  Toward a Catalogue of Architectural Bad Smells
  Proceedings of the 5th International Conference on the Quality of Software Architectures (QoSA)
- Ivo Krka, George Edwards, Yuriy Brun, and Nenad Medvidovic | May 2009
  From System Specifications to Component Behavioral Models
  New Ideas and Emerging Results Track, Companion Volume of the 31st International Conference on Software Engineering (ICSE)
- Joshua Garcia, Daniel Popescu, George Edwards, and Nenad Medvidovic | March 2009
  Identifying Architectural Bad Smells
  Proceedings of the 13th European Conference on Software Maintenance and Reengineering (CSMR)

- Steve Mastrianni, David Bantz, Terrence Buechner, Tom Chefalas, George Edwards, Song Jinho, Dong Jun Lan, Gary Leonardi, Leslie Liu, Randy Moulic, Dennis G. Shea, Andrew Wyskida | October 2008
  BlueStar: Managed Services for Enterprise Mobility
  Proceedings of the IEEE International Conference on e-Business Engineering (ICEBE)
- George Edwards, Leslie S. Liu, and Randy Moulic | October 2008
  Proxima: A Mobile Augmented-Image Search System
  Proceedings of the ACM International Conference on Multimedia (ACMMM)
- George Edwards and Nenad Medvidovic | September 2008
  A Methodology and Framework for Creating Domain Specific Development Infrastructures
  Proceedings of the 23rd IEEE ACM International Conference on Automated Software Engineering (ASE)
- Chiyoung Seo, George Edwards, Sam Malek, and Nenad Medvidovic | February 2008
  A Framework for Estimating the Impact of a Distributed Software System's Architectural Style on its Energy Consumption
  Proceedings of the Working International Conference on Software Architecture (WICSA)
- George Edwards, Chiyoung Seo, and Nenad Medvidovic | August 2007
  Construction of Analytic Frameworks for Component-Based Architectures
  Proceedings of the Brazilian Symposium on Software Components, Architectures and Reuse (SBCARS)
- Gan Deng, Ming Xiong, Aniruddha Gokhale, and George Edwards | May 2007
  Evaluating Real-time Publish/Subscribe Service Integration Approaches in QoS-enabled Component Middleware
  Proceedings of the 10th IEEE International Symposium on Object-oriented Real-time Distributed Computing (ISORC)
- George Edwards, Sam Malek, and Nenad Medvidovic | March 2007
  Scenario-Driven Dynamic Analysis of Distributed Architectures
  Proceedings of the 10th International Conference on Fundamental Approaches to Software Engineering (FASE)
- George Edwards, Gan Deng, Douglas C. Schmidt, Anirudda Gokhale, and Balachandran Natarajan | October 2004
  Model-Driven Configuration and Deployment of Component Middleware Publisher/Subscriber Services
  Proceedings of the 3rd ACM International Conference on Generative Programming and Component Engineering (GPCE)
- George Edwards, Douglas C. Schmidt, Aniruddha Gokhale, and Bala Natarajan | April 2004
  Integrating Publisher/Subscriber Services in Component Middleware for Distributed Real-time and Embedded Systems
  Proceedings of the 42nd Annual ACM Southeast Conference (ACMSE)

Workshop Papers

- Arman Shahbazian, George Edwards, Nenad Medvidovic | May 2016
  An End-to-End Domain Specific Modeling and Analysis Platform
  8th Workshop on Modelling in Software Engineering (MiSE)
- Chiyoung Seo, George Edwards, Daniel Popescu, Sam Malek, Nenad Medvidovic | August 2009
  A Framework for Estimating the Energy Consumption Induced by a Distributed System's Architectural Style
  8th Workshop on Specification and Verification of Component-Based Systems (SAVCBS)

- George Edwards, Joshua Garcia, Hossein Tajalli, Daniel Popescu, Nenad Medvidovic, Gaurav Sukhatme, and Brad Petrus | May 2009
  Architecture-Driven Self-Adaptation and Self-Management in Robotics Systems
  Proceedings of the Workshop on Software Engineering for Adaptive and Self-Managing Systems (SEAMS)
- Ivo Krka, Leslie Cheung, George Edwards, Leana Golubchik, Nenad Medvidovic | June 2008
  Architecture-Based Software Reliability Estimation: Problem Space, Challenges, and Strategies
  Proceedings of the Workshop on Architecting Dependable Systems (WADS)
- George Edwards, Chiyoung Seo, Daniel Popescu, Sam Malek, Nenad Medvidovic | November 2007
  Self-* Software Architectures and Component Middleware in Pervasive Environments
  Proceedings of the 5th International Workshop on Middleware for Pervasive and Ad-Hoc Computing (MPAC)
- Chiyoung Seo, Sam Malek, George Edwards, Daniel Popescu, Nenad Medvidovic, Brad Petrus, and Sharmila Ravula | May 2007
  Exploring the Role of Software Architecture in Fault-Tolerant and Dynamic Pervasive Systems
  Proc. of 1st Workshop on Software Engineering of Pervasive Computing Applications, Systems and Environments

