UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GOOGLE LLC,
Petitioner,

v.

BOOTLER, LLC,
Patent Owner.

Case No. IPR2025-00968
Patent No. 11,037,090

DECLARATION OF MARK CROVELLA, PH.D.

Google Exhibit 1003
Google v. Bootler

TABLE OF CONTENTS

I, Mark Crovella, Ph.D., declare:

[0001] I have been retained by Wolf, Greenfield & Sacks, P.C., counsel for Petitioner Google LLC to assess claims 1-17 (the "challenged claims") of U.S. Patent No. 11,037,090 ("the '090 patent," EX1001). I am being compensated for my time at my standard rate of $700.00 per hour, plus actual expenses. My compensation is not dependent in any way upon the outcome of the *inter partes* review of the '090 patent.

I. PERSONAL AND PROFESSIONAL BACKGROUND

[0002] I am a Professor in the Department of Computer Science at Boston University. From 2013 to 2018 I served as Chair of the Department. Since 2020 I am also a Professor in the Faculty of Computing and Data Sciences, and I serve as the Chair of Academic Affairs there. A brief summary of my background is as follows.

[0003] I earned an undergraduate degree in Biology from Cornell University, which I received in 1982. I received a master's degree in Computer Science from the University of Buffalo in 1989. My master's degree project involved the development of code using the PVM system running on an Intel iPSC hypercube (parallel) computer.

[0004] From 1982 to 1984, I worked as a computer programmer for the State of Colorado. From 1984 to 1994, I was employed at Calspan Corporation, a research and development firm in Buffalo, NY, where I rose to the level of Senior Computer Scientist. My work at Calspan focused on development of experimental software and large-scale simulation software in support of contracts between Calspan and the US Department of Defense.

[0005] I received a Ph.D. in Computer Science from the University of Rochester in 1994. My Ph.D. research concerned the measurement and analysis of parallel programs – software in which work is distributed over multiple processors or multiple independent computers. During that time I developed software for a variety of parallel computers and distributed systems, including the KSR-1 parallel computer, Silicon Graphics multiprocessor, and the 128-node BBN Butterfly. The subject of my Ph.D. thesis was "Performance Prediction and Tuning of Parallel Programs."

[0006] In 1994, I joined the faculty of Boston University, initially as an Assistant Professor of Computer Science. I was promoted to the rank of Associate Professor in 2000 and became a full Professor in 2006. I served as Chair of the Department from 2013 to 2018.

[0007] While at Boston University, much of my teaching has focused on distributed computing, the Web, and the Internet. I have taught the Department's course in Computer Networking for many years, a course in which we teach students how the communication protocols underlying distributed systems work, and my students in that course learn to write distributed programs that run on multiple computers and communicate using protocols such as UDP, TCP, and via sockets. I also developed the course in database systems that is taught to all majors in the Data Science program at Boston University. That course covers methods for storage, managing, linking, and querying data stores.

[0008] I have been pursuing research in areas including computer networking since 1994. I have conducted research in a variety of areas related to the Internet and the World Wide Web. Among other areas, I have studied the efficient design of Web servers and content distribution systems; I have studied the statistical properties of Internet traffic; and I have made extensive measurements of Internet infrastructure and the behavior of Internet protocols. From 2007 to 2009, I was the Chair of ACM SIGCOMM (the Special Interest Group in Computer Communication), the main professional organization for scientists in the field of computer networking. On the strength of my work on parallel and distributed systems, I have been elected a Fellow of the IEEE and also of the ACM.

[0009] I began my research at Boston University in 1994, as the Web was beginning to be widely used. At the time, there were many important and unanswered questions about how factors such as Web protocol design, Web server design, Internet structure and topology, and user behavior affected the performance (speed and reliability) of the Web. These questions were my principal research focus during the period from 1994 to roughly 2002.

[0010] One of the topics that I studied in detail during that period concerned how Web browsers presented information to users, and how user requests for information affected the overall traffic on the Internet. During that period my group produced a number of highly cited papers exposing how the statistical properties of Web pages, and user requests for Web pages, affected the performance of the Web.

[0011] I am co-author of *Internet Measurement: Infrastructure, Traffic, and Applications* (Wiley Press, 2006), which is the first book written on the subject. I am the author of over two hundred research papers; according to Google Scholar, my work has been cited by over 30,000 other publications. Also according to Google Scholar, as of May 2018, only 11 other researchers worldwide are more cited in the area of computer systems. I hold nine U.S. Patents derived from my Internet related research. I am a past editor of principal journals in the field of networking: *Computer Communication Review*, *IEEE/ACM Transactions on Networking*, *Computer Networks*, and *IEEE Transactions on Computers.*

[0012] I have considerable experience working with graph-structured data in my research, and I have used graph-structured data in the context of machine learning in a number of research projects. I have also done considerable research studying data derived from social media and social networks. Some examples of such research include the research discussed in the following papers: (1) Theodoros Lappas, Mark Crovella and Evimari Terzi (2012), "Selecting a Characteristic Set of Reviews," *Proceedings of the ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD) 2012*, Beijing, China; (2) Giovanni Comarela, Mark Crovella, Virgílio Almeida and Fabrício Benevenuto (2012), "Understanding Factors that Affect Response Rates in Twitter," *Proceedings of ACM Hypertext*, Milwaukee, WI; and (3) Gonca Gürsun, Mark Crovella and Ibrahim Matta (2011), "Describing and Forecasting Video Access Patterns," *Proceedings of the Infocom 2011 Miniconference*, Shanghai China.

[0013] I also have considerable experience working with data management (including via the use of databases), Web protocols and distributed systems in industry. In 2000, I co-founded a company that developed protocols for content delivery in the Web, which through a chain of acquisitions became part of Network Appliance, Inc. At Network Appliance I served for two years as a Technical Director working on content distribution and Web caching systems.

This role included designing systems to keep databases synchronized across multiple nodes in a distributed system that was used for managing content related to Web applications in multiple databases.

[0014] I have also served as Chief Scientist for Guavus, Inc., a company founded by one of my Ph.D. students, that commercialized work that we did analyzing the properties of Internet traffic. Guavus is a big-data analytics company that designs and delivers systems to manage and analyze immense datasets deriving from measurements of telecommunication networks. Guavus was subsequently acquired and is now a division of Thales, Inc.

[0015] My detailed employment background, professional experience, and list of technical papers and books are contained in the attached Curriculum Vitae.

[0016] I am very familiar with the subject matter of this case. I consider myself an expert in data management systems, distributed systems, and in computer networking, which includes network protocols, applications, and architecture.

[0017] My curriculum vitae is provided as Exhibit 1004.

II. MATERIALS REVIEWED AND CONSIDERED

[0018] My findings, as explained below, are based on my years of education, research, experience, and background, as well as my investigation and study of relevant materials for this declaration. When developing the opinions set forth in this declaration, I assumed the perspective of a person having ordinary skill in the art, as set forth in Section III below. In forming my opinions, I have studied and considered the materials identified in the list below, as well as any other materials cited in this declaration.

Exhibit	Description
1001	U.S. Patent No. 11,037,090
1002	Prosecution History of U.S. Patent No. 11,037,090
1004	Curriculum Vitae of Mark Crovella, Ph.D.
1005	U.S. Patent Application Publication No. 2013/0282486 ("Rahle")
1006	U.S. Patent No. 10,176,448 ("Rhodes")
1007	U.S. Patent No. 6,651,057 ("Jin")
1008	U.S. Patent No. 10,366,434 ("Belousova")
1009	U.S. Patent Application Publication No. 2009/0119268 ("Bandaru")
1010	U.S. Patent Application Publication No. 2005/0086206 ("Balasubramanian")
1011	U.S. Patent Application Publication No. 2015/0026152 ("Singh")
1012	U.S. Patent Application Publication No. 2008/0175243 ("Bhagwan")
1013	U.S. Patent Application Publication No. 20100023751 ("He")
1014	U.S. Patent No. 8,595,847 ("Petta")
1016	The American Heritage Dictionary of the English Language (2016)
1017	U.S. Patent No. 9,697,250 ("Ward")
1018	U.S. Patent Application Publication No. 2017/0329871 ("Subramani")
1019	U.S. Patent No. 6,594,751 ("Leivent")
1020	U.S. Patent Application Publication No. 2010/02474771 ("Mori")
1021	U.S. Patent No. 5,765,039 ("Johnson")
1024	U.S. Patent Application Publication No. 2012/0246132 ("Sebastian")
1025	U.S. Patent Application Publication No. 2017/0270184 ("Huang")
1026	U.S. Patent No. 5,896,517 ("Wilson")
1027	U.S. Patent Application Publication No. 2012/0233414 ("Meier")
1028	U.S. Patent Application Publication No. 2012/0123910 ("George")
1029	U.S. Patent Application Publication No. 2008/0295178 ("Beresniewicz")
1030	U.S. Patent No. 6,542,893 ("Quernemoen")

1031	U.S. Patent Application Publication No. 2012/0166366 (“Zhou”)
1032	U.S. Patent Application Publication No. 2013/0159348 (“Millis”)
1033	U.S. Patent No. 8,849,721 (“Fedorov”)

III. PERSON OF ORDINARY SKILL IN THE ART (“POSA”)

[0019] I have been informed and understand that for purposes of assessing whether prior-art references disclose every element of a patent claim (thus “anticipating” the claim) and/or would have rendered the claim obvious, the patent and the prior-art references must be assessed from the perspective of a person having ordinary skill in the art (“POSA”) to which the patent is related, based on the understanding of that person at the time of the patent claim’s priority date. I have been informed and understand that a POSA is presumed to be aware of all pertinent prior art and the conventional wisdom in the art, and is a person of ordinary creativity. I have applied this standard throughout my declaration.

[0020] The ’090 patent states that it relates to the field of “record linkage,” with “[p]articular applications includ[ing] master data management.” EX1001, 1:23-24. I have been asked to provide my opinions as to the state of the art in this field by late 2016. I use this timeframe because the face of the ’090 patent indicates an earliest claimed priority date of November 1, 2016 (the date that the patent’s parent application was filed). Whenever I offer an opinion in this declaration about the knowledge of a POSA, the manner in which a POSA would have understood the claims of the ’090 patent or its description, the manner in which a POSA would have understood the prior art, or what a POSA would have been led to do based on the prior art, I am referencing the late 2016 timeframe, even if I do not say so specifically in each case.

[0021] In my opinion, a person of ordinary skill in the art in the late 2016 timeframe (“POSA”) would have had a bachelor’s degree in computer science, computer engineering, or a similar degree, with one or two years of experience with data management. More education could compensate for less practical experience, and vice versa. This person would have been capable of understanding and applying the teachings of the ’090 patent and the prior-art references discussed in this declaration.

[0022] By 2016, I held a Ph.D. in Computer Science, and I had over ten years of experience with data management. For example, as I noted in paragraph 5 above, my Ph.D. research involved parallel programming, which is a field that involves, among other things, management of data between processors or computers running in parallel (for example, to maintain consistency or to avoid corruption of a master data set used by multiple entities). As another example, as I noted in paragraph 7 above, much of my teaching and research since joining Boston University in 1994 has been on distributed computing, the Web, and the Internet, all of which are fields that relate to data management, including links between different records. As another example, as I noted in paragraph 13 above, I co-founded and worked at a company that developed protocols for Web content delivery. Furthermore, I have co-authored many papers relating to data management and record linkage, including those mentioned in paragraph 12 above. Therefore, I was a person of more than ordinary skill in the art during the relevant timeframe. However, I worked with many people who fit the characteristics of the POSA, and I am familiar with their level of skill. When developing the opinions set forth in this declaration, I assumed the perspective of a person having ordinary skill in the art, as set forth above

IV. THE ’090 PATENT

A. Embodiments discussed in Specification

[0023] The ’090 patent discusses “aggregating, processing, and presenting service data,” which is “data retrieved from a particular delivery service source” such as “food or beverage delivery services.” EX1001, 3:54-60. According to the patent’s “background” section, “delivery services” were known commercial entities that had “recently…been introduced” to allow customers to order “food and beverage items from among several restaurants for which the delivery service can deliver food and beverage items” to the “customer’s home or business.” EX1001, 1:27-49. In the ’090 patent’s figures, examples include delivery services called “Eats Inc.” and “DeliverMe.co,” and both these delivery services deliver food from restaurants including “Flo Crepes Delivery.” EX1001, FIG. 11 (annotated below), 17:5-7, 17:62-63.

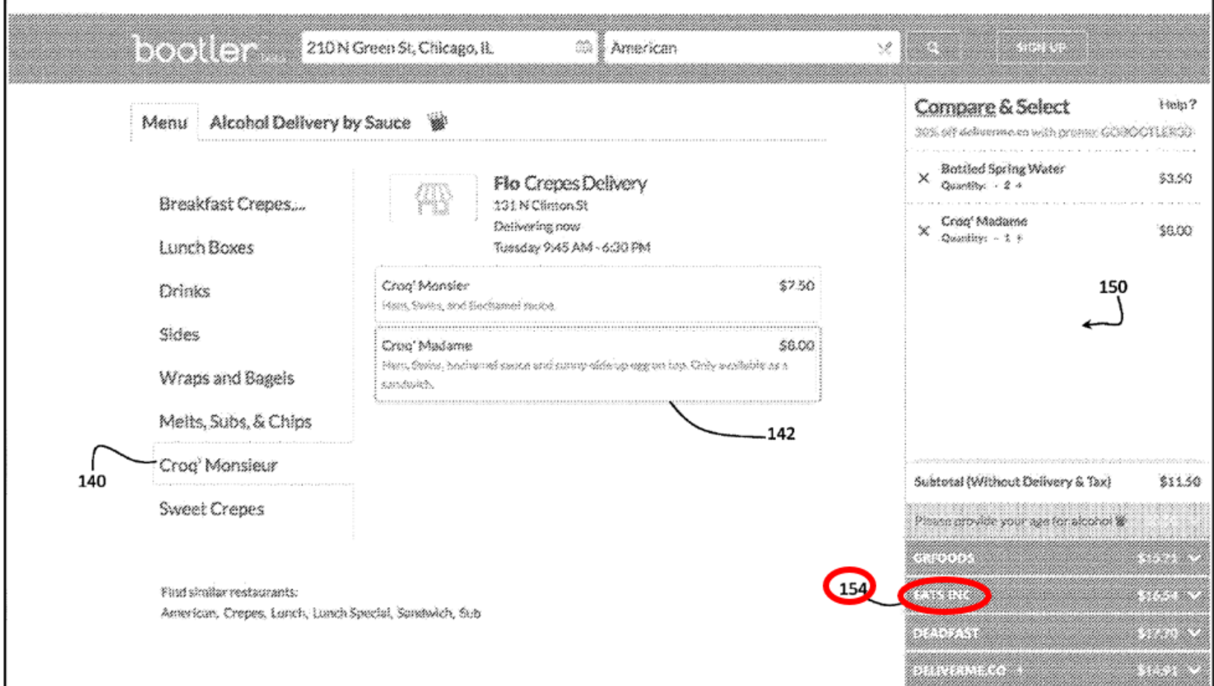


FIG. 11

EX1001, Fig. 11 (annotated)

[0024] In some embodiments discussed in the ’090 patent, data collected from delivery services can be used to “allow[] a consumer to search” for “restaurant and delivery services that are available from a particular location and match some search criteria.” EX1001, 3:61-65. For example, a user can search the ’090 patent’s system for “American” food, and the system can present a list of "matching restaurant results that are available through one or more delivery services." EX1001, 15:41-16:23, FIGs. 8-9.

[0025] Embodiments discussed in the '090 patent "request (pull) restaurant and menu data from a plurality of delivery service computers…by scraping (harvesting or extracting) the requested data from websites or by interfacing with the delivery service computer via an application programming interface (API)." EX1001, 10:45-56. A "record linkage" process "identifies common restaurants" represented in data from "multiple delivery services" (e.g., a same restaurant that more than one delivery service delivers from), by recognizing that the "restaurant name, geocoordinates, street address, etc." in more than one delivery service's data belong to the same "master restaurant" known to the system. EX1001, 11:50-12:14. System embodiments also combines "multiple source menus"—e.g., obtained from different delivery services delivering from the same restaurant—by "match[ing] or link[ing]" each "source menu item" to an identical "master menu item" in the system's "single master menu" for the restaurant. EX1001, 12:51-13:25. In one example, the combined data "allows for the user to search for terms such as 'pizza' and find all restaurants associated with that label." EX1001, 13:45-64.

B. Prosecution History

[0026] I have reviewed the prosecution history of the ’090 patent. The applicants amended the claims after the first office action to overcome a rejection over 35 U.S.C. §101 (for patent-ineligible subject matter) and to avoid interpretation of one claim under 35 U.S.C. §112(f) (means-plus-function). EX1002, 102-110, 139-145. To overcome a double-patenting rejection, the applicants also submitted a terminal disclaimer over the ’090 patent’s parent, U.S. Patent No. 10,445,683. EX1002, 145. Following an examiner interview in which the examiner proposed additional amendments to address the §101 and §112 issues (EX1002, 160), the examiner allowed the claims. EX1002, 155-157. No prior-art rejections were made during prosecution. The examiner said the “closest prior arts…fail to disclose scraping data from the plurality of service computers; linking and mapping the data with common sources and formatting the service data into searchable form.” EX1002, 158.

V. FOCUSED TESTIMONY REGARDING CERTAIN TERMS, THE SCOPE AND CONTENT OF THE PRIOR ART, AND THE KNOWELDGE, MOTIVATIONS, AND EXPECTATIONS OF A POSA

[0027] I have been asked to opine on how a POSA would understand certain terms used in the ’090 patent and in the prior art. I have also been asked to opine on how a POSA would understand prior art references cited in the Petition, and on what a POSA would have been motivated to do in view of the teachings of those references as understood in light of the POSA's background knowledge. I have also been asked to opine on the POSA's reasonable expectations, when applying these teachings and knowledge, for success in arriving at any of the implementations recited in the '090 patent's claims. I provide those opinions in this section.

A. POSAs' understanding of certain terms used in the '090 patent

[0028] Element [11C] recites "*grid points within a city*." The '090 patent refers to generating a "grid of points spanning a city's area," where "each master restaurant data object is determined to fall either inside of or outside of a given point's delivery range." EX1001, 13:54-60. The patent does not explain what it means for a "point" to have a delivery range, but it refers to "geographic points that each restaurant is available from." EX1001, 16:11-15. Thus, POSAs understood that *grid points within a city* encompass a set of geographic locations in a city.

