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(54) **SOFTWARE PRODUCT OPTIMIZATION IDENTIFICATION THROUGH NATURAL LANGUAGE PROCESSING**

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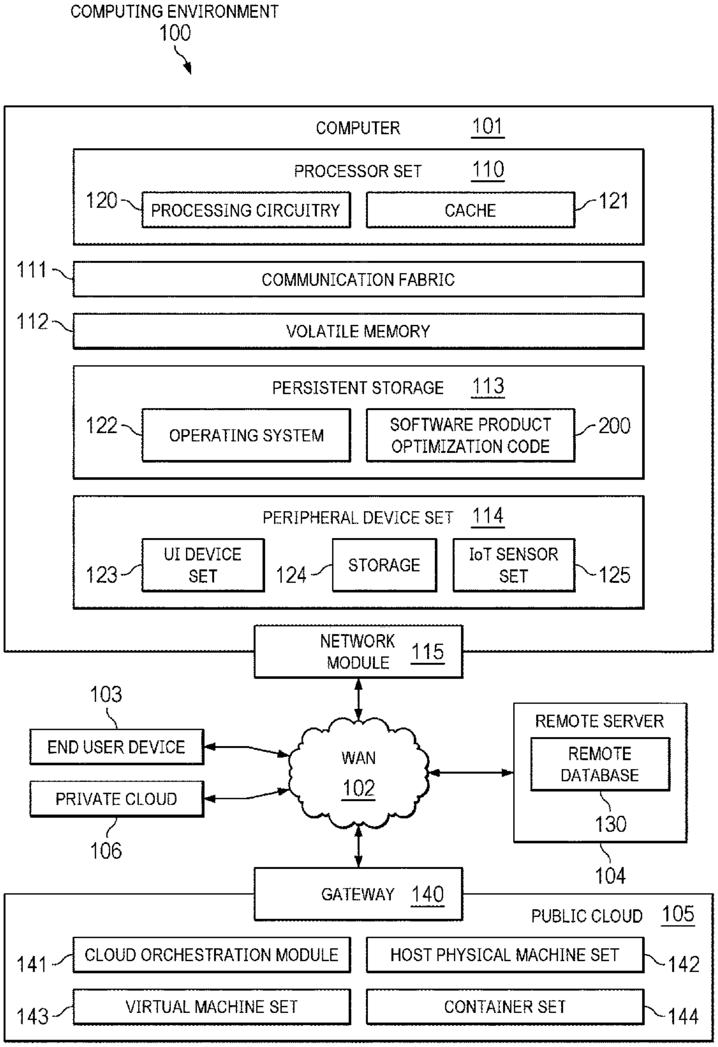
(57) **ABSTRACT**

Software product optimization is provided. Expressed sentiment in a set of opted in user-to-user business-related conversations among a group of users corresponding to an entity is associated with a software product in response to determining that the software product is identified by mentioned keywords in the set of opted in user-to-user business-related conversations based on a keyword corpus. It is determined whether the expressed sentiment associated with the software product is negative sentiment. A related software product listed in a software product catalog of the entity is identified as an optimization to the software product in response to determining that the expressed sentiment associated with the software product is negative sentiment. A recommendation to implement the related software product as the optimization to the software product is generated. The recommendation to implement the related software product as the optimization to the software product is sent to the group of users.