Book Chapters

- Ivo Krka, George Edwards, Leslie Cheung, Leana Golubchik, and Nenad Medvidovic | 2009
  A Comprehensive Exploration of Challenges in Architecture-Based Reliability Estimation
  Architecting Dependable Systems 6, R. de Lemos, J.-C. Fabre, C. Gacek, F. Gadducci, M. ter Beek (Eds.)

Posters And Demonstrations

- ***BlueStar Mobile Management Services***
  IBM Research Technology Fair | June 2008
- ***The Extensible Tool-chain for Evaluation of Architectural Models***
  USC Center for Software and Systems Engineering Convocation | October 2006
- ***A Model-Driven Framework for Architectural Evaluation of Mobile Software Systems***
  UCI Institute for Software Research Forum | April 2006

Invited Talks

- ***Metamodeling-Enabled Model-Checking for Complex Systems***
  Systems Engineering Research Center (SERC) Annual Research Review | November 2010
- ***XTEAM: Automated Synthesis of Domain-Specific Code Generators***
  Northrop Grumman Technology Day Research Showcase, Information Systems Track | May 2010
- ***Domain-Specific Model Analysis and Code-Generation Frameworks***
  Ground Systems Architecture Workshop (GSAW), Architecture-Centric Evolution (ACE) Working Group | March 2010
- ***Automated Analysis and Code Generation for Domain-Specific Models***
  USC Computer Science Department Annual Research Review | March 2010
- ***Automated Analysis and Code Generation for Domain-Specific Models***
  USC Center for Software and Systems Engineering Annual Research Review | March 2010

- ***Model-Driven Analysis Frameworks for Embedded Systems***
  USC Center for Software and Systems Engineering Annual Research Review | March 2009
- ***Creating Domain-Specific Development Infrastructures***
  USC Center for Software and Systems Engineering Annual Research Review | March 2008
- ***Weighing Architectural Trade-offs with XTEAM***
  USC Center for Software and Systems Engineering Annual Research Review | February 2007

Technical Reports

- George Edwards, Yuriy Brun, and Nenad Medvidovic | August 2010
  Automated Analysis and Code Generation for Domain-Specific Models
  Technical Report USC-CSSE-2010-517, Center for Software and Systems Engineering, University of Southern California
- George Edwards and Nenad Medvidovic | July 2009
  Model Interpreter Frameworks
  Technical Report USC-CSSE 2009-514, USC Center for Software and Systems Engineering, Center for Software and Systems Engineering, University of Southern California
- George Edwards and Nenad Medvidovic | May 2009
  A Highly Extensible Simulation Framework for Domain Specific Architectures
  Technical Report USC-CSSE-2009-511, Center for Software and Systems Engineering, Univ. of Southern California
- Yuriy Brun, George Edwards, and Nenad Medvidovic | May 2009
  Injecting Robustness into Autonomic Grid Systems
  Technical Report USC-CSSE-2009-510, USC Center for Software and Systems Engineering, University of Southern California

Patent Applications

- ***Method and Apparatus for Simulation of Domain-Specific Models***
  U.S. Provisional Patent Application 61/513,357, filed July 29, 2011. (abandoned)
- ***Extensible Collaborative Software Modeling***
  U.S. Patent Application 13/271,008, filed October 11, 2011. (abandoned)

Honors and Awards

- **2008 USC Computer Science Outstanding Student Research Award**
  Awarded each year for exceptional research achievement by a graduate student in computer science.
- **Annenberg Graduate Fellowship |** August 2007
  Supports highly qualified graduate students to conduct cutting-edge communication and digital media research and advance important new programs in the communications arena.
- **USC Viterbi School of Engineering Dean's Doctoral Fellowship |** May 2004
  Supports world-class students for four years in the pursuit and publication of research leading to the doctoral degree.
- **Vanderbilt *Summa Cum Laude* Graduate |** August 2003
  Awarded to graduates whose grade point average equals or exceeds that of the top 5 percent of the previous year's graduating seniors.