[0029] Element [1E] recites a "*master menu item*." The '090 patent describes an exemplary "*master menu item*" as a logical representation of a menu item that is linked to the corresponding item on the menus of various restaurants; in other words, for example, if multiple restaurants have pizza as a menu item, those menu items may all be associated with a master menu item representing pizza. EX1001, 13:5-9 ("In an example method, the trained algorithm identifies sets of identical items…. For each set of identical items that is identified, all items in the set are linked (e.g., related) to a combined master menu item…"), 13:14-17 ("In an example method, the master menu item description is chosen from its linked source items' descriptions by finding the most semantically-dense description."); 13:62-64 (system allows identification of "all restaurants associated with [the] label" "pizza").

[0030] Claim 3 refers to "*aliasing fields of the acquired data*." The '090 patent provides an "example" of "aliasing" in which fields used by delivery services (which may be in different forms from each other) to describe the same concept are mapped to a standardized set of one or more fields in a database. EX1001, 11:31-49 (showing different representations for delivery fees from two different services being converted to the same field format). The '090 patent provides no other definition or description of "aliasing," and POSAs would have understood that the mapping of one or more fields representing the same concept in potentially differing forms to the same standardized field invokes the generally known connotation of "aliases" as different ways of representing or referring to a same thing (e.g., as an author's "alias" is another name for the same person).

[0031] Claim 14 refers to a "*data warehouse configured to store the provided master data set in searchable format*." The specification says that "[t]he data warehouse…, in an example embodiment, is a structured query language (SQL) database, a particular example of which is a data warehouse." EX1001, 14:11-15. Thus, POSAs understood that the term "*data warehouse*" in the '683 patent encompasses at least a database implemented to store the master data set.

B. POSAs' understanding of teachings of Rahle (EX1005)

[0032] Rahle describes techniques for aggregating and sharing "[s]tructured information about nodes…in a social networking system…, such as menu items for a restaurant." Rahle, Abstract. Rahle explains that a social networking system is a web service that stores information about users, entities (including restaurants), and other "real-world concepts" (e.g., food items). Rahle, [0002]-[0005]. Rahle discloses a social networking system with a "social graph" data structure, wherein users and entities are represented as "nodes" that are connected by "edges" representing interactions between nodes. Rahle, [0014].

[0033] In Rahle's system, a restaurant having a web page can be represented as a "page object" node, and the social graph can store associations between the restaurant node and "sub-nodes…representing…the menu items served by the restaurant." *See* Rahle, [0014]-[0016], [0017]-[0018], [0039]. Rahle explains that "a social graph includes nodes connected by edges." Rahle, [0014]. Websites that are external to the system may be represented as "page objects," and this way, "[a]ny concept that can be embodied in a web page may become a node in the social graph." Rahle, [0015]. "Sub-nodes may be generated for different types of nodes in a social networking system, such as pages, users, and entities." Rahle, [0016]. For example, a restaurant is a type of entity that can be represented as a "page object," where the "page object" is a "type of node," and the social graph can store associations between the restaurant's page object and "sub-nodes" representing food items on that restaurant's menu. Rahle, [0017] ("If the menu item inputted by the user is not found as a sub-node already associated with the **page object for the restaurant**, the sub-node may be **associated with the restaurant** upon approval by the page owner. … In another embodiment, **the type of node** may indicate what types of sub-node objects may be associated with the page. **For example**, it may be assumed that a Mexican **restaurant** serves burritos while a Chinese restaurant serves fried rice based on template menus for each restaurant type created by administrators of the social networking system."), [0018] ("The social networking system 100 generates associations 112 between a page object 102 and sub-node objects 104 after it is determined that the sub-node objects 104 should be associated with the page object 102.").

[0034] A user can search the social graph for menu-item sub-nodes to find restaurants (represented by associated nodes) that serve those menu items, such as "by searching for all restaurants that serve burritos" in a specified location. Rahle, [0023]; *see also* Rahle, [0059] ("For example, a viewing user may view typical Mexican food items, such as tacos, burritos, and quesadillas, as well as restaurants represented by pages that serve these items."), claims 27-28 (referring to receiving search queries for sub-nodes and ranking results).

[0035] Rahle describes "a variety of methods" for generating sub-nodes, such as menu items, and associating those sub-nodes with nodes, such as restaurants that serve those menu items, in the social-graph data structure. *See* Rahle, Abstract (sub-nodes "definable by the node owner," and "[u]sers may associate other sub-nodes to the node"), [0021] ("Sub-node objects 104 may be associated with page objects 102 using a variety of methods, including using a third-party database or external system provides a listing of sub-nodes to the social networking system 100 to be associated with the page object 102."), [0022] ("Another method of generating sub-node objects 104 to be associated with a page object 102 includes identifying attributes of page objects 102 that match existing sub-node objects 104…."), [0005] ("Users may generate associations between other sub-nodes and the node, such as identifying other menu items served by a restaurant, and the owner of the node may confirm these associations."), [0037]-[0050] (section on "Generating Sub-Nodes on a Social Networking System").

[0036] The system gathers information regarding restaurants' menu items from a variety of sources, and generates data mappings that associate the appropriate restaurant nodes with the appropriate menu-item sub-nodes based on the gathered information. *See* Rahle, [0037] (describing "sub-node generating module" including "external data gathering module"), [0038] ("An external data gathering module 300 interfaces with external websites 216 to process information about sub-node objects 104 of the social networking system 100. This information may include content on a third-party website and other data licensed from third-party providers. For example, a page owner of a page object 102 for a restaurant may already have menu items listed on an external website 216…. In addition, third-party external systems, such as restaurant review websites, may license information about restaurants to the social networking system…."), [0039]-[0040] (describing "data mapping module" that "ensures that data gathered from external systems have been mapped to the correct page object in the social networking system"), [0041] ("The page interface module 304 may be used by page owners of page objects to generate sub-node objects and associate them to page objects."), [0042]-[0043] (discussing "heuristics analysis module" that can be used to "help to suggest new sub-nodes to other page objects that represent Mexican restaurants that may serve the menu item but had not yet associated the menu item with the restaurant's page object" and also for "gathering and analyzing different types of information about sub-node objects that have been generated"), [0044] ("A machine learning module 308 may be used in the sub-node generating module 222 to refine data mapping of external data and other information gathered about sub-node and page objects in the social networking system 100.").

[0037] One way the system can gather such information is by providing a "user interface" or an "application programming interface (API)" by which a restaurant "page owner" can input or upload the restaurant's "menu items," which the system maps to "sub-nodes to be associated with" the restaurant's "page." Rahle, [0041] (discussing "page interface module"). Another way is to gather information from "third-party website[s] and other data licensed from third-party providers," such as gathering information on a restaurant's "menu items [as] listed on an external website" or licensing such information from "restaurant review websites." Rahle, [0038]. Rahle says that information can be gathered by an "external data gathering module" that "interfaces with external websites…to process information about sub-node objects…of the social networking system…. For example, a page owner of a page object…for a restaurant may…have menu items listed on an external website…. The external data gathering module…may be used to gather such menu information…to generate sub-nodes." Rahle, [0038].

[0038] POSAs understood that "gathering" information from the external websites involves what the '090 patent refers to as *scraping*. EX1001, 10:54-55 (referring to "scraping (harvesting or extracting) the requested data from websites"). At minimum, POSAs would have found it obvious to implement the "external data gathering module" to scrape websites. POSAs understood that gathering data from websites by scraping them was a typical and customary way to extract information from websites, and implementing website scraping was within a POSA's programming skill. My testimony regarding a POSA's background knowledge is corroborated by, *e.g.*: Petta (EX1014), 1:11-13 ("Web scraping generally includes activities to extract data or content from a website"); Bandaru (EX1009), [0004]-[0005] (published in 2009 and disclosing "a method and system for associating, extracting or mapping content found on multiple websites related to a specific business" and noting that "[s]ince the earliest days of the internet, major search engines have used special software robots, known as spiders, to locate information and build lists of words, found across multiple websites," using a "crawling mechanism, which operates transparently to the end-user, to gather information about individual websites and web pages"). POSAs knew, for example, that "***extracting*** or mapping content found on multiple websites related to a specific business" was a beneficial way of gathering "details about local restaurants" that "can then be searched by an end-user through a web-based interface." Bandaru (EX1009), [0004]-[0006], [0064] (corroborating POSAs' knowledge that "identifying, collecting, analyzing, mapping and ***extracting*** relevant information…associated with a specific local business gathered from multiple online data sources" including third-party "websites" was a beneficial way of gathering information "about restaurants" as in Rahle).

[0039] The system processes this information to identify the sub-nodes corresponding to the listed menu items, and a "data mapping module" maps them "to the correct page object" (e.g., restaurant) node in the system. Rahle, [0038]-[0039]. "Inexact matching, including fuzzy matching that accounts for misspellings, and feedback from users…may also be used in matching sub-node[s]…to attributes of page objects." Rahle, [0022]. The "data mapping module" maps formatted menu item data to "the correct page object" for a restaurant "based on analyzing attributes of the page objects to identify matching external data." Rahle, [0039]-[0040]. POSAs understood, or at a minimum would have found obvious, that the "correct page object" representing a restaurant is identified by analyzing the attributes of the restaurant page object to determine, for a given item of menu data, the correct restaurant to which the data should be mapped, especially given that restaurant menu data may come from sources other than the restaurants themselves, such as Rhodes's delivery service websites/systems in Rahle-Rhodes (as I discuss in Section V.D below).

[0040] "A machine learning module…may be used…to refine data mapping of external data and other information gathered about sub-node and page objects." Rahle, [0044]. The "machine learning module" uses a "machine learning algorithm" to "analyze user feedback received from the user feedback module to train the data mapping model for mapping sub-node objects to page objects based on external data." Rahle, [0044]. POSAs understood that using "user feedback" to train involves using previously-collected data, because the "feedback" provided by the user is feedback on how accurately the previously-collected menu data was mapped. Rahle discusses using "user feedback" to "train" the model in paragraph [0044], and discusses the following example:

> For example, a user of the social networking system 100 may identify that a song by the rapper Biggie Smalls **was** incorrectly **mapped** to a **page object** for a page for the entertainer "Biggie Smalls," a pet dog with the same name. This user feedback may be used by the machine learning module 308 to **retrain** the data mapping model.

Rahle, [0044]. In this example, if the user is providing feedback identifying that a song "**was** incorrectly **mapped**" (past tense) to the wrong page object, then this feedback is about previously-collected data (in this case, the song) that was previously mapped to page objects. The discussion of songs in paragraph [0044] is just an illustrative "example" about how Rahle's feedback process works; this thus teaches that the same feedback process could be used, for example, to identify that a previously-collected menu item was mapped to the page object for the wrong restaurant.

[0041] As a result of these various techniques for generating sub-nodes that I discussed in paragraphs 35-40 above, for example, multiple "Mexican restaurants represented by page objects" that "all serve burritos" may "be associated with a sub-node object 104 for 'burrito'" in the social-graph data structure. Rahle, [0035].

[0042] Rahle stores the social graph in a collection of "stores." Rahle, [0029]-[0036], FIG. 2. POSAs understood that these stores together constitute a *database*, which POSAs understood is a "a collection of data arranged for ease and speed of search and retrieval." Heritage (EX1016), 462. This understanding is supported by Rahle, [0014], which states that Rahle incorporates by reference U.S. Patent Application No. 13/239,340, which later issued as U.S. Patent No. 8,849,721 ("Fedorov," EX1033). Fedorov, which is entitled "Structured objects and actions on a social networking system," says that "an object may be described in…formats, such as a database or flat file…." Fedorov, 4:8-10. *See also* Fedorov, 25:42 (referring to prior art "database objects"). As noted above, Rahle's "graph" contains "objects," such as "page objects" and "sub-node objects." Rahle, [0014], [0018], [0022]. At a minimum, POSAs would have found it obvious and reasonably expected success to implement the "stores" in a database, because using databases to store structured data such as social-graph data was customary and was within a POSA's skill. My testimony regarding a POSA's background knowledge is corroborated by, *e.g.*: Ward (EX1017), 1:38-41 ("Today, alphanumeric indicia representative of a dataset are typically stored according to digital, electronic data structures such as…an electronic relational database."); Subramani (EX1018), [0003] (discussing known background concept of "graph databases"); Fedorov (EX1033), 4:8-10, 25:42 (discussed earlier in this paragraph). Moreover, Rahle itself discloses that "sub-nodes may be created from information in a "database of structured information" input to Rahle's system." Rahle, [0032].

[0043] POSAs understood that databases store data in storage devices. My testimony regarding a POSA's background knowledge is corroborated by, *e.g.*: Quernemoen (EX1030), 4:21-33 (describing known "data ***storage*** requirements" for databases).

[0044] As I noted above, in Rahle's social graph, each sub-node representing a particular menu item can be stored with connections to all nodes representing restaurants that serve that menu item. See, *e.g.*, Rahle, [0016], [0023]-[0024],

[0035]. POSAs understood, or at least would have found obvious, that these connections are implemented via references in the sub-node objects to the page objects representing the restaurant menu webpages. Implementing objects with such references to other objects (*e.g.*, for example, pointers) was a typical way to create connections between objects and was within a POSA's programing skill. My testimony regarding a POSA's background knowledge is corroborated by, *e.g.*: Leivent (EX1019), 1:22-25 ("In object-oriented database systems, and any other systems having large numbers of inter-connected objects, inter-object references, sometimes called pointers, provide a complex structure providing access to the stored objects."), 1:42-49 ("Every object-oriented database system has some way to identify an object. Currently, some systems use an 'object identifier' (OID), which embodies a reference to an object. Some systems use pointers. An operation called 'dereferencing', finds an object by following a pointer to the object and by making the object available to a requesting application."); Mori (EX1020), [0004] ("…in the direct access type hierarchical database, pointers provided in the respective segments point to other segments to thereby maintain the tree structure of the segments in the database"); Johnson (EX1021), 3:35-45 ("A reference is a link or pointer to another object, and implies a relationship to that other object. A reference is typically used when it is desired not to duplicate data.").

[0045] As I noted above, Rahle discloses that "page objects" for restaurants may have associated "attributes." Rahle, [0014], [0022]. Non-limiting examples of attributes include restaurant "hours, location, recommendations," and "menus." Rahle, [0014]. POSAs understood that a restaurant's location uniquely identifies an attribute, because no two restaurants can have precisely the same location. Rahle also discloses (consistent with POSAs' understanding) that different types of restaurants may serve different types of food, *e.g.*, "Mexican" or "Chinese," (similar to the '090 patent's example "tag" values of "Ecuadorian" or "Spanish" that I discuss *supra* §V.A, *see* EX1001, FIG. 3), and discloses that users often "search" for different types of food that I discussed above. Rahle, [0017], [0003], [0023]. Thus, POSAs would at minimum have found it obvious to implement Rahle to include cuisine type as a restaurant page object "attribute."

[0046] POSAs would have been motivated to implement Rahle to index these attributes so that users may search for restaurants having, *e.g.*, specific hours, ratings, or cuisines, and would reasonably have expected success because creating search indices was well-known and within a POSA's skill. My testimony regarding a POSA's background knowledge is corroborated by, *e.g.*: Huang (EX1025), [0003] (discussing "conventional technologies of establishing indexes for search objects"); Sebastian (EX1024), [0004] ("Indexes may be used in order to improve (*e.g.*, decrease) access time to records in a database. Index creation is a well-known technique in the field of relational databases.”).

[0047] Rahle’s techniques “can be executed by a computer ***processor*** for performing any or all of the steps, operations, or processes described.” Rahle, [0068]. The processor “execute[s]” a “computer program product” comprising “instructions” that are stored on a “non-transitory, tangible computer readable storage medium.” Rahle, [0068]-[0069]. POSAs understood that such instructions are loaded into a memory to be executed by a processor. My testimony regarding a POSA’s background knowledge is corroborated by, *e.g.*: Wilson (EX1026), 1:11-21 (“A data processing system comprises, in general, a processor, a memory subsystem and an I/O (input/output) subsystem. The instructions describing the required behavior of the data processing system, together with various working values, are stored in the memory subsystem, and the system operates by the continual action of the processor in fetching instructions in an orderly manner from the memory subsystem and performing the operations specified by them, reading data values from memory and writing them back in accordance with the instructions' requirements.”); Meier (EX1027), [0002] (“A digital processor executes a sequence of instructions in order to perform a specific task. These instructions; any data used, manipulated, or produced as part of the task; and any other relevant information are stored in memory accessible to the processor. When executing a store instruction, the processor stores information in the memory.”).

[0048] Rahle discloses that users access the social networking system via a “web server” that serves “web pages” to the user. Rahle, [0030]. POSAs would have found it obvious to implement this web server to access a database that stores content that has been prepared for display to a user on a web page, as this was a typical web server architecture that was within a POSA’s skill to implement. My testimony is corroborated by, *e.g.*: George (EX1028), [0005] (“When a user accesses a typical ecommerce web site with a product request, the request and its associated parameters, such as the product name and model number, are passed from a web server to an application server. The application server performs necessary computation to identify what kind of data it needs from the database. Then the application server sends appropriate queries to the database or other sources. After the database returns the query results to the application server, the application server uses these to prepare a web page and passes it to the web server, which then sends it to the user.”); Beresniewicz (EX1029), [0003] (“When a user of a client browser makes an input to a web application, the web application may generate one or more statements containing SQL (Structured Query Language), PL/SQL (Procedural Language/SQL) code or the like that proffers a query to a database. A database server accesses the information from the database and returns information to the web application, which returns the information to the client. The client browser then displays or otherwise presents the requested information to the user.”). Furthermore, POSAs would have found it obvious for the database that stores content that has been prepared for display to receive the most recent data in the graph for display, because POSAs understood that it would be beneficial for content shown to the user on the social networking systems “web pages” to be the most up-to-date possible. Rahle, [0003] (noting one problem motivating Rahle’s invention is the inability to share information about “restaurant that opened recently”).

C. POSAs’ understanding of teachings of Rhodes (EX1006)

[0049] Rhodes relates to a “service” that “enable[s] customers to order food items from a variety of restaurants, and may arrange for couriers to deliver the food items from the restaurants to the customers. Rhodes, 1:11-15. Rhodes refers to such a service as a “delivery service.” Rhodes, 3:8-29 (“For instance, a service provider may provide a delivery service that enables buyers to order items…from merchants, such as restaurants…”). POSAs understood that this type of service is an example of the type of “delivery service” that the ’090 patent’s Background admits was known in the art. *See* EX1001, 1:33-49.

[0050] The customer "may use the website associated with the [delivery] service provider…to place an order." Rhodes, 9:31-35. The customer's "web browser" and the delivery service's "website" together function as a "buyer application" that "present[s] a GUI on the buyer device…that enables the buyer…to browse through the items available from different merchants" (e.g., restaurants) and "plac[e] an order." Rhodes, 9:28-37, 11:46-51. "[T]he buyer may scroll through the listing of merchants, select a merchant from which to order, and then be presented with a menu of the items provided by the selected merchant." Rhodes, 24:42-45, FIGs. 8-9.