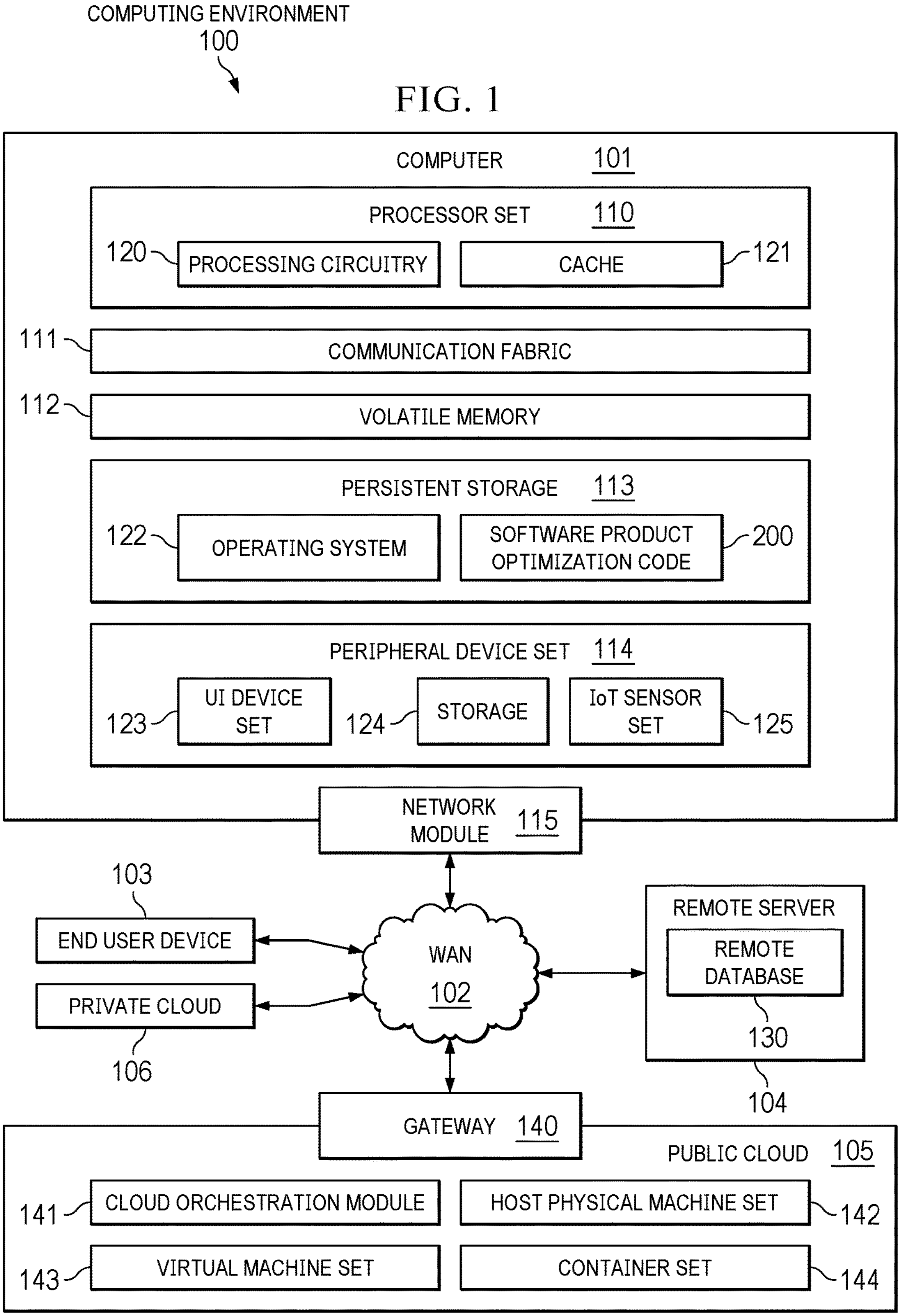


FIG. 1

COMPUTING ENVIRONMENT
100
COMPUTER 101
PROCESSOR SET 110
120
PROCESSING CIRCUITRY
CACHE
121
111
COMMUNICATION FABRIC
112
VOLATILE MEMORY
PERSISTENT STORAGE 113
122
OPERATING SYSTEM
SOFTWARE PRODUCT OPTIMIZATION CODE
200
PERIPHERAL DEVICE SET 114
123
UI DEVICE SET
124
STORAGE
IoT SENSOR SET
125
NETWORK MODULE 115
103
END USER DEVICE
PRIVATE CLOUD
106
WAN
102
REMOTE SERVER
REMOTE DATABASE
130
104
GATEWAY 140
PUBLIC CLOUD 105
141
CLOUD ORCHESTRATION MODULE
HOST PHYSICAL MACHINE SET
142
143
VIRTUAL MACHINE SET
CONTAINER SET
144