- **NSF Research Experiences for Undergraduates Grant** | June 2003
  Supports active research participation by undergraduate students in any of the areas of research funded by the National Science Foundation.
- **Vanderbilt Dean's List with High Honors** | Dec 2000, May '01, Dec '01, May '02, Dec '02, May '03
  Recognizes outstanding academic performance in a semester. Students are named to the Dean's List when they earn a grade point average of at least 3.500.
- **Vanderbilt School of Engineering Merit Scholarship** | May 2000
  Awarded to approximately 5 percent of all applicants based on exceptional accomplishment and high promise in intellectual endeavors.
- **National Merit Scholar** | May 2000
  Awarded for academic achievement to 8,200 high school students each year out of 1.5 million entrants.

Teaching

Lecturer, CSCI 102–Data Structures | Fall 2012

Lecturer, CSCI 568–Requirements Engineering | Spring 2012, Spring 2013, Spring 2014, Spring 2015, Spring 2016

Teaching Assistant, Infosys Intensive Course on Software Architecture | December 2009

Guest Lecturer, CSCI 589–Software Engineering for Embedded Systems | Fall 2007, Fall 2008

Guest Lecturer, CSCI 377–Introduction to Software Engineering | Fall 2007, Fall 2008, Fall 2009

Guest Lecturer, SAE 599–Model-Driven Systems Architecture | Summer 2007, Spring 2008

Teaching Assistant, CSCI 589–Software Engineering for Embedded Systems | Fall 2006

Research Community Service

- Reviewer for the **Journal of Systems and Software**, Elsevier | 2010–2013
- Reviewer for **IEEE Transactions on Software Engineering (TSE)** | 2010–2012
- Reviewer for the **50th International Conference on Objects, Models, Components, Patterns (TOOLS Europe)**
  Prague, Czech Republic | May 28–June 1, 2012
- Program Committee Member for the **Research in Applied Computation Symposium (RACS)**
  Miami, FL | November 2–5, 2011
- Reviewer for the **Workshop on Software Engineering for Adaptive and Self-Managing Systems (SEAMS)**
  Cape Town, South Africa | May 3–4, 2010
- Reviewer for the **24th IEEE/ACM International Conference on Automated Software Engineering (ASE)**
  Auckland, New Zealand | November 1–20, 2009
- Reviewer for **DSN 2009 Workshop on Architecting Dependable Systems (WADS)**, Lisbon, Portugal | June 29, 2009
- Reviewer for **Architecting Dependable Systems 6**, Springer Publishing | 2009
- Reviewer for the **6th IEEE International Conference on Autonomic Computing (ICAC)** | June 15–19, 2009
- Reviewer for **IEEE Software Special Issue: Domain-Specific Languages & Modeling** | July/August, 2009

- Reviewer for the **23rd International Conference on Automated Software Engineering (ASE)**
  L'Aquila, Italy | Sept. 15–19, 2008
- Reviewer for the **Working IEEE/IFIP Conference on Software Architecture (WICSA)**
  Vancouver, Canada | February 18–21, 2008
- Program Committee Member for the **Institute for Software Research (ISR) Graduate Student Research Symposium (GSRS),** Irvine, CA | June 1, 2007
- Reviewer for the **3rd International Conference on the Quality of Software Architectures (QoSA)**
  Boston, MA | July 12–13, 2007
- Reviewer for the **10th International ACM SIGSOFT Symposium on Component-Based Software Engineering (CBSE),**
  Boston, MA | July 9–11, 2007
- Reviewer for the **First IEEE International Conference on Self-Adaptive and Self-Organizing Systems (SASO)**
  Boston, MA | July 9–11, 2007
- Reviewer for the **Second Workshop on Sharing and Reusing Architectural Knowledge - Architecture, Rationale, and Design Intent (SHARK/ADI),** Minneapolis, MN | May 19–20, 2007
- Reviewer for the **Workshop on Tools, Operating Systems and Programming Models for Developing Reliable Systems (TOPMoDelS),** Long Beach, CA | March 26–30, 2007

Professional Associations

- **Member**, Association for Computer Machinery (ACM) and ACM Special Interest Group on Simulation and Modeling
- **Member**, IEEE Computer Society