[0051] Rhodes teaches that "[c]onventionally," delivery services charge "delivery fees" that are tied to "delivery zones," such that "the further away the buyer is from the merchant [restaurant], the higher the delivery fee." Rhodes, 2:31-37. Additionally, different restaurants may have different "revenue sharing arrangement[s]" with different delivery services that affect the delivery fees. Rhodes, 3:52-60, Abstract, 3:17-20. For example, a restaurant that has a "higher revenue sharing arrangement" with the delivery service may have "a very large delivery zone" while another restaurant "may have a delivery zone dramatically smaller, due to a lower revenue sharing arrangement" (Rhodes, 3:52-60), such that "the delivery fee is higher for merchants having lower shared revenue and lower for merchants having higher shared revenue values"

(Rhodes, 24:1-4). *See also* Rhodes, 13:43-47 (describing example). The delivery service's website GUI may present to the buyer "merchants and items and the delivery fee that are available for the buyer to select for delivery." Rhodes, 15:14-17, FIGs. 8-9.

D. POSAs' motivations and reasonable expectations in view of teachings of Rahle and Rhodes as understood in light of POSAs' background knowledge (Rahle-Rhodes Combination)

[0052] Rahle's system seeks to gather information about restaurants' menu items from a variety of sources, such that users can compare "aggregated" information in a rich data structure where "more information" provides "enhanced user experience" where "users become more engaged." Rahle, [0004]. *See also* my discussion in Section V.B above (citing, *e.g.*, Rahle, [0004]-[0005], [0023], [0035], [0038]); Rahle, [0064] (describing ways for users to share information about restaurants and dishes using Rahle's system). Information about restaurants' menu items can be gathered both directly from restaurants and/or from "external…third-party website[s] and other data licensed from third-party providers." Rahle, [0038], [0041]. For example, a restaurant "may already have menu items listed on an external website" from which Rahle's system can "gather such menu information." Rahle, [0038]. Also, "a third-party database or external system," such as a "restaurant review website[]," can "provide[] a listing of sub-nodes" including menu items directly to Rahle's system via API, "to be associated with" a particular restaurant's "page object." Rahle, [0021].

[0053] Rahle teaches that one type of "external system" that makes available "a listing of sub-node objects" including a restaurant's menu items is "a food ordering system." Rahle, [0047]. As I discussed in Section V.C above, Rhodes teaches that a known type of food ordering system is a "delivery service," which can provide a website, hosted on a computer, presenting "a menu of the items provided by" each restaurant from which the delivery service delivers. Rhodes, 2:31-34, 3:8-29, 24:42-45, FIGs. 8-9, 9:28-37, 11:46-51, 36:1-12. And the '090 patent acknowledges that it was "background" knowledge that "delivery services" provided "a website or application" that lists "items that are available" for ordering from "restaurants for which the delivery service can deliver." EX1001, 1:25-49 ("Background of the Invention" section). Thus, POSAs would have understood that a delivery service is both "an external website" (external to the restaurant) where a restaurant "may already have menu items listed" and an "external system" (e.g., a "food ordering system") capable of providing restaurant menu items via API, as discussed in Rahle. Rahle, [0038], [0021], [0047].

[0054] Given Rahle's teachings to gather information about restaurants' menu items from such "third-party website[s]" and "third-party external systems" (Rahle, [0038]), POSAs would have been motivated to implement Rahle's system to obtain such information from delivery services like Rhodes's (alternatively or in addition to obtaining menu-item information from other sources Rahle describes). POSAs would have reasonably expected success with this implementation for the reasons I explain below at the end of this Section.

[0055] POSAs would have understood that "receiving, aggregating, and sharing" this information from available sources including delivery services would provide "a better understanding of" the items available from restaurants and "enhanced user experience." Rahle, [0004]. For example, POSAs would have understood that not all restaurant owners may be attentive to providing or updating their own information in a social-networking system, whereas a delivery service's information about the restaurant's menu items may be more likely up-to-date to allow customers to order those items. This understanding is also supported by Rahle itself, which teaches that it is desirable to obtain menu-item data for a restaurant from sources other than the restaurant page owner to identify items being served that the page owner did not input to the social graph. *See* Rahle, [0025]. Therefore, POSAs would have been motivated to implement Rahle's system to obtain menu data from delivery services to capture data that might otherwise be missed or left out-of-date.

[0056] Also, as discussed *supra* §V.C, Rhodes teaches that it was "[c]onventional[]" for customers to order restaurant food from delivery services that may charge differing "delivery fees." Rhodes, 2:31-41. POSAs also know from their own personal experience that different delivery services may charge different delivery fees, since POSAs (like many other people) used such delivery services.

[0057] Based on Rhodes's teachings, POSAs would have understood that delivery services may have differing "revenue sharing arrangement[s]" with restaurants, which may result in different delivery services charging different delivery fees for delivering from the same restaurant. *See*, *e.g.*, Rhodes, 3:52-60, Abstract, 3:17-20, 24:1-4, 13:43-47 (which I discuss in Section V.C above). In my opinion, POSAs would therefore have been motivated to implement Rahle's system to obtain information about restaurants and their menu items from delivery services for the additional purpose of collecting and sharing information about the applicable delivery fees for ordering such menu items from various delivery services, to "enhance[] [the] user experience" by "provid[ing] a better understanding" that includes such "valuable structured information" (Rahle, [0004]) which is readily available from delivery services' websites and systems as Rhodes teaches (Rhodes, 15:14-17, FIGs. 8-9).

[0058] Rahle further teaches generally that "web pages hosted on websites external to the social networking system…may be represented as page objects," and that "[a]ny concept that can be embodied in a web page may become a node in the social graph…in this manner." Rahle, [0015]. Thus, in my opinion, in implementing Rahle's system to obtain restaurant and menu-item information from delivery services having websites, POSAs would further have been motivated to represent each delivery service as a node (e.g., page object) in the social graph. POSAs would have reasonably expected success with this implementation for the reasons I discuss below at the end of this section. Representing each delivery service as a node would further a goal Rahle teaches of using the social graph to allow "users [to] interact with many objects external to the social networking system that are relevant" to an entity the user is interested in, such as a restaurant (e.g., "'San Tung Chinese Restaurant'"). Rahle, [0015].

[0059] In the resulting implementation, a restaurant's page-object node and its menu-item sub-nodes would be linked (associated) with the delivery services' page-object node in the social graph, because both are "attributes" of the delivery service's webpage and have a connection to the delivery service that can be desirably represented as information in the social graph. Rahle, [0014], [0022], [0040]. POSAs would have reasonably expected success because Rahle teaches that nodes (including page objects) and sub-nodes can be linked to multiple different other nodes and sub-nodes. *E.g.*, Rahle, [0035] ("Mexican restaurants represented by page objects…may all serve burritos and be associated with a sub-node object…for 'burrito.'"), [0040] ("multiple streaming music services may be linked to the same sub-node object 104 for a song that is listed on the artist's page on the social networking system 100").

[0060] Additionally, POSAs would have been motivated to associate menu-item sub-nodes with delivery-service page objects to beneficially allow users to search for a menu item and be presented options for delivery services providing that item, potentially with different delivery fees that can also be presented to better inform the user, as Rhodes discloses. Rhodes, 2:31-37, 15:14-17.

[0061] As I noted *supra* §V.B, Rahle discloses that "page objects" for restaurants may have associated "attributes." Rahle, [0014], [0022]. Non-limiting examples of attributes include restaurant "hours, location, recommendations," and "menus." Rahle, [0014]. Rhodes discloses (and POSAs understood) that restaurants have "names" (Rhodes, 24:42-50); thus, in Rahle-Rhodes, it would have at minimum have been obvious to treat the restaurant's name as an "attribute" of a restaurant. POSAs also understood that a restaurant's name uniquely identifies a restaurant because, at least in a given user's city, a restaurant's name uniquely identifies a restaurant.

[0062] Rhodes discloses that restaurants have a "delivery zone"; this "delivery zone" represents a set of locations to which food from the restaurant can be delivered. Rhodes, 4:38-60. In Rahle-Rhodes, POSAs would have been motivated to associate the "page objects" representing restaurants with the restaurants' delivery zones in order to beneficially allow users of the social graph to determine whether food from a restaurant can be delivered to their location. POSAs would reasonably have expected success in such an implementation, because it makes use of capabilities Rahle already discloses, including the "external data gathering module" (to gather delivery-zone data) and "page objects" (representing restaurants to which delivery-zone data is associated). Rahle, Abstract, [0015], [0038].

[0063] POSAs would reasonably have expected success with each aspect of the implementation of Rahle in view of Rhodes that I discussed above in this Section. All of the different implementation aspects I discussed above make use of capabilities Rahle already discloses, including the "external data gathering module," "sub-nodes," and "page objects." Rahle, Abstract, [0015], [0038]. Furthermore, Rahle's system is intended to be flexible and to provide links between sub-nodes and various types of page objects beyond the specific examples Rahle mentions. Rahle, [0015] ("Any concept that can be embodied in a web page may become a node in the social graph."), [0017]-[0018]

(restaurant page object is a "type of node"). I am familiar with the software programming skills of a POSA, as I discussed in Section III above. In my opinion, adapting Rahle's system, which already gathers information on restaurants and their menu items from various sources including "third-party website[s]" and "third-party external systems," to collect such menu data from delivery services that each host menus for multiple restaurants would have been a simple adaptation of Rahle's software programming that was within a POSA's ordinary skill. My testimony regarding a POSA's background knowledge is corroborated by, *e.g.*: Balasubramanian (EX1010), [0009]-[0010] (known in the art to use a "focused crawler. A focused crawler crawls the Web searching for documents and pages that match the focus topic…. For example, a search engine runs focus crawlers for the topics petroleum, music, and technology. Three focus crawlers may crawl the web searching for documents that match the focus criteria."); Singh, (EX1011) [0002] ("Web crawler is an internet bot that browses through the World Wide Web (WWW) for indexing one or more web sites. Some of the web crawlers browse through websites having specific content (e.g., healthcare, technology, etc.). Such web crawlers are usually referred as focused web crawlers, or focused crawlers."); Bhagwan (EX1012), [0005]; He (EX1013), [0003].

E. POSAs' understanding of teachings of Jin (EX1007)

[0064] Jin relates to "information retrieval," including for scenarios where "the user specifies a query…specifying areas of interest, and the system then retrieves documents it determines may satisfy the query." Jin, 1:11-27. The '090 patent similarly relates to information retrieval. *Compare*, *e.g.*, Jin, 1:11-27, *with* EX1001, 15:41-61 (user specifies query and system "retrieves data…that relate to the…search term"), 16:16-23 ("The website database 42 returns basic restaurant **information** for matches for a first page of results (step 90). The website server 44 **retrieves** the matching restaurant results that are available through one or more delivery services….").

[0065] Jin discloses techniques for "search[ing] for documents relevant to a topic." Jin, 2:11-12. Jin's method involves "score normalization" that relies on "statistics"; these statistics include "scores" assigned to "training stories," also called "training documents," where the stories/documents are either "off-topic" or "on-topic" and where a "score" is "a measure of the relevance of a particular [story/document] to a topic." Jin, 3:1-11, 3:54-57. "The training documents are input to a training module" that "examin[es] the frequency of key words in the training documents in order to generate a model…for each topic." Jin 4:30-34. The model "relates to how frequently different key words appear in the training documents that have been annotated as being on-topic for a particular topic.

This frequency is used to characterize the topic." Jin, 4:35-38. This model is then used to compute a document's "score[]." Jin, 4:50-58. Each topic also has a "threshold score" that is "determined by an initial tuning session." Jin, Abstract, 1:66-67, 5:1-6. Subsequently, when a story or document is analyzed for relevance to a topic, it is considered to be "on-topic" if its score is above the "threshold score." Jin, 3:11-25.

F. POSAs' motivations and reasonable expectations in view of teachings of Rahle, Rhodes, and Jin, as understood in light of POSAs' background knowledge (Rahle-Rhodes-Jin Combination)

[0066] POSAs would have been motivated to implement Rahle in view of Rhodes in the same manner and for the same reasons I discussed *supra* §V.D, and additionally to incorporate teachings of Jin as discussed below.

[0067] Rahle says that "sub-node objects" may be "associated with a page object" by "identifying attributes of page objects that match existing sub-node objects." Rahle, [0022]. POSAs seeking to implement Rahle's teaching to identify matching attributes would have been motivated to use Jin's teachings as discussed in Section V.E above as specific techniques for identifying attribute matches, for multiple reasons.

[0068] First, POSAs understood that the task to which Jin is directed—i.e., "search[ing] for documents relevant to a topic" (Jin, 2:11-12), as discussed *supra* §V.E—is well suited to accomplish Rahle's goal of "associat[ing]" "sub-node objects" with page objects by "identifying attributes of page objects that match existing sub-node objects" (Rahle, [0022]). Jin says "[a] topic is one or more words or phrases specifying an area of interest." Jin, 3:41-42. POSAs understood that a food-item sub-node as discussed in Rahle (e.g., "burrito"—Rahle, [0016]) can be a "word[] or phrase[] specifying an area of interest" (Jin, 3:41-42), that a menu portion might be relevant to. Thus, POSAs understood that, just as Jin's techniques are usable to identify whether a particular news-topic concept has a match in an article document in the specific example Jin discusses (Jin, 3:42-44), Jin's techniques would be equally applicable in Rahle-Rhodes to identify whether a particular food-topic concept has a match to items in a menu document such as on a webpage. In particular, items on a restaurant's menu are "attributes" of a "page object" representing a webpage with that restaurant's menu, as discussed *supra* §V.B (e.g., paragraph 45). *See* Rahle, [0022], [0005]. Using Jin's techniques, these items can beneficially be matched to "topics" (concepts) that are the food items represented by sub-nodes, as Rahle teaches. *See* Rahle, [0014]-[0016], [0017]-[0018], [0039]; *supra* §V.B (*e.g.*, paragraphs 32-33).

[0069] Second, POSAs would have been motivated to use Jin's techniques to achieve the benefits Jin teaches, such as better determination of matches. *See* Jin, 7:25-36 (stating that Jin's technique leads to a "more accurate decision" about whether a document matches a topic), 8:52-55 ("From the foregoing description, it should be apparent that an automatic, efficient, and robust system and method for normalizing scores associated with testing documents has been presented.").

[0070] The resulting Rahle-Rhodes-Jin combination is identical to the Rahle-Rhodes combination I discussed *supra* §V.D, with the addition of using Jin's teachings for implementing Rahle's process of identifying matching attributes, as discussed in the previous three paragraphs. For example, as I discussed above, Jin's technique would be used to determine whether a menu item and/or its description on a restaurant menu relate to the "topic" (*e.g.*, a concept) of a food item such as a burrito that is represented by a sub-node object. *Supra* §V.E; Jin, 3:5-11, 3:54-57. Additionally, Jin says "training documents" may be "any…files or data that are identifiable by their association with one or more topics"; thus, in Rahle-Rhodes-Jin, where the relevant "topics" are food items, POSAs would have found it obvious to use previously collected menu items, as "training documents," since those items would be "identifiable by their association with" food items. Jin, 3:35-44. Furthermore, Rahle discloses "analyz[ing] user feedback…to train the data mapping model for mapping sub-node objects to page objects based on external data" (Rahle, [0044]), and Jin says a "human annotator" may "label[]…training documents as being" "on-topic" or "off-topic" (Jin, 6:51-56). Thus, in view of Jin, POSAs would have been motivated and reasonably expected success to implement Rahle's training of the data mapping model by labeling pairs in which a page is "on-topic" for a sub-node object as being good matches, where the matching is done using Jin's word frequency techniques.

[0071] POSAs would reasonably have expected success implementing Rahle's attribute identification using Jin's techniques because those techniques were within a POSA's skill to implement via a processor executing instructions, as Rahle discloses (*see supra* §V.B (e.g., paragraph 47). *See* Jin, 2:20-23 ("apparatus consistent with [Jin's] invention" includes "a memory having program instructions and a processor responsive to the program instructions").

G. POSAs' understanding of teachings of Belousova (EX1008)

[0072] Belousova discloses a "restaurant service system includ[ing] a restaurant server" that "builds a food taxonomy including dishes, dish attributes and dish ingredients." Belousova, Abstract. A "restaurant service" is a service that "aggregates the participating restaurants' menus, each of which includes a plurality…of menu items," each of which has a "title (meaning a name), a description…and attributes, such as price." Belousova, 1:22-27. "A dish is a food item that has the same or different menu item titles in different menus."

Belousova, 7:21-29. Belousova's system can be used for "food search and food ordering." Belousova, 4:40-43.

[0073] Like Rahle, Belousova recognizes that "[t]wo menu items from two different restaurants may indicate the same dish…but have different menu item titles." Belousova, 2:3-6; Rahle, [0022]. This is also consistent with a POSA's understanding (*e.g.*, different Chinese restaurants may refer to the same dish as "General Gau's Chicken" or "General Tso's Chicken"). Belousova notes that these different names for the same items may cause "conventional restaurant service[s]" to "treat the two menu items as two unrelated items, and thus provide inferior food search results." Belousova, 2:6-9. Belousova's "taxonomy" addresses the shortcomings of conventional restaurant services by "provid[ing] superior food search results and recommendation, and rich navigation and discovery capabilities." Belousova, 2:19-29.

[0074] Belousova represents "dishes" in its "taxonomy" as "nodes," where each node for a dish has "properties, such as dish attributes and dish ingredients." Belousova, 3:62-4:1. This is similar to Rahle's representation of menu items, with Belousova's use of "nodes" for dishes and Rahle's use of "sub-nodes" for menu items being merely a difference in terminology reflecting the fact that Rahle's menu-item sub-nodes are associated with restaurant "nodes" that serve them. The nodes representing dishes in Belousova's taxonomy are arranged hierarchically such that, for example, "nodes" for different kinds of salads are all descendants of a "root node" for "salad." Belousova, 6:56-7:4, Fig. 20. For each dish, the "taxonomy" also includes "attributes" such as "[h]ealthy" or "vegan," and "ingredients" such as "noodle" and "tofu." Belousova, Abstract, 7:30-43, Figs. 15, 20 (below).