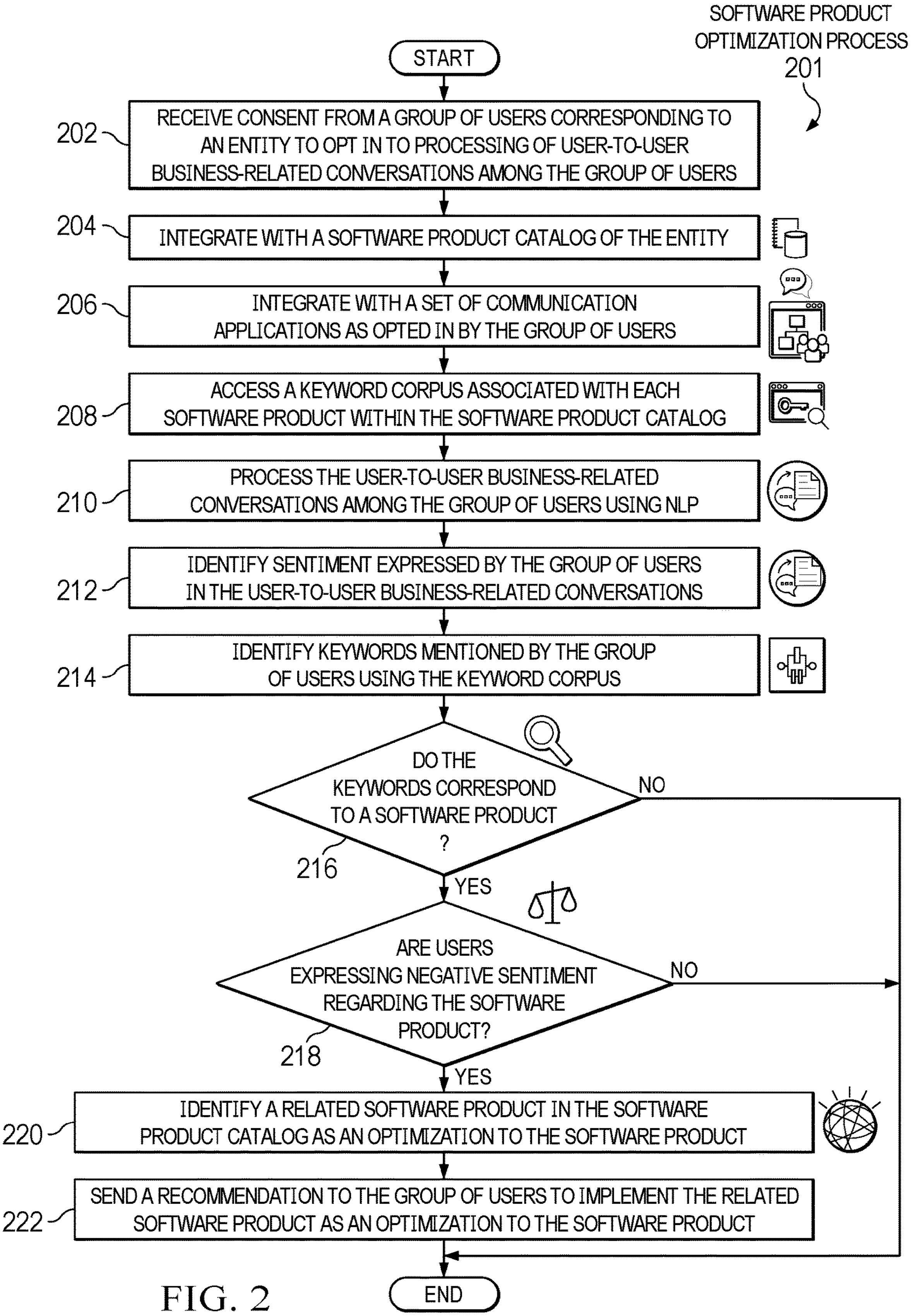
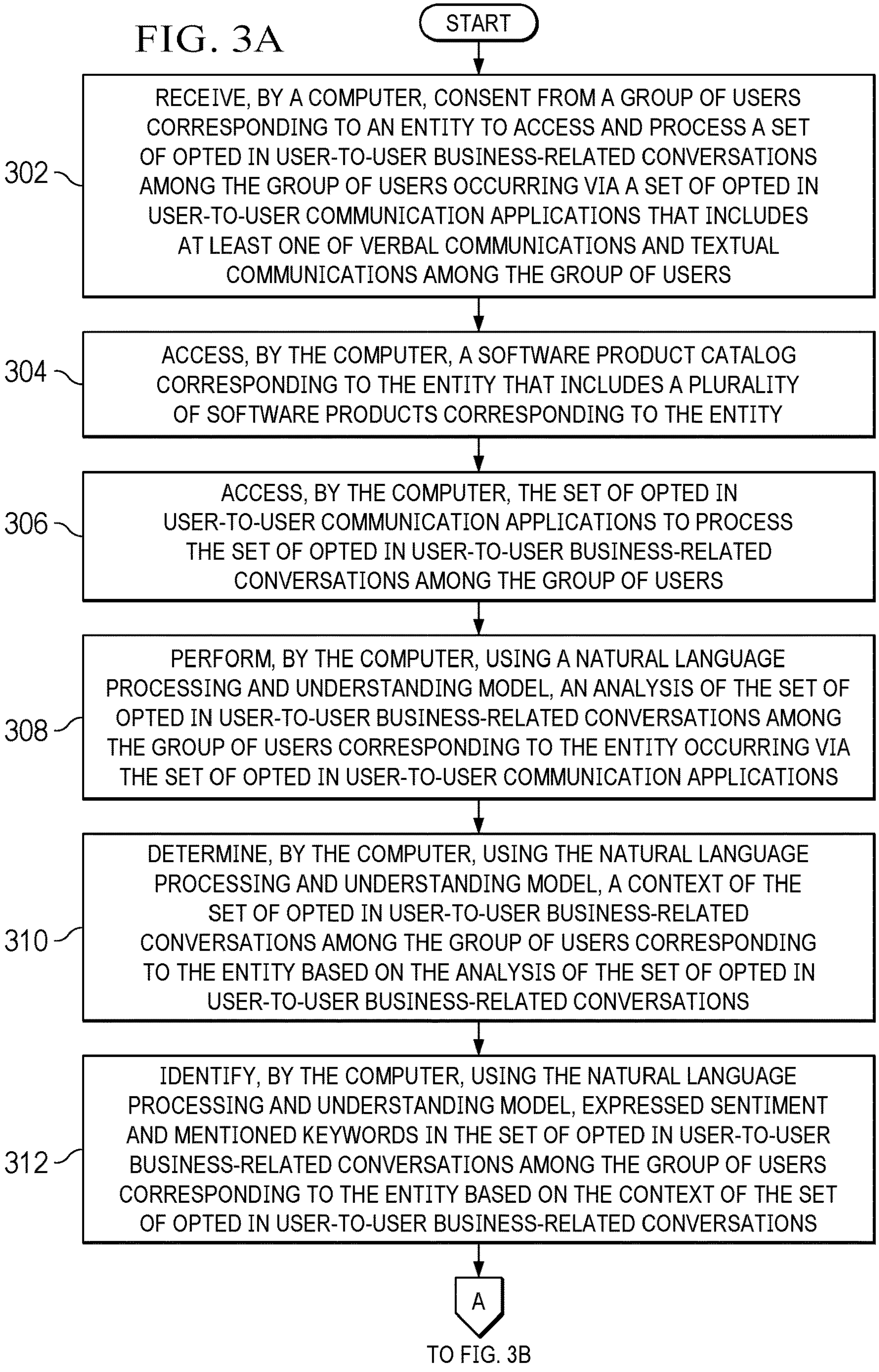