<u>**2000**</u>

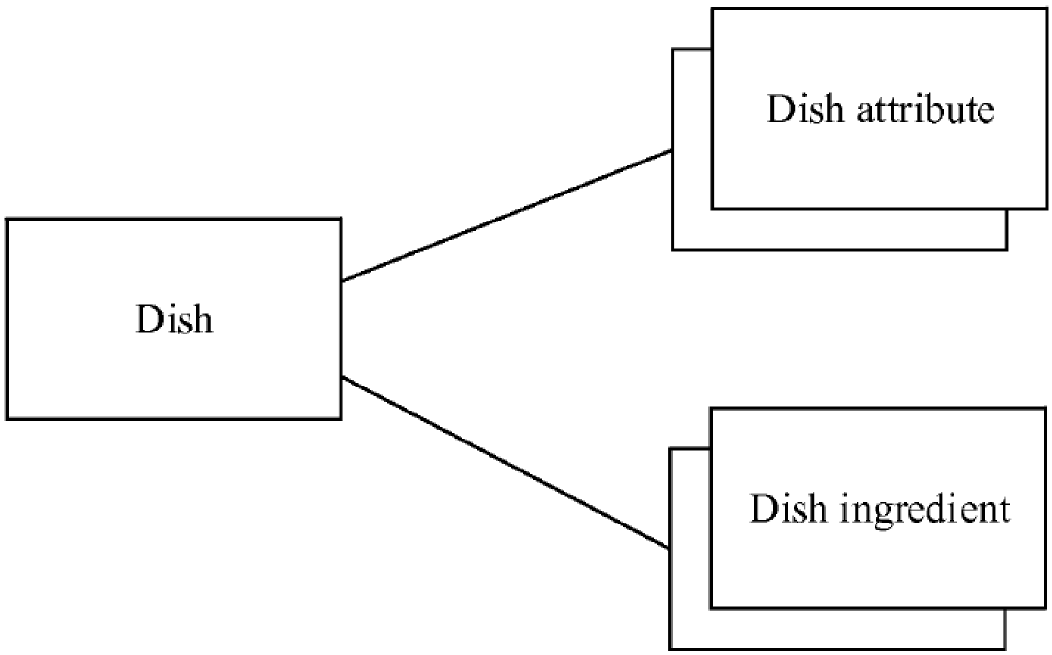
2002 2004 2006 2008

- [0] Salad
  - [1] Chicken Salad
    - [2] Grilled Chicken Salad
    - [2] Chicken Salad Sandwich
  - [1] Caesar Salad
    - [2] Chicken Caesar Salad
  - [1] Tuna Salad
  - [1] Greek Salad
  - [1] House Salad
  - [1] Garden Salad
  - [1] Chef Salad
  - [1] Green Salad
  - [1] Cobb Salad
  - [1] Spinach Salad
  - [1] Potato Salad
  - [1] Shrimp Salad
  - [1] Egg Salad
  - [1] Antipasto Salad
  - [1] Salad (Lunch Only)
  - [1] Chicken Salad Sandwich
  - [1] Taco Salad
  - [1] Side Salad
  - [1] Chopped Salad
- [0] Pizza
  - [1] Cheese Pizza
  - [1] Veggie Pizza
  - [1] Pizza and
  - [1] Hawaiian Pizza
  - [1] White Pizza
  - [1] Large Pizza
  - [1] BBQ Chicken Pizza
  - [1] Pizza Slice
  - [1] Pepperoni Pizza
  - [1] Buffalo Chicken Pizza
  - [1] Margherita Pizza

- [0] Sandwich
  - [1] Chicken Sandwich
    - [2] Grilled Chicken Sandwich
  - [1] Cheese Sandwich
    - [2] Grilled Cheese Sandwich
  - [1] Club Sandwich
  - [1] Turkey Sandwich
  - [1] Steak Sandwich
  - [1] Sandwich with2 Toppings
  - [1] Egg Sandwich
  - [1] BLT Sandwich
  - [1] Sandwich Combo
  - [1] Parmigiana Sandwich
  - [1] Roast Beef Sandwich
  - [1] Chicken Salad Sandwich
  - [1] Veggie Sandwich
  - [1] Sandwich (Lunch Only)
  - [1] Ham Sandwich
- [0] Pasta
  - [1] Ravioli
    - [2] Cheese Ravioli
  - [1] Penne
  - [1] Lasagna
  - [1] Baked Ziti
  - [1] Linguine
  - [1] Tortellini
  - [1] Rigatoni
  - [1] Fettuccine Alfredo
- [0] Sushi
  - [1] Roll
  - [1] Nigiri Sushi
  - [1] Tuna
  - [1] Sashimi
- [0] Steak
  - [1] Pepper Steak
  - [1] Sirloin
  - [1] Steak Sandwich
  - [1] Filet Mignon

FIG. 20

Belousova, Fig. 20



Belousova, Fig. 15

[0075] Belousova's taxonomy is stored in a "database operatively coupled to the restaurant server." Belousova, 5:35-38, 7:14-15. Belousova's taxonomy is built by a "server software application." Belousova, 7:44-45. For each restaurant, the application "retrieves the menu and menu items of the restaurant" and "saves the menu and the menu items into the database." Belousova, 7:49-51, 7:66-67. "Inside the database…the menu is associated with the restaurant…, and each menu item is associated with the menu" and "also associated with the restaurant." Belousova, 7:67-8:4. The application also "maps…menu items to dishes." Belousova, 8:4-7. The server software performs "one or more processes to map menu items to dishes." Belousova, 8:41-43. One such process uses, "[f]or each dish in the taxonomy, a machine learning based classifier" that is "trained from the menu items mapped to [a] dish. The trained classifier is then applied to new menu items and unmapped menu items to determine whether they should be mapped to the dish." Belousova, 10:15-19.

[0076] Belousova discloses that each "menu item" that a dish gets mapped to is represented by a "menu item record" and that a "menu item dish mapping between the menu item record and the dish record" is stored in Belousova's "database." Belousova, 8:8-12. POSAs understood, or at least would have found obvious, that the "menu item dish mapping" is implemented via references from the dish records to the menu item records, as such references were the customary way to create connections between objects and were within a POSA's programing skill. My testimony regarding a POSA's background knowledge is corroborated by, *e.g.*: Leivent (EX1019), 1:22-24 ("In object-oriented database systems, and any other systems having large numbers of inter-connected objects, inter-object references, sometimes called pointers, provide a complex structure providing access to the stored objects."), 1:42-49 ("Every object-oriented database system has some way to identify an object.

Currently, some systems use an 'object identifier' (OID), which embodies a reference to an object. Some systems use pointers. An operation called 'dereferencing', finds an object by following a pointer to the object and by making the object available to a requesting application."); Mori (EX1020), [0004] ("…in the direct access type hierarchical database, pointers provided in the respective segments point to other segments to thereby maintain the tree structure of the segments in the database"); Johnson (EX1021), 3:35-45 ("A reference is a link or pointer to another object, and implies a relationship to that other object. A reference is typically used when it is desired not to duplicate data.").

H. POSAs' motivations and reasonable expectations in view of teachings of Rahle, Rhodes, and Belousova, as understood in light of POSAs' background knowledge (Rahle-Rhodes-Belousova Combination)

[0077] Belousova's "taxonomy" and Rahle's "social graph" both represent food items as "nodes" (called "sub-nodes" in Rahle) and link those food-item nodes to menus of restaurants that serve those items. Belousova, 3:62-4:1; Rahle, [0014]-[0015], [0022], [0005]; *supra* §§V.B, V.G. Specifically, in Rahle, a "sub-node" representing a "menu item" is stored with connections to all nodes representing restaurants that serve that menu item; "a sub-node for burritos, for example, may be used for all restaurants serving burritos, enabling users…to compare user reviews…of burritos nearby." Rahle,

[0016], [0023]-[0024], [0035]; *supra* §V.B. Likewise, in Belousova, a "dish," which is represented by a "node," is also mapped to "menu items" on restaurant menus. Belousova, 3:62-4:1, 8:4-7. Thus, POSAs understood that Belousova uses the term "dish" for what Rahle refers to as a "menu item," and that in both cases, the dish/item is associated with restaurant menus. Belousova and Rahle also both disclose that nodes for food items can have properties such as ingredients or other "attributes" (e.g., "[h]ealthy," "vegan") associated with them. Belousova, Abstract, 7:30-43, Fig. 15; Rahle, [0022] (referring to "attributes of a particular meal…such as…vegetarian, vegan, and gluten-free"), [0056] (referring to "sub-node attributes"). Furthermore, POSAs understood that Belousova's "taxonomy" (Belousova, 3:61-4:1) is a graph structure, like Rahle's "social graph" (Rahle, [0014]) in that it represents concepts as nodes and relationships between those concepts as associations/links/edges connecting the nodes. My testimony regarding a POSA's background knowledge is corroborated by, *e.g.*, Subramani (EX1018), [0002] ("A graph is collection of vertices (sometimes referred to as 'nodes') and edges. The nodes of a graph may represent any entity, and an edge may represent a relationship between the nodes connected by the edge."). Moreover, Belousova refers to its "taxonomy" as a "graph." *E.g.*, Belousova, 6:56-57 ("A food taxonomy of a restaurant service includes a hierarchical graph of dishes….”), 7:5-6 (describing exemplary taxonomy shown in Fig. 20 as a “directed graph”).

[0078] POSAs would have found it obvious to implement Rahle using Belousova’s teachings in either or both of the two manners discussed below, which are each implementable independently of each other and would have been obvious to a POSA independent of each other.

[0079] First, Belousova teaches to use such a graph structure with nodes representing restaurants and the food items they serve to provide a “food ordering” service. Belousova, 4:39-44. In view of Belousova’s teachings and the similarities between the data structures and system components described in Rahle and Belousova, POSAs would have been motivated and reasonably expected success to add such a service to Rahle’s “social networking system” (Rahle, Abstract) using Rahle’s restaurant-and-food graph structure, whether as a separately provided service (e.g., with a separate user interface) or integrated with the rest of Rahle’s social-network service, to beneficially enable users of Rahle’s system to order food.

[0080] Second, as discussed *supra* §V.D, in Rahle-Rhodes, “sub-nodes” representing menu items are linked to “page objects” representing websites showing restaurant menus, as Rahle teaches, where the websites can be either restaurant websites or websites of “delivery services” as Rhodes teaches.

Rahle, [0014]-[0018], [0039]; Rhodes, 1:11-15, 2:42-45, 3:8-29. Rahle teaches to implement its "sub-node generating module" to determine which menu items are linked to which websites. Rahle, [0037]-[0038]. POSAs looking for specific ways to implement Rahle's teachings would have been motivated and reasonably expected success to use Belousova's technique of using a "classifier" to map "menu items to dishes" (*i.e.*, sub-nodes in the graph) (Belousova, 8:4-7, 10:15-19) in order to achieve Belousova's benefits, discussed in the previous paragraph, and because "classifiers" such as Belousova's were well-known software modules that were within a POSA's skill to implement. My testimony regarding a POSA's background knowledge is corroborated by, *e.g.*, Zhou (EX1031), [0002] ("In many classification problems, a set of possible classes may be organized in a hierarchical structure or a more general taxonomy according to semantic relationships among classes. Classification problems are typically solved by using a classification algorithm to train a classifier. The classifier maps various objects, e.g., documents, web pages, to appropriate classes."); Millis (EX1032) [0002] ("Development of a taxonomy involves the assignment of classifiers to attributes of an entity. An attribute is a feature of the entity. For example, where the entity is a company, attributes of the company may include customer service, pricing, and shipping policy. A classifier is a word that is related to an attribute that describes the attribute for a particular entity.”).

[0081] In the implementation of Rahle in view of Belousova that I discussed above, POSAs understood, or at least would have found obvious, that the sub-node representing a particular food item contains references to that same food item listed as a menu item on the menus of restaurants that serve that item. Belousova discloses that each “menu item” that a dish gets mapped to is represented by a “menu item record” and that a “menu item dish mapping between the menu item record and the dish record” is stored in Belousova’s “database.” Belousova, 8:8-12. POSAs understood, or at least would have found obvious, that the “menu item dish mapping” is implemented via references from the dish records to the menu item records, as such references were the customary way to create connections between objects and were within a POSA’s programing skill. My testimony regarding a POSA’s background knowledge is corroborated by, *e.g.*: Leivent (EX1019), 1:22-24 (“In object-oriented database systems, and any other systems having large numbers of inter-connected objects, inter-object references, sometimes called pointers, provide a complex structure providing access to the stored objects.”), 1:42-49 (“Every object-oriented database system has some way to identify an object. Currently, some systems use an ‘object identifier’ (OID), which embodies a reference to an object. Some systems use pointers. An operation called 'dereferencing', finds an object by following a pointer to the object and by making the object available to a requesting application."); Mori (EX1020), [0004] ("…in the direct access type hierarchical database, pointers provided in the respective segments point to other segments to thereby maintain the tree structure of the segments in the database"); Johnson (EX1021), 3:35-45 ("A reference is a link or pointer to another object, and implies a relationship to that other object. A reference is typically used when it is desired not to duplicate data."). Thus, in Rahle-Rhodes-Belousova, where what Belousova calls "dishes" are represented by sub-nodes, POSAs would have found it obvious in view of Belousova to implement the sub-nodes with references to corresponding items on restaurant menus.

[0082] In all other respects, the Rahle-Rhodes-Belousova combination is identical to the Rahle-Rhodes combination discussed in Section V.D above.

[0083] Additionally, Belousova teaches storing a graph structure like Rahle's in a "database." *E.g.*, Belousova, 7:14-15 ("The nodes and the node properties are stored in the database[.]"), 7:48-49 ("The food taxonomy data is stored in a database."), 3:20-25, 6:37-45, Figs. 1-6. Thus, Belousova provides additional teachings evidencing the obviousness of storing Rahle-Rhodes's social-graph data in a database as I discussed *supra* §V.D (*e.g.*, paragraph 52).

I. POSAs' motivations and reasonable expectations in view of teachings of Rahle, Rhodes, Belousova, and Jin, as understood in light of POSAs' background knowledge (Rahle-Rhodes-Belousova-Jin Combination)

[0084] In my opinion, POSAs would have been motivated to incorporate the teachings of Jin that I discussed *supra* §V.E into the Rahle+Rhodes+Belousova combination I discussed *supra* §V.H, and would reasonably have expected success doing so, for the same reasons I discussed *supra* §V.F for incorporating Jin's teachings into Rahle+Rhodes. The same reasons apply because the addition of Belousova to the Rahle+Rhodes combination does not impact any part of Rahle+Rhodes that is relevant to the reasons for combining Rahle+Rhodes with Jin. The resulting Rahle+Rhodes+Belousova+Jin combination is identical to the Rahle+Rhodes+Belousova combination that I discussed *supra* §V.H, except that it further uses Jin's teachings in the same manner I discussed *supra* §V.F.

VI. APPENDIX: PETITION'S MAPPING OF PRIOR ART TO '090 PATENT'S CLAIMS

[0085] I understand that the Petitioner is filing a Petition for *inter partes* review arguing that claims 1-17 of the '090 patent would have been obvious to a POSA in view of the prior art that I discussed in Section V above. I agree that claims 1-17 would have been obvious over the prior art. I understand that the Petition presents a mapping of the prior art to claims 1-17 of the '090 patent substantially as set forth in Section VI below. I agree with this mapping, and in my opinion all of the statements in Section VI below are accurate.

A. Ground 1: RAHLE+RHODES RENDERs OBVIOUS CLAIMS 1-7, 11-17

1. Claim1: [1Pre] A computer-implemented method for providing a searchable aggregated data structure for a networked application, the method comprising:

[0086] Rahle's claims are "method" claims. See Rahle at page 10-13. Rahle's methods are for providing a "social graph [that] includes nodes connected by edges that are stored on a social networking system." Rahle, [0014].

[0087] "Nodes include…objects of the social networking system, such as web pages embodying concepts and entities, and edges connect the nodes." Rahle, [0014]. One type of node is "a graph object for a restaurant" whose "web page[] may be represented as [a] page object in the social networking system." Rahle, [0014]-[0015]. Within the graph, there are "sub-node objects" that represent potential "attributes of page objects" (nodes), "such as menu items for a restaurant." Rahle, [0022], [0005]. By "generat[ing] associations between…sub-nodes and [a] node," the graph stores information about which "menu items [are] served by a restaurant," for example. Rahle, [0005].

[0088] Rahle's social graph—or alternatively a portion of the social graph containing nodes representing restaurants and sub-nodes representing menu items—is *a searchable aggregated data structure*.

[0089] The graph is composed of "***structured data***" (Rahle, [0064]) including nodes and sub-nodes connected by edges/associations (Rahle, Abstract, [0014], [0005], [0018], FIG. 1 below); thus, it is a *data structure*.

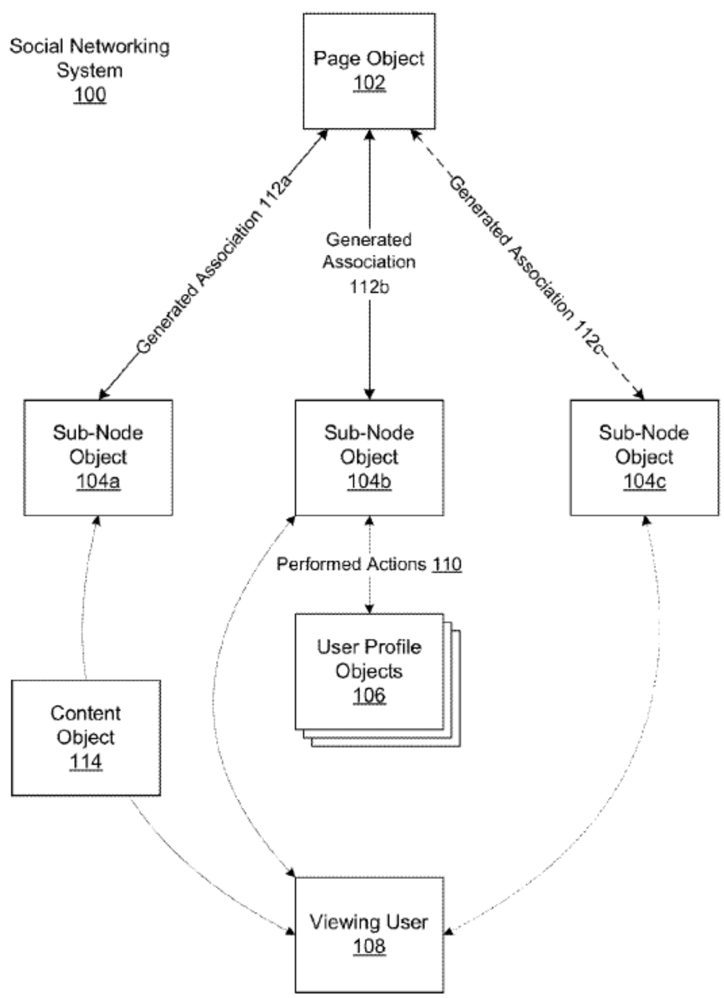


FIG. 1

[0090] Information in the graph is "***aggregated***," including around menu-item sub-node objects (Rahle, Abstract, [0004]-[0005], [0023], [0035], [0064]); thus, the graph is an *aggregated data structure*. Furthermore, the graph can be "***searched***"—e.g., for restaurants that serve a user's desired menu item, or for known menu items that are already represented as sub-nodes to be associated with a restaurant newly identified as serving those items. Rahle, [0022]-[0023], [0031], [0047]-[0049], claims 27-28. Thus, the graph is a *searchable aggregated data structure*.

[0091] Rahle's methods are "***implemented by computer***" in a "social networking system 100" including a "web server 208" and other *computer-implemented* "modules." Rahle, [0067]-[0070], [0029]-[0036], FIG. 2 (below).

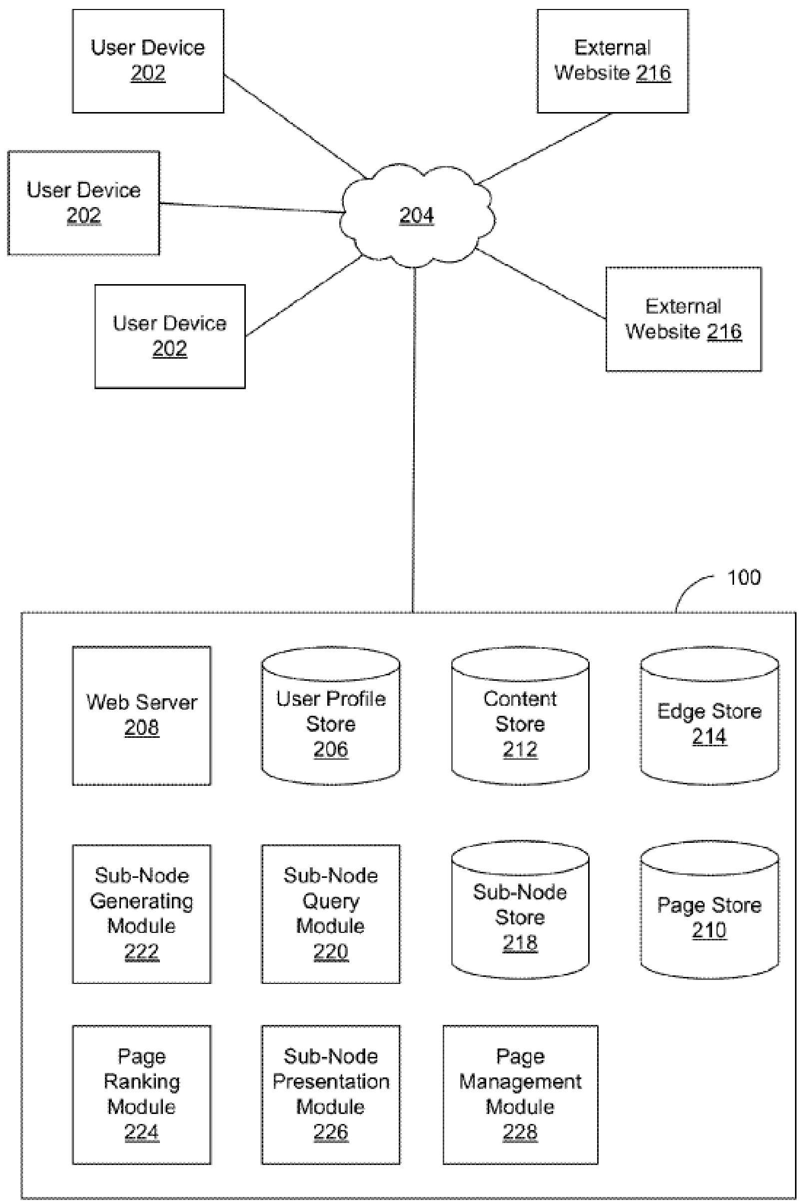


FIG. 2

[0092] Rahle's social networking system 100 (shown in Figure 2 above) includes "modules for various ***applications***," and it interacts via "***network*** 204" with "user devices 202" that execute "an ***application***, for example, a browser ***application***…to interact with the social networking system 100," such as by searching the social graph. Rahle, [0026]-[0031], [0023], claim 8. Thus, Rahle's *searchable aggregated data structure* is *provided for a networked application*.

a. [1A]: acquiring by a processor source data from a plurality of delivery service computers associated with a plurality of food or beverage delivery services over a communication network, the acquired source data being in a plurality of formats, where the acquired source data includes, for each of the plurality of food or beverage delivery services, data representing multiple source menu items,

[0093] Rahle's techniques "can be executed by a computer ***processor*** for performing any or all of the steps, operations, or processes described." Rahle, [0068]. Rahle's techniques discussed *supra* §V.B include *acquiring source data from a plurality of computers over a communication network, where the acquired source data includes data representing multiple source menu items*.

[0094] For example, in Rahle, "[a]n external data gathering module" executed by the system's *processor* "interfaces with external websites" to *acquir[e] source data representing source* "***menu items*** listed on [the] external website[s]" as being *provided by* particular restaurants. Rahle, [0038].

[0095] The data acquired by Rahle's system *includes multiple source menu items* provided by multiple restaurants. For example, Rahle discloses that the acquired data can include data representing "nachos" and "flan" as menu items provided by one "Mexican restaurant," data representing "burritos, quesadillas, and nachos" as menu items provided by another "Mexican restaurant," and data sufficient to identify "all restaurants serving burritos." Rahle, [0021], [0036], [0016], [0035], [0059] (Rahle's system "provide[s] an interface for users to view…food ***items***…such as tacos, burritos, and quesadillas, as well as ***restaurants*** represented by pages that serve these items"). Furthermore, as discussed *supra* §V.D and further below, in Rahle-Rhodes, the acquired data may include the same restaurant's menu acquired from multiple sources (*e.g.*, websites of different delivery services serving that restaurant). The various menu items are the *source menu items*, *i.e.*, items on restaurant menus.

[0096] The "external websites" are hosted on *a plurality of computers* from which the system 100 *acquires* this *source data over* "***network*** 204" (*a communication network*), as shown in FIG. 2 (below). Rahle, [0026]-[0030].

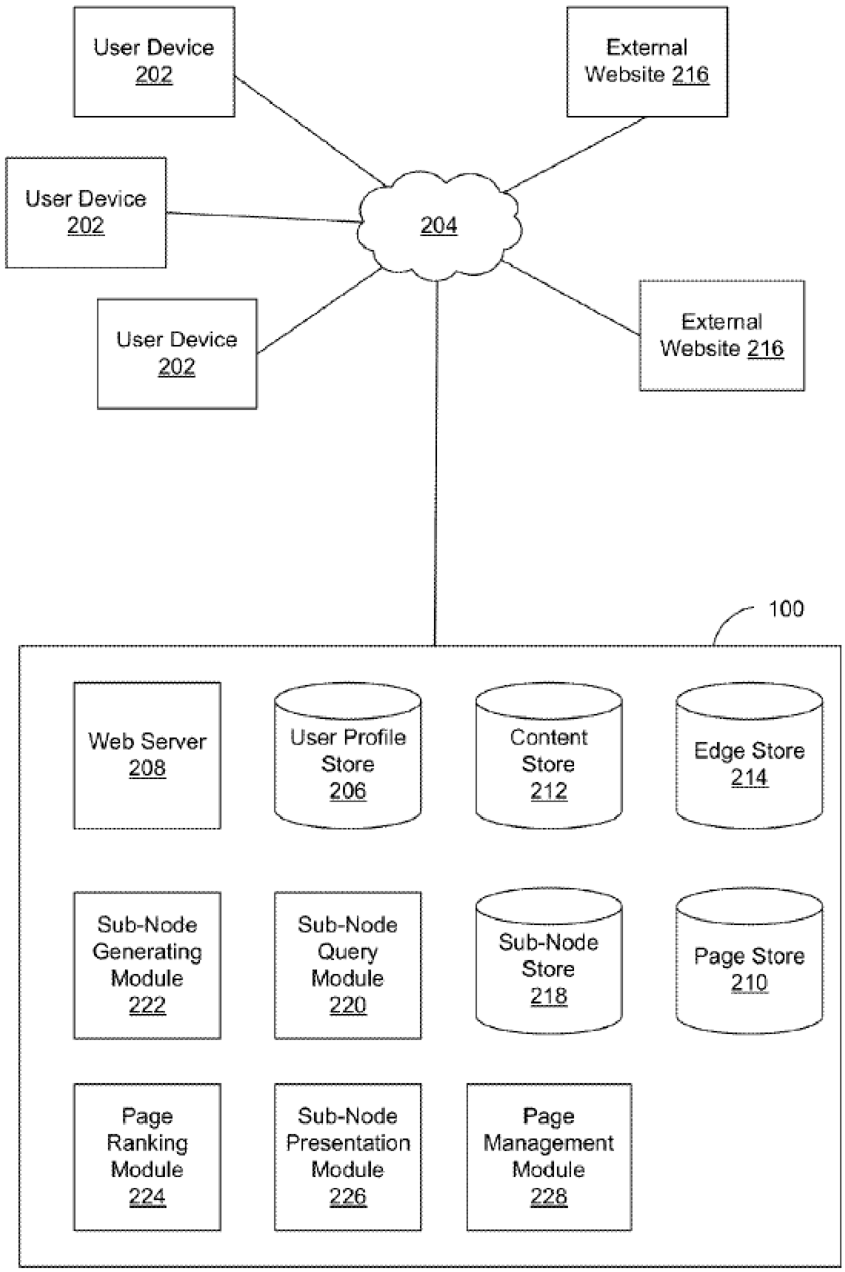


FIG. 2

[0097] In the Rahle-Rhodes combination, Rahle's *processor acquires* this *source data from a plurality of food or beverage delivery services* like Rhodes's; these delivery services use *computers* (Rhodes, 36:1-12), which host "external website[s]" or "external systems" from which source menu data is acquired in Rahle (Rahle, [0038]); *supra* §V.D. Thus, in Rahle-Rhodes, the delivery services' computers are *a plurality of delivery service computers associated with a plurality of food and beverage delivery services*, and Rahle's system *acquires source data* from these computers *over a communication network* as discussed in the previous paragraph.

[0098] Rhodes teaches that each delivery service has a "computing device 102" that communicates over "network(s) 106" and can host a website presenting "a ***menu*** of the ***items*** provided by" each *restaurant* from which the delivery service delivers. *See* Rhodes, 36:1-37:49 ("service computing device 102" includes "communication interface(s)" enabling communication over networks such as "Internet" or "cellular networks"), FIG. 1 (showing "Service Computing Device(s) 102" connected to other devices over "Network(s) 106"), FIG. 12 (illustrating components of "service computing device"), 24:42-45 (user may use buyer application to "select a merchant from which to order, and then be presented with a ***menu*** of the ***items*** provided by the selected merchant"), 25:64-26:1 (describing "Italian ***Restaurant***" as an exemplary "merchant"), FIGs. 8-9 (illustrating buyer application, *see* 23:1-4, 25:64-26:1), 9:28-37 (buyer can use buyer application to place order from a "service provider," *i.e.*, a delivery service as explained *supra* §VI.B), 11:46-51 (buyer can browse "items available from various different merchants" and place order with delivery service).

[0099] Rhodes teaches that the source data that can be acquired from each one of the plurality of food or beverage delivery services includes data representing multiple source menu items provided by multiple restaurants—for example, "California burrito," "chili queso & chips," various "tacos," and "iced tea" provided by "The Tex-Mex Restaurant," and "spaghetti primavera" and "cheese lasagna" provided by "The Italian Restaurant." Rhodes, FIGs. 8-10, 3:11-16, 11:46-51 (delivery service website allows buyer "to browse through the items [plural] available from various different merchants").

[0100] Finally, Rahle teaches that "listing[s]" of "sub-node objects" received "through an external system" can be in the form of an "Excel spreadsheet, a database file, or a comma separated value file." Rahle, [0047]-[0049]. Additionally, Rahle teaches that "data exchanged over [a] network" linking the social networking system with external websites can be "represented using technologies and/or ***formats*** including the hypertext markup language (HTML) and the extensible markup language (XML)." Rahle, [0028]. Thus, Rahle discloses the *acquired source data being in a plurality of formats*. *Compare* Rahle, [0028], *with* EX1001, 10:40-11:2 (referring to delivery service computers storing data in various "file formats" and noting that "data acquisition and processing module" can acquire data in "format[s]" including "HTML" and "XML").

b. [1B]: wherein said acquiring source data comprises one or more of: employing an application programming interface to interface with the plurality of delivery service computers, or scraping data from the plurality of delivery service computers;

[0101] Rahle discloses that a "third-party external system may have listings of sub-nodes that are associated with [a] page object, such as menu items that a particular restaurant serves," and that "[t]hrough an ***interface*** with the social networking system, sub-nodes may be generated for respective page objects representing the restaurant," where the sub-nodes may include "menu items served by the restaurant." Rahle, [0016]. One such "interface" disclosed by Rahle is an "***application programming interface (API)***," which third parties may use "to generate sub-node objects…to be associated with a particular page object…such as…a menu of food items for a restaurant." Rahle, [0032]; *see also* Rahle, [0047]. As discussed *supra* §V.D, in Rahle-Rhodes, Rhodes's "delivery services" are third parties whose *plurality of delivery service computers* (*supra* §VI.A.1.a ([1A])) submit data to Rahle's social networking system. Thus, in Rahle-Rhodes, *acquiring source data comprises employing an application programming interface to interface with the plurality of delivery* *service computers*. This is sufficient to meet claim 1, which can be met by any "***one*** *or more of*" the two recited options for *acquiring*.

[0102] Rahle also discloses an "external data **gathering** module" that "interfaces with external websites"—such as Rhodes's delivery-service websites in Rahle-Rhodes (as discussed *supra* §V.C)—"to process information about sub-node objects…of the social networking system…. For example, a page owner of a page object…for a restaurant may…have menu items listed on an external website…. The external data **gathering** module…may be used to gather such menu information…to generate sub-nodes." Rahle, [0038]. POSAs understood that "gathering" information from the external websites involves what the '090 patent refers to as *scraping*, or at least would have found it obvious to implement Rahle this way, for the reasons discussed in Section V.B above (e.g., paragraph 38).

c. [1C]: mapping by the processor the acquired service data according to a predetermined data format to provide formatted data;

[0103] The *acquired source data* (*supra* §VI.A.1.a ([1A])) includes menu items acquired from Rhodes' delivery service webpages/systems; this data is acquired *service* data, as it is acquired from a delivery service and can be compared with data from other delivery services, such as in the linking, identifying, and combining processes discussed below for [1D]-[1F]. *See*

EX1001, 3:56-58 ("'Service data" as used herein refers to data retrieved from a particular delivery service source that is capable of being compared with similar data from a different delivery service source.") The menu items are stored in Rahle's "social graph," as discussed *supra* §VI.A.1 ([1Pre]). Rahle, [0005], [0014]-[0015], [0022]. Rahle's social graph uses a *predetermined data format* that represents information as node objects (including page objects), sub-node objects, and edges/associations linking nodes and sub-nodes; the sub-nodes objects are stored in a "sub-node store," ([0031]), page objects are stored in a "page store," ([0031]), and edges are stored in an "edge store" ([0034]). Storing the menu information in Rahle's format involves *mapping*, *i.e.*, converting, the information from the format in which it existed on the third-party websites/systems into the Rahle's format, to *provide formatted data* (*i.e.*, data in Rahle's social graph). *See* EX1001, 11:29-32 ("A mapping module…transforms the received raw files by converting the raw files from its particular source format to a standardized format.").

[0104] As discussed *supra* §VI.A.1.a ([1A]), Rahle's techniques "can be executed by a computer ***processor*** for performing any or all of the steps, operations, or processes described"; thus, the *mapping* is performed *by the processor*. Rahle, [0068].

d. [1D]: linking by the processor the formatted data to common sources of the source menu items, each of the

common sources being represented by source identification data uniquely identifying a respective one of the sources, such that at least one food or beverage delivery service is linked to each common source and its source menu items;

[0105] As discussed *supra* §VI.A.1.a ([1A]), the *source menu items* are the items on the menus of restaurants. Thus, the *sources of the source menu items* include restaurants, as the '090 patent describes. *E.g.*, EX1001, 5:65-6:10 (referring to "example apparatuses" that collect "data representing multiple source menu items provided by multiple restaurants"), 5:46-56, 9:13-17 (referring to "source menus from linked restaurants"), 12:1-13 (referring to "source restaurant").

[0106] In Rahle's system, a "graph object for a restaurant may have several defined attributes," including "location." Rahle, [0014]. Rahle's system includes a "data mapping module" that maps "data gathered from external systems" to "the correct page object" "based on analyzing attributes of the page objects to identify matching external data." Rahle, [0039]-[0040]. Thus, Rahle teaches that the data mapping module *links* the *formatted data*, *i.e.*, the formatted menu-item data gathered from external systems (*see supra* §VI.A.1.c for [1C]), to the correct page object for a restaurant *based on* "attributes" including, *e.g.*, the restaurant's "location" as matched in the external data.

[0107] "Restaurant location data" is a type of *source identification data*. *See* EX1001, claim 4. As discussed *supra* §V.B, POSAs understood that a restaurant's location *represents* a restaurant and *uniquely identifies* the restaurant, because no two restaurants can have precisely the same location. Furthermore, as discussed *supra* §V.C, Rhodes discloses (consistent with POSAs' understanding) that restaurants have "names"; thus, in Rahle-Rhodes, it would at minimum have been obvious to treat the restaurant's name, *i.e.*, *restaurant name data*, as an "attribute" of a restaurant. Rhodes, 24:42-50; Rahle, [0014], [0022]. A restaurant's name is also *source identification data*, *see* EX1001, claim 4, and POSAs understood the name *uniquely identifies* the restaurant as discussed *supra* §V.D.

[0108] The restaurants that the *formatted data* is linked to are *common sources*, for two independent reasons. First, the restaurants share menu items in common. *Supra* §V.B; Rahle, [0016], [0023]-[0024], [0035]. Second, in Rahle-Rhodes, any restaurant may be served by multiple delivery services. *Supra* §V.D; *see* EX1001, 11:56-61 (referring to a "master ***restaurant***…that may be ***common*** across multiple delivery services"). Additionally, as explained *supra* §V.C, in Rahle-Rhodes, a restaurant's page-object node and its menu-item sub-nodes are linked in the social graph with the page-object node for any delivery service serving the restaurant. Rahle, [0014], [0022], [0040]. Thus, *at* *least one food or beverage delivery service is linked to each common source and its source menu items*. This linking is performed *by the processor* for the same reasons discussed *supra* §VI.A.1.c ([1C]).

e. [1E]: identifying by the processor common menu items among the source menu items in the formatted data, and, for each identified common menu item, associating the source menu items with a master menu item;

[0109] As discussed *supra* §V.D, in Rahle-Rhodes, "sub-nodes" represent food items such as burritos that may appear in multiple menus from multiple restaurants, and these sub-nodes are associated with "page objects" representing restaurant menu websites or delivery-service websites. Rahle, [0014], [0022], [0040]. Rahle says that "sub-node objects" may be "associated with a page object" by "***identifying*** attributes of page objects that match existing sub-node objects." Rahle, [0022]. Thus, Rahle associates the sub-node for a food item (*e.g.*, a burrito) with the page object representing a restaurant or delivery service website by *identifying* the listing of a burrito as an item on the website as an "attribute" of the page object representing the site, which "match[es]" the "sub-node object[]" for the burrito menu item. Rahle, [0022].

[0110] The burrito is a *common menu item*, because it is a menu item that appears on, and is thus *common* to, multiple menus. Rahle, [0035] ("Mexican restaurants represented by page objects 102 may all serve burritos and be associated with a sub-node object 104 for 'burrito.'"), [0016], [0023]-[0024], [0059]. As discussed *supra* §VI.A.1.a ([1A]), the restaurant menu items are the *source menu items*, which are in *source data*. Thus, Rahle teaches that the *source menu items* appear *in the formatted data* that is created by formatting the source data as discussed *supra* §VI.A.1.c ([1C]). Moreover, Rahle discloses that there are multiple items common to different menus. Rahle, [0036] ("The page object… may provide a complete listing of the ***menu items*** served, including burritos, quesadillas, and nachos."), [0059] ("a viewing user may view typical Mexican food items, such as tacos, burritos, and quesadillas, as well as restaurants represented by pages that serve these items"). In Rahle-Rhodes, which gathers menu-item information from multiple delivery services that can serve food from the same and/or different restaurants as discussed *supra* §V.D, Rahle's system will identify not only menu items that are *common* to multiple restaurants, but also *common* to multiple delivery services (e.g., multiple delivery services serving the same restaurant and/or serving different restaurants that offer the same menu item). Thus, Rahle *identifies common menu items among the source menu items in the formatted data*. The *identifying* is performed *by the processor* for the same reasons discussed *supra* §VI.A.1.c ([1C]).

[0111] The ’090 patent describes an exemplary “*master menu item*” as a logical representation of a menu item that is linked to the corresponding item on the menus of various restaurants; in other words, for example, if multiple restaurants have pizza as a menu item, those menu items may all be associated with a master menu item representing pizza. *Supra* §V.A; EX1001, 13:5-9 (“In an example method, the trained algorithm identifies sets of identical items…. For each set of identical items that is identified, all items in the set are linked (e.g., related) to a combined master menu item…”), 13:14-17; 13:62-64 (system allows identification of “all restaurants associated with [the] label” “pizza”). Rahle likewise discloses that a “sub-node” representing a food item such as a burrito may be linked to the menus of multiple restaurants serving burritos. Rahle, [0016] (“a sub-node for burritos, for example, may be used for all restaurants serving burritos”), [0023] (“discussing “sub-node object 104 for ‘burrito’” and ranking restaurants linked to that sub-node as serving burritos), [0024], [0035], [0059]. Thus, a “sub-node” of Rahle representing a food item such as a burrito is a *master menu item*. Furthermore, by virtue of restaurants being associated with a sub-node, the items on each restaurant’s menu that correspond to the sub-node, *i.e.*, the *source menu items*, are also *associated* with the sub-node, *i.e.*, the *master menu item* (as explained in the paragraph above).

f. [1F]: combining by the processor the linked data and the master menu items into a master data set; and

[0112] The ’090 patent refers to “[e]xample systems” where “the ***master data set*** represent[s] the multiple menu items provided by the plurality of food delivery services.” EX1001, 5:33-45. As discussed *supra* §VI.A.1.d ([1D]), Rahle-Rhodes’s formatted *data*, *i.e.*, the menu-item data gathered from external systems and formatted, is *linked* to page objects for restaurants. Additionally, as discussed *supra* §VI.A.1.e ([1E]), the “sub-nodes” representing food items are *master menu items*, and these “sub-nodes” are also associated with restaurants’ page objects and menu-item data. In Rahle-Rhodes, the “sub-nodes” represent food items that may be delivered by multiple delivery services, as discussed *supra* §V.D. Thus, Rahle-Rhodes meets *combining the linked data and the master menu items into a master data set*, *i.e.*, the set of formatted source menu-item data and sub-node data. The *combining* is performed *by the processor* for the same reasons discussed *supra* §VI.A.1.c ([1C]).

g. [1G]: importing by the processor the master data set and the source identification data into the searchable aggregated data structure.

Rahle’s social graph—or alternatively a portion of the social graph containing nodes representing restaurants and sub-nodes representing menu items—is *the searchable aggregated data structure* discussed *supra* §VI.A.1.a

([1A]). Rahle discloses adding, *i.e.*, *importing*, data into the social graph as new data is acquired, *e.g.*, added by users or discovered by the "external data gathering module." *See*, *e.g.*, Rahle, [0016] ("social networking system may import…user generated content as generated sub-nodes of" a "page object[] representing" a "restaurant"), [0038] (describing exemplary use of "external data gathering module" to "import" a music catalogue), [0021] (discussing creation of new sub-node objects for newly-discovered food), [0051] (same). Thus, in Rahle-Rhodes, after a set of restaurant menu data is acquired and associated with sub-nodes representing food items (as discussed *supra* §V.D), the *master data set* representing the menu data and sub-nodes (*see supra* §VI.A.1.f ([1F])) is *imported into* the social graph. Likewise, because the *source identification data* is the "attributes" of a page object associated with a restaurant (*see supra* §VI.A.1.d ([1D])), the *source identification data* is *imported* into the social graph when new restaurant data is acquired as discussed above. The *importing* is performed *by the processor* for the same reasons discussed *supra* §VI.A.1.c ([1C]).

2. Claim 2: The method of claim 1, wherein said scraping comprises extracting raw data objects from webpage data from the delivery service computers.

[0113] The '090 patent discusses "raw" data obtained from delivery service computers as being the data in the format it is acquired in before being converted to the format of the system's data structure. EX1001, 5:47-51, 10:62-

11:2. As discussed *supra* §VI.A.1.b ([1B]), Rahle's "external data gathering module," which "interfaces with external websites" to retrieve *data objects* (*e.g.*, menu items), performs *scraping* to *extract* the menu items *from webpage data* (e.g., menu listings on the webpage), or at minimum would have been obvious to implement this way.. Rahle, [0038]. POSAs knew, for example, that "***extracting*** or mapping content found on multiple websites related to a specific business" was a beneficial way of gathering "details about local restaurants" that "can then be searched by an end-user through a web-based interface." Bandaru (EX1009), [0004]-[0006], [0064] (corroborating POSAs' knowledge that "identifying, collecting, analyzing, mapping and ***extracting*** relevant information…associated with a specific local business gathered from multiple online data sources" including third-party "websites" was a beneficial way of gathering information "about restaurants" as in Rahle). As discussed *supra* §VI.A.1.c ([1C]), the data objects are gathered in their native format from the external websites and then converted to the social graph's formatting; thus, the objects are *raw data objects* when they are extracted from the webpage data. Furthermore, as discussed *supra* §VI.A.1.a ([1A]), in Rahle-Rhodes, the external websites include *delivery service computers* as Rhodes teaches. *Supra* §§V.D, VI.A.1.a ([1A]). Thus, *said scraping comprises extracting raw data objects from webpage data from the delivery service computers*.

3. Claim 3: The method of claim 1, wherein said mapping the acquired data comprises: aliasing fields of the acquired data from formats used by the delivery service computers to respective fields of the predetermined data format.

[0114] As discussed *supra* §VI.A.1.c ([1C]), the recited *mapping* is performed as part of Rahle's process of converting information from the format in which it existed on third party websites/formats into Rahle's format to provide formatted data (*i.e.*, data in Rahle's social graph).

[0115] The '090 patent provides an "example" of "aliasing" in which fields used by delivery services (which may be in different forms from each other) to describe the same concept are mapped to a standardized set of one or more fields in a database. EX1001, 11:29-49 (showing different representations for delivery fees from two different services being converted to the same field format). The '090 patent provides no other definition or description of "aliasing," and as explained *supra* §V.A (e.g., paragraph 30) POSAs would have understood that the mapping of one or more fields representing the same concept in potentially differing forms to the same standardized field invokes the generally known connotation of "aliases" as different ways of representing or referring to a same thing (e.g., as an author's "alias" is another name for the same person).

[0116] Rahle discloses using "inexact matching, including fuzzy matching that accounts for misspellings," to match sub-node objects to page objects.

Rahle, [0022]. In Rahle-Rhodes, where sub-nodes represent menu items and a menu item can be provided by multiple delivery services (*see supra* §V.D), this results in mapping to the same sub-node different mentions of the same menu item from different delivery service computers that may use different terminology or spelling for the menu item, such that the sub-node field and the various source fields having different terminology/spellings are aliases of each other. Thus, in Rahle-Rhodes, the *mapping comprises aliasing fields of the acquired data from formats used by the delivery service computers to respective fields of the predetermined data format*.

[0117] For example, Rahle's system maps different types of fields used by different third-party systems to the same standardized sub-node fields in similar fashion as the '090 patent's above-discussed example, as explained below. Rahle discloses that "[e]ach of the menu items in [a] file" obtained from a restaurant "may be searched for in the social networking system…to identify a sub-node matching the menu item." Rahle, [0047]. "[I]dentifying information of a sub-node object" includes fields such as "a sub-node object identifier or the name of the sub-node." Rahle, [0048]. Rahle discloses that this search capability allows a sub-node to be "matched" to a user query for an item, where the query may include the item's name as it appears on a menu, such as "tofu taco." Rahle, [0049]-[0050]. Thus, Rahle teaches that a food item that is represented by one *field* in source data from an external system such as a restaurant's menu (*e.g.*, an item name that may be spelled differently and/or use different terminology in different menus) is represented in the graph by a sub-node that has its own identifying fields (*e.g.*, a standardized sub-node name or identifier), enabling a search for a form of the item's name to return the sub-node identifying that item. Thus, in Rahle-Rhodes, where the external third-party systems include Rhodes's delivery services (*see supra* §V.D), Rahle's system maps *fields* used to store data on the different delivery services' computers to *fields* of sub-nodes.

4. Claim 4: The method of claim 1, wherein the source identification data comprise one or more of name data, location data, or an identification code

[0118] As discussed *supra* §VI.A.1.d ([1D]), Rahle makes use of "attributes" of a restaurant, which are *source identification data* of [1D] and include the restaurant's location, *i.e.*, *location data*, and the restaurant name, *i.e.*, *name data*. Rahle, [0014]. This satisfies claim 4, which recites that the "source identification data comprise ***one or*** more" of a list.

5. Claim 5: The method of claim 4, wherein said linking comprises: analyzing the source identification data to determine the common sources; and linking the formatted

data associated with like common sources to a master data object.

[0119] *Said linking* is the *linking* of [1D], which is met in Rahle-Rhodes by Rahle's "data mapping module" mapping formatted menu-item data to "the correct page object" for a restaurant "based on analyzing attributes," *i.e., source identification data*, "of the page objects to identify matching external data" (Rahle, [0039]-[0040]), as discussed *supra* §VI.A.1.d ([1D]). The restaurants identified by the page objects are *the common sources*. *Supra* §VI.A.1.d ([1D]). As discussed *supra* §V.B (e.g., paragraph 39), POSAs understood, or at a minimum would have found obvious, from Rahle's description at [0039]-[0040] that the "correct page object" representing a restaurant is identified by *analyzing* the attributes of the restaurant page object, *i.e.*, *the source identification data*, to determine, for a given set of externally acquired data, the correct restaurant to which the data should be mapped.

[0120] In Rahle-Rhodes, each restaurant is represented by its own "page ***object***"; thus, the page object representing a restaurant is a *master data object*. *Supra* §VI.A; Rahle, [0014]-[0016], [0017]-[0018]; EX1001, 11:65-12:2 ("…master restaurant data object (e.g., a data object uniquely identifying a master restaurant…)"). As discussed *supra* §VI.A.1.d ([1D]), each common restaurant is *linked to formatted data* including that restaurant's menu. Because restaurants are represented by "page objects," *i.e.*, *master restaurant data* *objects* as discussed above, the formatted data is *associated with like common sources* and is *linked to a master data object*.

6. Claim 6

a. [6PRE]-[6A]: The method of claim 1, wherein said identifying comprises: training an algorithm to identify sets of identical menu items from the menu items across different delivery services, wherein the identified menu items include menu items having same or different spellings or descriptions; and

[0121] As discussed *supra* §VI.A.1.e ([1E]), the recited *identifying* occurs as part of Rahle's process of associating sub-node objects representing food items with corresponding menus websites from restaurants serving those items (as provided by delivery-services in Rahle-Rhodes). Rahle, [0022]. Rahle discloses performing this associating as part of "generating" sub-nodes (Rahle, [0022]), and Rahle discloses an embodiment where a "sub-node generating module" uses a "machine learning module" that uses a "machine learning ***algorithm***" to "analyze user feedback received from the user feedback module to ***train*** the data mapping model for mapping sub-node objects to page objects based on external data." Rahle, [0044], [0029]. Thus, the *identifying* of [1E] *comprises training an algorithm* in Rahle-Rhodes based on Rahle's teachings. Additionally, identifying items on different menus that map to the same food item involves *identifying sets of identical menu items*, because mentions of a menu item identified on more than one different menu constitute a *set* of menu items, and each set of mentions that are all referring to the same food item (e.g., to a burrito) is a *set of identical menu items*.

[0122] Moreover, Rahle discloses that the *identified menu items* include *menu items having same or different spellings or descriptions*, because different restaurants may or may not spell or describe the same item slightly differently. Rahle, [0022] ("Inexact matching, including fuzzy matching that accounts for misspellings…may also be used in matching sub-node[s]…to attributes of page objects."). Furthermore, the menu items from which the identical sets are identified are *from across different delivery services*, since the menus are obtained from the delivery-service computers, as discussed *supra* §VI.A.1.a ([1A]).

b. [6B] wherein said associating comprises, for each set of identical menu items, creating a master menu item that contains references to the identified identical menu items in that set.

[0123] As discussed *supra* §VI.A.6.a ([6A]), *each set of identical menu items* is a set of items on different menus that are all associated with a sub-node representing a given food item. The sub-node objects are *master menu items* as discussed *supra* §VI.A.1.e ([1E]). As discussed *supra* §VI.A.1.e ([1E]), the recited *associating* is met by Rahle's disclosure of associating page objects for restaurant menus with sub-node objects for food items served by those restaurants. Rahle, [0016], [0024], [0035], [0045]. Rahle discloses "generat[ing]," *i.e.*, "***creat[ing]***," sub-nodes for food items during the associating process if a food item is found on a menu and a sub-node for that item does not already exist. Rahle, [0021] ("a new sub-node object…for flan may be **generated** because the sub-node object…for flan had not yet been ***created*** in the social networking system…and was not found when the page owner submitted the menu item to the social networking system").

[0124] Finally, as explained below, for *each set of identical menu items*, the sub-node, *i.e.*, the *master menu item* as discussed above, *contains references to the identified identical menu items*. As discussed *supra* §V.B, in Rahle, each sub-node representing a particular menu item can be stored with connections to all nodes representing restaurants that serve that menu item. Rahle, [0016], [0023]-[0024], [0035]. POSAs understood, or at least would have found obvious, that these connections are implemented via *references* in the sub-node objects to the page objects representing the restaurant menu webpages, for the reasons discussed in Section V.B above (*e.g.*, paragraph 44).

7. Claim 7: The method of claim 6, wherein said training an algorithm uses at least the multiple source menu items or previously collected menu data.

[0125] Rahle discloses an embodiment where the "***train[ing]***" process discussed *supra* §VI.A.6.a for [6A] utilizes "user feedback." Rahle, [0044] ("a social networking system… uses a machine learning algorithm to analyze user feedback… to ***train*** the data mapping model for mapping sub-node objects to page objects"). POSAs understood that using "user feedback" to "train" involves *using at least the multiple source menu items or previously collected menu data*, because the "feedback" provided by the user is feedback on how accurately the previously-collected menu data was mapped, as discussed in Section V.B above (*e.g.*, paragraph 40).

8. Claim 11

a. [11Pre]-[11A]: The method of claim 1, wherein said linking comprises: analyzing the source identification data to determine the common sources;

[0126] *See supra* §VI.A.5 for claim 5, which depends from claim 1 though claim 4 and recites identical language as the additional limitation of [11A].

b. [11B] linking the formatted data associated with like common sources to a master data object; and

[0127] *See supra* §VI.A.5 for claim 5, which depends from claim 1 though claim 4 and recites identical language as the additional limitation of [11B].

c. [11C] associating the master data object with one or more grid points within a city.

[0128] As discussed *supra* §V.A (e.g., paragraph 28), POSAs understood that *grid points within a city* encompass a set of geographic locations in a city.

[0129] Rhodes discloses that restaurants have a "delivery zone"; this "delivery zone" represents a set of locations to which food from the restaurant can be delivered, *i.e.*, a *grid of points within a city*. Rhodes, 4:38-60. As discussed in Section V.D above (e.g., paragraph 62), in Rahle-Rhodes, POSAs would have been motivated to *associate* the "page objects" representing restaurants, *i.e.*, the *master data objects* (*see supra* §VI.A.8.b ([11B])), with the restaurants' delivery zones in order to beneficially allow users of the social graph to determine whether food from a restaurant can be delivered to their location. As also discussed in Section V.D above (e.g., paragraph 62), POSAs would reasonably have expected success in such an implementation, since it makes use of capabilities Rahle already discloses, including the "external data gathering module" (to gather delivery-zone data) and "page objects" (representing restaurants to which delivery-zone data is associated). Rahle, Abstract, [0015], [0038].

9. Claim 12: [12Pre] A system for providing an interactive food or beverage ordering service accessible by a user computing device, the system comprising:

[0130] Ground 1 treats "*for providing an interactive food or beverage ordering service*" as non-limiting. (Grounds 3-4 in Sections VI.C-VI.D below address the alternative if "*for providing an interactive food ordering service*" is considered a limitation of the claim.).

[0131] Rahle's social graph is part of a "social networking ***system***." Rahle, Abstract, [0005]. This system is *accessible by a user computing device*. Rahle, [0026]-[0027], Fig. 2 (discussing "***user*** devices" that "comprise one or more computing devices" that access the social networking system). In Rahle-Rhodes, Rahle's *system comprises* the remaining elements of claim 12 as discussed *infra* §§VI.A.9.a-h for [12A]-[12H].

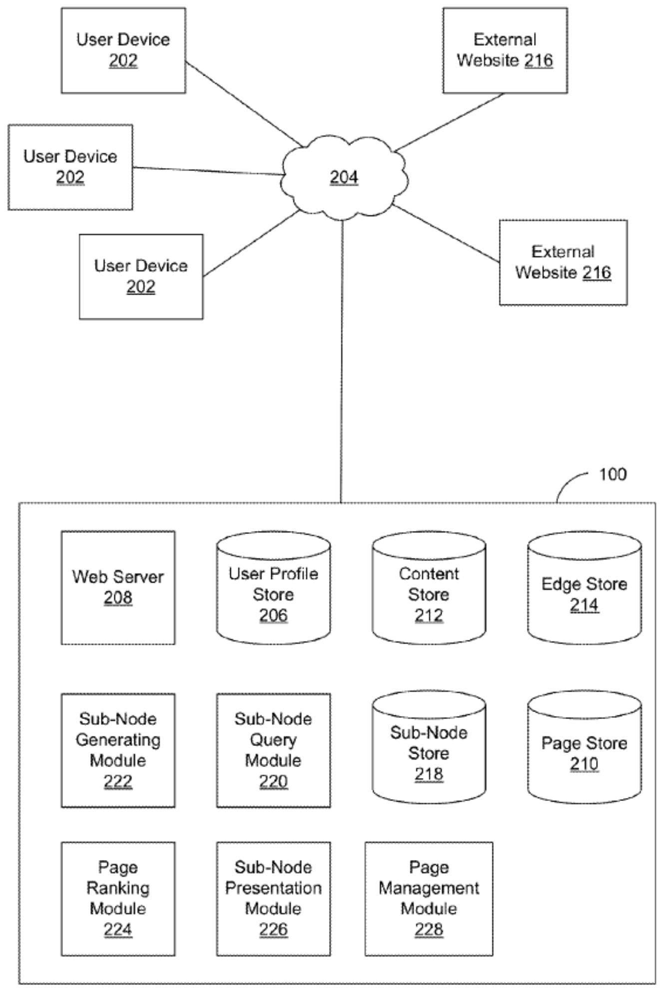


FIG. 2

Rahle, Fig. 2

a. [12A] a data acquisition and processing module comprising a processor, memory, and computer-readable instructions stored on a non-transitory medium that are executable by the processor to acquire source data from a plurality of delivery service computers associated with a plurality of food

or beverage delivery services and provide a master data set of formatted data, wherein the master data set includes, for each of the plurality of food or beverage delivery services, data representing multiple menu items linked to identification data uniquely identifying sources of the menu items delivered by the plurality of food or beverage delivery services; and

[0132] Rahle's techniques "can be executed by a computer ***processor*** for performing any or all of the steps, operations, or processes described." Rahle, [0068]. The processor "execute[s]" a "computer program product" comprising "instructions" that are stored on a "non-transitory, tangible computer readable storage medium." Rahle, [0068]-[0069]. As discussed *supra* §V.B (e.g., paragraph 47), POSAs understood that such instructions are loaded into a *memory* to be executed by a processor. Thus, Rahle's system comprises *a processor*, a *memory accessible to the processor, and a set of computer-readable instructions stored on a non-transitory medium that are executable by the processor*.

[0133] As discussed below, Rahle's processor, memory, and instructions (as modified in view of Rhodes's teachings as discussed *supra* §V.D) in Rahle-Rhodes together comprise a *data acquisition and processing module* that performs the task recited in [12A]. The processor executing the instructions does, *inter alia*, the following: (1) *acquires source data from a plurality of delivery service computers associated with a plurality of food or beverage* *delivery services* (*see supra* §VI.A.1.a ([1A])); and (2) *provides formatted data* (*see supra* §VI.A.1.c ([1C])). The *formatted data*, which represents menu items, is part of a *master data set* as explained *supra* §VI.A.1.f ([1F]). *Data representing multiple source menu items* is part of data collected from the delivery service computers as discussed *supra* §VI.A.1.a for ([1A]), and this data gets mapped to the formatted data as discussed *supra* §VI.A.1.c ([1C]). Thus, because the *formatted data* is part of the *master data set* as discussed above, the *master data set includes data representing multiple menu items*.

[0134] Furthermore, the data representing multiple menu items is linked to identification data uniquely identifying sources of the menu items delivered by the plurality of food or beverage delivery services, as explained below. The menu items represented by the data are menu items on the menus of restaurants serving those items, as discussed supra §VI.A.1.a for [1A]; thus, the restaurants are the sources of the menu items. The menu items are delivered by the plurality of food and beverage services, because those services provide delivery for the restaurants, as also discussed supra §VI.A.1.a ([1A]). These restaurants are represented by "page objects" that have "attributes" such as restaurant name and location; these "attributes" are identification data uniquely identifying the restaurants, as discussed supra §VI.A.1.d ([1D]). The data representing the menu items is linked to the restaurants as discussed supra §V.A.1.d ([1D]), and is thus also linked to identification data uniquely identifying sources of the menu items.

b. [12B] a website database accessible to the processor and configured to receive updated data from the master data set, the master data set representing the multiple menu items provided by one or more of the plurality of food or beverage delivery services;

[0135] The set of formatted menu item data and sub-node data in Rahle-Rhodes are a *master data set*, as discussed *supra* §VI.A.1.f ([1F]). The *master data set* includes, and thus *represents, multiple menu items* served by the restaurants as discussed *supra* §VI.A.1.a ([1A]); in Rahle-Rhodes, these items are *provided by each one of* Rhode's delivery services for the multiple restaurants as explained *supra* §V.D, *i.e.*, provided by *each one of the plurality of food or beverage delivery services*.

[0136] The '090 patent describes an exemplary "website database" as a database that is "in communication with a user-facing website server" and is designed to "receive objects that are structured in the way that is expected for rendering pages for the user." EX1001, 14:16-30. Rahle discloses that users access the social-networking system via a "web server" that serves "web pages" to the user. Rahle, [0030]. POSAs would have found it obvious to implement this web server to access a database that stores content that has been prepared for display to a user on a web page, as explained in Section V.B above (*e.g.*, paragraph 48). Moreover, Moreover, POSAs understood that databases were an obvious way to store data. *infra* §VI.A.13 (claim 16). Such a database for storing content for display is a *website database* as in the '090 patent's example. *See* EX1001, 14:16-30.

[0137] Furthermore, POSAs would have found it obvious for the website database to be *configured for receiving updated data from the master data set*, because POSAs understood that it would be beneficial for content shown to the user on the social-networking system's "web pages" to be the most up-to-date possible, as discussed in Section V.B above (*e.g.*, paragraph 48). Rahle, [0003] (noting one problem motivating Rahle's invention is the inability to share information about "restaurant that recently opened"). The *website database* is intended for storing content to display to users of Rahle's social networking system as discussed above. As discussed *supra* §VI.A.1.a ([1A]), Rahle's techniques "can be executed by a computer ***processor*** for performing any or all of the steps, operations, or processes described"; thus, the website database is *accessible to the processor*, because the processor performs the displaying of the content. Rahle, [0068].

c. [12C] wherein the data acquisition and processing module further comprises a plurality of modules in the form of a computer-readable instructions stored

on a non-transitory medium that are executable by the processor including

[0138] Rahle-Rhodes's *data acquisition and processing module comprises* the *modules* recited in [12D]-[12H], as explained below. The '090 patent discusses the "API" and various "modules" as software. EX1001, 19:56-20:11 ("modules" are implemented as "software" executed by hardware "such as a processor"), 10:50-56, 11:19-26, 11:29-32, 11:50-56, 12:51-54, 22:14-31 (claim 12 reciting "a plurality of modules in the form of a computer-readable instructions...including: an application programming interface…"). Likewise, as discussed above and in the sections below for [12D]-[12H], Rahle discloses the processor performing the required functions; moreover, these functions are performed by the processor as part of the same "computer program product" discussed *supra* §VI.A.8.a ([11A]) that is part of the *data acquisition and processing module*. Rahle, [0068] (Rahle's techniques "can be executed by a computer processor for performing ***any or all*** of the steps, operations, or processes described"). Because Rahle's "computer program product" is *in the form of a computer-readable instructions stored on a non-transitory medium that are executable by the processor*, as discussed *supra* §VI.A.9.a for [12A], the modules discussed below for [12D]-[12H] are likewise in this form.

d. [12D] an application programming interface configured to interface the data acquisition and

processing module with the plurality of delivery service computers, or

[0139] Rahle discloses that the social networking system includes an *application programing interface* that interfaces *with the plurality of delivery service computers* as discussed *supra* §VI.A.1.b for [1B]. Rahle discloses that the API is used by third parties to "to generate sub-node objects…to be associated with a particular page object…such as…a menu of food items for a restaurant." Rahle, [0032]; *see also* Rahle, [0047]. As discussed *supra* §V.D, in Rahle-Rhodes, Rhodes's "delivery services," which run the *delivery service computers*, are third parties that submit data to Rahle's social networking system. Furthermore, as discussed *supra* §VI.A.9.a for [12A], the portion of the social networking system that acquires data from the delivery service computers is part of the *data acquisition and processing module*. Thus, in Rahle-Rhodes, the API is *configured to interface the data acquisition and processing module with the plurality of delivery service computers*.

e. [12E] an extraction module configured to extract the source data from the plurality of delivery service computers as raw files by scraping data from one or more of the plurality of delivery service computers

[0140] As discussed *supra* §VI.A.1.a ([1A]), Rahle's "external data gathering module" gathers, *i.e.*, *extracts*, *source data from the plurality of delivery service computers* in Rahle-Rhodes. Rahle, [0038]. This data is *extracted* as *raw* data *from the delivery service computers* via a *scraping* process as explained *supra* §VI.A.2 (claim 2). Rahle discloses receiving data from external sources in the form of "file[s]." Rahle, [0028], [0041], [0047]-[0049]. Thus, the "external data gathering module" constitutes *an extraction module configured to extract the source data from the plurality of delivery service computers as raw files by scraping data from one or more of the plurality of delivery service computers*.

f. [12F] a mapping module configured to convert the raw files to a standardized format to provide formatted data;

[0141] As discussed *supra* §VI.A.8.c ([11C]), the *raw files* represent the *source data* in Rahle-Rhodes. Rahle's *processor maps* this source data *to* the format used by Rahle's social graph, *i.e.*, a *standardized format*, *to provide formatted data*, as discussed *supra* §VI.A.1.c ([1C]). This mapping process *converts* the data, since the data starts in the "raw" format and ends up in Rahle's format. Thus, Rahle-Rhodes includes a *mapping module* that is configured to perform the task [12F] recites.

g. [12G] a linking module configured to perform record linkage on the formatted data according to the identification data that uniquely identifies sources; and

[0142] As discussed *supra* §VI.A.1.d ([1D]), Rahle *links formatted data* to restaurants based on restaurant identifier data, *i.e.*, *identification data that uniquely identifies sources*. The '090 patent describes an example of "record linkage" that "identifies a unique restaurant…that may be common across multiple delivery services based on the identification data, and links the mapped source data to data associated with that master restaurant." EX1001, 11:61-66. As explained *supra* §VI.A.1.d for [1D], in Rahle-Rhodes, Rahle's *linking* process does the same thing the '090 patent discusses, by identifying common restaurants served by multiple delivery services and linking those restaurants to their formatted menu item data; thus, Rahle's linking performs *record linkage on the formatted data*. Rahle-Rhodes therefore includes a *linking module* that is *configured to* perform the task [12G] recites.

h. [12H] a menu combining module configured to combine multiple source menus from linked sources into the master data set

[0143] As discussed *supra* §VI.A.1.f ([1F]), Rahle *combines* formatted menu data with sub-nodes into a *master data set*. The menu data combined into the master data set in Rahle-Rhodes includes multiple *source menus* from the same restaurant gathered from different sources (*e.g.*, from different delivery services and from the restaurant itself) and *source menus* from multiple restaurants, *i.e.*, *sources*, as discussed *supra* §VI.A.1.a ([1A]). These restaurants are *linked sources* because Rahle links page objects for restaurants to the restaurants' menu items, as discussed *supra* §VI.A.1.d ([1D]). Thus, Rahle-Rhodes includes a *menu combining module* that is *configured to* perform the task [12H] recites.

10. Claim 13: The system of claim 12, wherein the website database comprises the master data set in a searchable format.

[0144] As discussed *supra* §§VI.A.9.b ([12B]) and VI.A.1.f ([1F]), the *master data set* is made up of formatted menu item data and sub node data. This data is part of Rahle's social graph, which is a *searchable* data set as discussed *supra* §VI.A.1 for [1Pre] and that has its own *format* as discussed *supra* §VI.A.1.c for [1C]. The website database contains, and thus *comprises*, the master data set as discussed *supra* §VI.A.9.b for [12B]. Thus, Rahle-Rhodes meets claim 13.

11. Claim 14: The system of claim 12, further comprising: a data warehouse configured to store the provided master data set in a searchable format; wherein the data warehouse is accessible by the website database to receive data.

[0145] Rahle-Rhodes's *master data set*, which is *in a searchable format* (*see supra* §VI.A.10 for claim 13) is part of the social graph, as discussed *supra* §VI.A.1.g for [1G]. As discussed *infra* §VI.A.13 (claim 16), Rahle's social graph is stored in a database. This database is a *data warehouse configured to store the provided master data set in a searchable format*, because it is a database implemented to store the master data set, as the '090 patent describes. *See supra* §V.A (e.g., paragraph 31); EX1001, 14:11-15 ("data warehouse" may be implemented as an "SQL database"). Furthermore, as discussed *supra* §VI.A.9.b ([12B]), the *website database* is *provided* the most recent *master data set*. Since the *data warehouse* stores the social graph, the *data warehouse is accessible by the website database to receive data*, *i.e.*, the most recent master data set.

12. Claim 15: [15Pre] An apparatus for providing a searchable aggregated data structure for a networked application, the apparatus comprising:

[0146] Rahle discloses a method *for providing a searchable aggregated data structure for a networked application*, as discussed *supra* §VI.A.1 for [1Pre]. This method is performed by an *apparatus*, *e.g.*, Rahle's "social networking system." Rahle, Abstract, [0005]. As discussed *infra* §§VI.A.12.a-VI.A.12.h ([15A]-[15H]), this apparatus *comprises* the remaining elements of claim 15.

a. [15A] a processor; a memory accessible by the processor; and a set of computer-readable instructions stored on a non-transitory medium accessible by the processor, the instructions being executable by the processor to perform a method comprising:

[0147] Rahle discloses a processor, a memory accessible by the processor, and a set of computer-readable instructions stored on a non-transitory medium and accessible by the processor, where the instructions are executable by the processor, as discussed supra §VI.A.9.a ([12A]). Rahle's techniques "can be executed by a computer **processor** for performing any or all of the steps, operations, or processes described." Rahle, [0068]. Thus, Rahle's processor executes the instructions to perform a method. As discussed infra §§VI.A.12.b-h, in Rahle-Rhodes, this method comprises the recited steps.

b. [15B] acquiring source data from a plurality of delivery service computers associated with a plurality of food or beverage delivery services over a communication network, the acquired source data being in a plurality of formats, where the acquired source data includes, for each of the plurality of food or beverage delivery services, data representing multiple source menu items,

[0148] *See supra* §VI.A.1.a ([1A]).

c. [15C]: and wherein said acquiring source data comprises one or more of: employing an application programming interface to interface with the plurality of delivery service computers, or scraping data from the plurality of delivery service computers

[0149] *See supra* §VI.A.1.b ([1B]).

d. [15D]: mapping the acquired source data according to a predetermined data format to provide formatted data;

[0150] *See supra* §VI.A.1.c ([1C]); *service data* as [1C] recites is also *source data* as [15D] recites as explained *supra* §VI.A.1.c ([1C]).

e. [15E]: linking the formatted data to common sources of the source menu items represented by source identification data such that at least one food or beverage delivery service is linked to each common source and its source menu items;

[0151] *See supra* §VI.A.1.d ([1D]).

f. [15F]: identifying common menu items among the source menu items in the formatted data, and, for each identified common menu item, associating the source menu items with a master menu item;

[0152] *See supra* §VI.A.1.e ([1E]).

g. [15G] combining the linked data and the master menu items into a master data set; and

[0153] *See supra* §VI.A.1.f ([1F]).

h. [15H] importing the master data set and the source identification data into the searchable aggregated data structure.

[0154] *See supra* §VI.D.1.g ([1G]).

13. Claim 16: The apparatus of claim 15, further comprising: a storage device in communication with the processor for storing the searchable aggregated data structure in a database accessible to the processor.

[0155] Rahle *stores* its social graph, *i.e.*, the *searchable aggregated data structure* (*supra* §VI.A.1 ([1Pre])), as data in a collection of data "***stores***." Rahle, [0029]-[0036], Fig. 2. Rahle teaches that the stores are *accessible to the processor* because the *processor* performs various operations on the social graph (which is data stored in the stores), including search and retrieval operations (*supra* §VI.A.1 ([1Pre])) as well as others discussed above for Elements [1A], [1C]-[1G]. POSAs understood that these stores together constitute a *database*, or at a minimum would have found it obvious and reasonably expected success to implement the "stores" in a database, as discussed *supra* §V.B (*e.g.*, paragraph 42). As also discussed *supra* §V.B (*e.g.*, paragraph 43), POSAs understood that databases store data in *storage devices*. Thus, Rahle-Rhodes's above-discussed *database* that stores the *searchable aggregate data structure* uses a *storage device* that is *for storing the searchable aggregated data structure in the database*. This storage device is *in communication with the processor* because the processor performs the storage of the aggregated data structure in the database. *See* Rahle, [0068] (Rahle's techniques "can be executed by a computer ***processor*** for performing any or all of the steps, operations, or processes described").

14. Claim 17: The apparatus of claim 15, further comprising: a network interface for communicating with the plurality of delivery source computers.

[0156] Rahle's "social networking system," *i.e.*, the *apparatus of claim 15* (*see supra* §VI.A.12 ([15Pre])), includes "conventional components such as ***network interfaces***," which POSAs understood are used by the system *for communicating* with external websites/systems. Rahle, [0029]-[0030]. In Rahle-Rhodes, these external websites/systems include the *plurality of delivery service computers*. *Supra* §§V.D, VI.A.1.a ([1A]).

B. <u>GROUND 2:</u> RAHLE+RHODES+JIN Renders Obvious Claims 1-17

1. Claims 1-5, 11-17

[0157] Rahle-Rhodes-Jin meets claims 1-5 and 11-17 for the same reasons discussed in Ground 1 (Section VI.A above), since the addition of Jin does not disturb any aspect of Rahle-Rhodes relevant to these claims.

2. Claim 6

a. [6PRE]-[6A]

[0158] As discussed *supra* §VI.A.1.e for [1E] in Ground 1, the recited *identifying* occurs as part of identifying page-object attributes that match sub-nodes. Rahle, [0022]. As discussed *supra* §V.F, in Rahle-Rhodes-Jin, Rahle's identifying process is implemented using the teachings from Jin discussed *supra* §V.E. Jin's teachings involve using "***training*** documents" that are "input to a ***training*** module" that "examin[es] the frequency of key words in the training documents in order to generate a model…for each topic." Jin, 4:30-34. Thus, in Rahle-Rhodes-Jin, the *identifying* of [1E] *comprises training an algorithm*. The remaining portions of [6Pre]-[6A] are met for the same reasons discussed *supra* §VI.A.6.a for [6Pre]-[6A] in Ground 1 in Rahle-Rhodes.

b. [6B]

[0159] Rahle-Rhodes-Jin meets [6B] for the same reasons discussed *supra* §VI.A.6.b for [6B] in Ground 1 for Rahle-Rhodes.

3. **Claim 7:** The method of claim 6, wherein said training an algorithm uses at least the multiple source menu items or previously collected menu data.

[0160] In Rahle-Rhodes-Jin, the recited *training* in [6A] is met by Jin's technique that uses "training documents" that are "input to a training module." Jin, 4:30-34; *supra* §V.F. Jin says "training documents" may be "any…files or data that are identifiable by their association with one or more topics." Jin, 3:36-44. Thus, as discussed *supra* §V.F (*e.g.*, paragraph 70), in Rahle-Rhodes-Jin, where the relevant "topics" are food items, POSAs would have found it obvious to use *previously collected* menu items, *i.e.*, *menu data*, as "training documents," since those items would be "identifiable by their association with" food items. Jin, 3:36-44.

4. **Claim 8: The method of claim 7, wherein said training an algorithm trains one or more word frequency models.**

[0161] Rahle-Rhodes-Jin's *training an algorithm* involves using "training documents" that are "input to a training module," as discussed *supra* §VI.B.2.a. Jin, 4:30-34. Jin says the "training module" into which documents are input "examin[es] the ***frequency*** of key ***words*** in the training documents in order to generate a ***model***…for each topic." Jin 4:30-34. Thus, *said training an algorithm trains one or more word frequency models*.

5. Claim 9: The method of claim 8, wherein training one or more word frequency models comprises labeling sets of items matched using word frequency techniques.

[0162] The ’090 patent refers to “training an algorithm using the multiple source menus and/or previously collected menu data to recognize identical items across source menus using word frequency models” by using “manual training” that is “accomplished by labeling pairs of items matched using the simpler word frequency techniques.” EX1001, 12:54-13:4.

[0163] Rahle discloses “analyz[ing] user feedback…to train the data mapping model for mapping sub-node objects to page objects based on external data.” Rahle, [0044]. Jin says a “human annotator” may “***label[]***…training documents as being” “on-topic” or “off-topic.” Jin, 6:51-56. Thus, as discussed in Section V.F above (*e.g.*, paragraph 70), in view of Jin, POSAs would have been motivated and reasonably expected success to implement Rahle’s training of the data mapping model by *labeling sets* in which a page is “on-topic” for a sub-node object as being good *matches*; these *sets of items* (pages and sub-nodes) are *matched* using *word frequency techniques* as discussed *supra* §VI.B.2.a ([6A]). Thus, Rahle-Rhodes-Jin meets claim 9.

6. Claim 10: The method of claim 8, wherein said associating comprises: processing the source menu items against the one or more word frequency models.

[0164] Rahle-Rhodes-Jin's *associating* is met by Rahle's disclosure of associating page objects for restaurant menus with sub-node objects for food items served by those restaurants. *Supra* §§VI.B.2.b (citing §VI.A.6.b). This associating is done after sub-node objects representing food items are matched to page objects representing menus of restaurants serving those items, as discussed *supra* §VI.A.1.e. This matching involves *processing source menu items against the one or more word frequency models* because the word frequency models are used for the matching, as discussed *supra* §VI.B.2.a for [6Pre]-[6A]; thus, Rahle-Rhodes-Jin meets claim 10.

C. Ground 3: Rahle+Rhodes+Belousova Renders Obvious Claims 1-7, 11-17

1. Claim 1: [1Pre]

[0165] Rahle-Rhodes-Belousova meets [1Pre] for the same reasons discussed *supra* §VI.A.1 for [1Pre] in Ground 1, since Rahle-Rhodes-Belousova is identical to Rahle-Rhodes in the relevant respects. *Supra* §V.H. Rahle-Rhodes-Belousova meets [1Pre] for the additional reason that Belousova teaches that a graph structure storing restaurant menu items, like Belousova's "food taxonomy" or Rahle's social-graph structure, is a *searchable aggregated data structure*. Belousova's taxonomy can be implemented as a "hierarchical

structure with dishes being nodes at different levels within the hierarchical ***structure***." Belousova, 3:62-4:4, 6:56-7:4. "The food taxonomy ***data*** is stored in the database 104." Belousova, 7:48-49. The graph structure *aggregates* "menu items" from multiple restaurants, mapped to dishes (nodes) in the graph structure. Belousova, 3:18-25; *see* 1:22-25 ("The restaurant service ***aggregates*** the…menus" of "hundreds or thousands [of] participating restaurants."). Via the taxonomy, "the dishes, dish attributes and dish ingredients are indexed in the database 104 for fast ***searching***" by the server software application. Belousova, 6:56-7:20, 11:48-56, 12:29-37.

a. [1A]-[1D]

[0166] Rahle-Rhodes-Belousova meets [1A]-[1D] for the same reasons discussed *supra* §§VI.A.1.a-d for [1A]-[1D] in Ground 1, since Rahle-Rhodes-Belousova is identical to Rahle-Rhodes in the relevant respects. *Supra* §V.H.

b. [1E]

[0167] As discussed *supra* §VI.A.1.e for [1E] in Ground 1, the food items found on restaurant menus are *common menu items among the source menu items in the formatted data*, and Rahle's sub-nodes representing food items are *master menu items*. As discussed *supra* §V.H, food items that appear on multiple restaurant menus are referred to as "dishes" in Belousova, and these items are represented as "sub-nodes" in in Rahle-Rhodes-Belousova. As also discussed *supra* §V.H, the "sub-nodes" representing "dishes" are associated with page objects representing menus using Belousova's "classifier"-based technique that "maps…***menu items*** to dishes." Belousova, 8:4-7, 10:15-19. Thus, POSAs understood that in Rahle-Rhodes-Belousova, the *processor identifies common menu items among the source menu items in the formatted data*, and that *for each identified common menu item*, the *source menu items* on each restaurant menu representing that item are *associated with* the corresponding *master menu item*, *i.e.*, the sub-node representing that "dish."

c. [1F]-[1G]

[0168] Rahle-Rhodes-Belousova meets [1F]-[1G] for the same reasons discussed *supra* §§VI.A.1.f-g for [1F]-[1G] in Ground 1, since Rahle-Rhodes-Belousova is identical to Rahle-Rhodes in the relevant respects.

2. Claims 2-5

[0169] Rahle-Rhodes-Belousova meets the added limitations of claims 2-5 for the same reasons discussed in Ground 1. *Supra* §V.H.

3. Claim 6

a. [6PRE]-[6A]

[0170] As discussed *supra* §VI.C.1.b for [1E], in Rahle-Rhodes-Belousova, the recited *identifying* occurs as part using Belousova's "classifier" to "map[]…menu items to dishes." Belousova, 8:4-7, 10:15-19. Belousova discloses "***train[ing]***" the classifier, *i.e.*, *training an algorithm*. Belousova, 3:34-36. Belousova says that in this training process, "[f]or each dish, the server trains a dish classifier from menu items mapped to the dish and menu items that are mapped to different dishes. The dish classifier is then applied to new menu items and other unmapped menu items to determine whether these menu items should be mapped to the dish;" thus, Belousova trains the classifier to *identify sets of identical menu items*, *i.e.*, sets of "menu items" that should be mapped to a given "dish." Belousova, 3:34-41. Furthermore, Belousova notes (consistent with POSAs' understanding and with Rahle [0022]) that the different "menu items" that map to the same dish may have the *same or different spellings or descriptions from each other*. Belousova, 2:3-7 ("[t]wo menu items from two different restaurants may indicate the same dish…but have different menu item titles"); *supra* §V.G (paragraph 73). Additionally, the menu items from which the identical sets are identified are *from across different delivery services*, since the menus are obtained from the delivery-service computers, as discussed *supra* §VI.C.1.a ([1A]).

b. [6B]

[0171] As discussed *supra* §VI.C.1.b ([1E]), the recited *associating* is met in Rahle-Rhodes-Belousova by Belousova's "classifier" "mapp[ing]…menu items to dishes." Belousova, 8:4-7, 10:15-19. As discussed *supra* §VI.C.3.a ([6A]), *each set of identical menu items* is a set of items on different menus that are mapped to a dish. As discussed *supra* §V.H, in Rahle-Rhodes-Belousova, dishes are represented by sub-node objects; the sub-node objects are *master menu items* as discussed *supra* §VI.C.1.b ([1E]). Rahle discloses "generat[ing]," *i.e.*, "***creat[ing]***," sub-nodes for food items if a food item is found on a menu and a sub-node for that item does not already exist. Rahle, [0021]. Belousova likewise discloses *generating* a new "dish" to map to a menu item if the corresponding dish did not previously exist. Belousova, 8:5-8. Thus, in Rahle-Rhodes-Belousova, *said associating comprises, for each set of identical menu items, creating a master menu item* if necessary, *i.e.*, a new sub-node representing a dish.

[0172] Finally, POSAs understood, or at least found obvious, that for *each set of identical menu items*, the sub-node, *i.e.*, the *master menu item* as discussed above, *contains references to the identified identical menu items*. Belousova discloses that each "menu item" that a dish gets mapped to is represented by a "menu item record" and that a "menu item dish mapping between the menu item record and the dish record" is stored in Belousova's "database." Belousova, 8:8-12. As explained in Section V.H above (*e.g.*, paragraph 81), POSAs understood, or at least would have found obvious, that the "menu item dish mapping" is implemented via *references* from the dish records to the menu item records, as such references were the customary way to create connections between objects and were within a POSA's programing skill. Thus, in Rahle-Rhodes-Belousova, where what Belousova calls "dishes" are represented by sub-nodes, POSAs would have found it obvious in view of Belousova to implement the sub-nodes with *references* to corresponding items on restaurant menus.

4. Claim 7

[0173] In Rahle-Rhodes-Belousova, the recited *training an algorithm* is met by Belousova's "train[ing]" of its classifier. Belousova, 3:34-36; *supra* §VI.C.3.a. Belousova says the classifier is trained "from menu items mapped to the dish and menu items that are mapped to different dishes." Belousova, 3:34-41. Thus, the training *uses the multiple source menu items and/or previously collected menu data*, because menu items, *i.e.*, *menu data*, can only have been "mapped" (past tense) if they were *previously collected*.

5. Claims 11-17

[0174] Rahle-Rhodes-Belousova meets the added limitations of claims 11-17 for the same reasons discussed in Ground 1. *Supra* §V.H.

[0175] Rahle-Rhodes-Belousova also meets claims 12-14 even if "*for providing an interactive food ordering service*" in [12Pre] is accorded patentable weight. As discussed *supra* §V.G, Belousova discloses providing a "food ordering" service to users (Belousova, 4:39-44)—*i.e.*, a service users can *interact* with. As discussed *supra* §V.H, POSAs would have found it obvious to incorporate such a service into Rahle's "social networking system" (Rahle, Abstract), making use of Rahle-Rhodes's graph structure containing restaurant menu-item data as provided by food delivery services. Thus, in Rahle-Rhodes-Belousova, Rahle's "social networking ***system***" is *for providing an interactive food ordering service* (e.g., in addition to other uses/services).

[0176] Rahle-Rhodes-Belousova also meets claim 16 for an additional, independent reason. Belousova teaches storing a graph structure like Rahle's in a "database." *E.g.*, Belousova, 7:14-15 ("The nodes and the node properties are stored in the database[.]"), 7:48-49 ("The food taxonomy data is stored in a database."), 3:20-25, 6:37-45, Figs. 1-6. Thus, Belousova provides additional teachings evidencing the obviousness of storing Rahle-Rhodes's social-graph data in a database as discussed *supra* §VI.A.13 (claim 16). In Rahle-Rhodes-Belousova, the *searchable aggregated data structure* is stored in a *database* as Belousova teaches, and that database is *accessible to the processor* as Rahle teaches (*see supra* §VI.A.13 (claim 16)). Rahle-Rhodes-Belousova discloses a *storage device in communication with the processor* that is *for storing the searchable aggregated data structure* in the above-mentioned database for the same reasons discussed *supra* §VI.A.13 for claim 16 in Ground 1. *Supra* §VII.B

D. Ground 4: Rahle+Rhodes+Belousova+Jin Render Obvious Claim 1-17

[0177] Rahle+Rhodes+Belousova+Jin meets claims 1-7, 11-17 for the same reasons given *supra* §VI.C for Ground 3 for Rahle+Rhodes+Belousova; Rahle+Rhodes+Belousova+Jin also meets the additional limitations of claims 6-10 for the same reasons given *supra* §VI.B for Ground 2 for Rahle+Rhodes+Jin.

I declare that all statements made herein of my own knowledge are true, that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

I declare under penalty of perjury that the foregoing is true and correct.

Dated: May 7, 2025

Mark Crovella

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Mark Crovella, Ph.D.

VII. CLAIM LISTING APPENDIX

Claim 1
[1Pre] A computer-implemented method for providing a searchable aggregated data structure for a networked application, the method comprising:
[1A] acquiring by a processor source data from a plurality of delivery service computers associated with a plurality of food or beverage delivery services over a communication network, the acquired source data being in a plurality of formats, where the acquired source data includes, for each of the plurality of food or beverage delivery services, data representing multiple source menu items,
[1B] wherein said acquiring source data comprises one or more of: employing an application programming interface to interface with the plurality of delivery service computers, or scraping data from the plurality of delivery service computers;
[1C] mapping by the processor the acquired service data according to a predetermined data format to provide formatted data;
[1D] linking by the processor the formatted data to common sources of the source menu items, each of the common sources being represented by source identification data uniquely identifying a respective one of the sources, such that at least one food or beverage delivery service is linked to each common source and its source menu items;
[1E] identifying by the processor common menu items among the source menu items in the formatted data, and, for each identified common menu item, associating the source menu items with a master menu item;
[1F] combining by the processor the linked data and the master menu items into a master data set; and
[1G] importing by the processor the master data set and the source identification data into the searchable aggregated data structure.
Claim 2
The method of claim 1, wherein said scraping comprises extracting raw data objects from webpage data from the delivery service computers.
Claim 3
The method of claim 1, wherein said mapping the acquired data comprises: aliasing fields of the acquired data from formats used by the delivery service computers to respective fields of the predetermined data format.
Claim 4
The method of claim 1, wherein the source identification data comprise one or more of name data, location data, or an identification code.

Claim 5
The method of claim 4, wherein said linking comprises: analyzing the source identification data to determine the common sources; and linking the formatted data associated with like common sources to a master data object.
Claim 6
[6Pre] The method of claim 1,
[6A] wherein said identifying comprises: training an algorithm to identify sets of identical menu items from the menu items across different delivery services, wherein the identified menu items include menu items having same or different spellings or descriptions; and
[6B] wherein said associating comprises, for each set of identical menu items, creating a master menu item that contains references to the identified identical menu items in that set.
Claim 7
The method of claim 6, wherein said training an algorithm uses at least the multiple source menu items or previously collected menu data.
Claim 8
The method of claim 7, wherein said training an algorithm trains one or more word frequency models.
Claim 9
The method of claim 8, wherein training one or more word frequency models comprises labeling sets of items matched using word frequency techniques.
Claim 10
The method of claim 8, wherein said associating comprises: processing the source menu items against the one or more word frequency models.
Claim 11
[11Pre] The method of claim 1, wherein said linking comprises:
[11A] analyzing the source identification data to determine the common sources;
[11B] linking the formatted data associated with like common sources to a master data object; and
[11C] associating the master data object with one or more grid points within a city.
Claim 12
[12Pre] A system for providing an interactive food or beverage ordering service accessible by a user computing device, the system comprising:
[12A] a data acquisition and processing module comprising a processor, memory, and computer-readable instructions stored on a non-transitory medium that are executable by the processor to acquire source data from a plurality of

delivery service computers associated with a plurality of food or beverage delivery services and provide a master data set of formatted data, wherein the master data set includes, for each of the plurality of food or beverage delivery services, data representing multiple menu items linked to identification data uniquely identifying sources of the menu items delivered by the plurality of food or beverage delivery services; and
[12B] a website database accessible to the processor and configured to receive updated data from the master data set, the master data set representing the multiple menu items provided by one or more of the plurality of food or beverage delivery services;
[12C] wherein the data acquisition and processing module further comprises a plurality of modules in the form of a computer-readable instructions stored on a non-transitory medium that are executable by the processor including:
[12D] an application programming interface configured to interface the data acquisition and processing module with the plurality of delivery service computers, or
[12E] an extraction module configured to extract the source data from the plurality of delivery service computers as raw files by scraping data from one or more of the plurality of delivery service computers;
[12F] a mapping module configured to convert the raw files to a standardized format to provide formatted data;
[12G] a linking module configured to perform record linkage on the formatted data according to the identification data that uniquely identifies sources; and
[12H] a menu combining module configured to combine multiple source menus from linked sources into the master data set.
Claim 13
The system of claim 12, wherein the website database comprises the master data set in a searchable format.
Claim 14
The system of claim 12, further comprising: a data warehouse configured to store the provided master data set in a searchable format; wherein the data warehouse is accessible by the website database to receive data.
Claim 15
[15Pre] An apparatus for providing a searchable aggregated data structure for a networked application, the apparatus comprising:
[15A] a processor; a memory accessible by the processor; and a set of computer-readable instructions stored on a non-transitory medium accessible by the processor, the instructions being executable by the processor to perform a method comprising:

[15B] acquiring source data from a plurality of delivery service computers associated with a plurality of food or beverage delivery services over a communication network, the acquired source data being in a plurality of formats, where the acquired source data includes, for each of the plurality of food or beverage delivery services, data representing multiple source menu items,
[15C] and wherein said acquiring source data comprises one or more of: employing an application programming interface to interface with the plurality of delivery service computers, or scraping data from the plurality of delivery service computers;
[15D] mapping the acquired source data according to a predetermined data format to provide formatted data;
[15E] linking the formatted data to common sources of the source menu items represented by source identification data such that at least one food or beverage delivery service is linked to each common source and its source menu items;
[15F] identifying common menu items among the source menu items in the formatted data, and, for each identified common menu item, associating the source menu items with a master menu item;
[15G] combining the linked data and the master menu items into a master data set; and
[15H] importing the master data set and the source identification data into the searchable aggregated data structure.
Claim 16
The apparatus of claim 15, further comprising: a storage device in communication with the processor for storing the searchable aggregated data structure in a database accessible to the processor.
Claim 17
The apparatus of claim 15, further comprising: a network interface for communicating with the plurality of delivery source computers.