SOFTWARE PRODUCT OPTIMIZATION PROCESS
201
START
202
RECEIVE CONSENT FROM A GROUP OF USERS CORRESPONDING TO AN ENTITY TO OPT IN TO PROCESSING OF USER-TO-USER BUSINESS-RELATED CONVERSATIONS AMONG THE GROUP OF USERS
204
INTEGRATE WITH A SOFTWARE PRODUCT CATALOG OF THE ENTITY
206
INTEGRATE WITH A SET OF COMMUNICATION APPLICATIONS AS OPTED IN BY THE GROUP OF USERS
208
ACCESS A KEYWORD CORPUS ASSOCIATED WITH EACH SOFTWARE PRODUCT WITHIN THE SOFTWARE PRODUCT CATALOG
210
PROCESS THE USER-TO-USER BUSINESS-RELATED CONVERSATIONS AMONG THE GROUP OF USERS USING NLP
212
IDENTIFY SENTIMENT EXPRESSED BY THE GROUP OF USERS IN THE USER-TO-USER BUSINESS-RELATED CONVERSATIONS
214
IDENTIFY KEYWORDS MENTIONED BY THE GROUP OF USERS USING THE KEYWORD CORPUS
DO THE KEYWORDS CORRESPOND TO A SOFTWARE PRODUCT ?
216
NO
YES
ARE USERS EXPRESSING NEGATIVE SENTIMENT REGARDING THE SOFTWARE PRODUCT?
218
NO
YES
220
IDENTIFY A RELATED SOFTWARE PRODUCT IN THE SOFTWARE PRODUCT CATALOG AS AN OPTIMIZATION TO THE SOFTWARE PRODUCT
222
SEND A RECOMMENDATION TO THE GROUP OF USERS TO IMPLEMENT THE RELATED SOFTWARE PRODUCT AS AN OPTIMIZATION TO THE SOFTWARE PRODUCT
END

FIG. 2

FIG. 3A


START
302
RECEIVE, BY A COMPUTER, CONSENT FROM A GROUP OF USERS CORRESPONDING TO AN ENTITY TO ACCESS AND PROCESS A SET OF OPTED IN USER-TO-USER BUSINESS-RELATED CONVERSATIONS AMONG THE GROUP OF USERS OCCURRING VIA A SET OF OPTED IN USER-TO-USER COMMUNICATION APPLICATIONS THAT INCLUDES AT LEAST ONE OF VERBAL COMMUNICATIONS AND TEXTUAL COMMUNICATIONS AMONG THE GROUP OF USERS
304
ACCESS, BY THE COMPUTER, A SOFTWARE PRODUCT CATALOG CORRESPONDING TO THE ENTITY THAT INCLUDES A PLURALITY OF SOFTWARE PRODUCTS CORRESPONDING TO THE ENTITY
306
ACCESS, BY THE COMPUTER, THE SET OF OPTED IN USER-TO-USER COMMUNICATION APPLICATIONS TO PROCESS THE SET OF OPTED IN USER-TO-USER BUSINESS-RELATED CONVERSATIONS AMONG THE GROUP OF USERS
308
PERFORM, BY THE COMPUTER, USING A NATURAL LANGUAGE PROCESSING AND UNDERSTANDING MODEL, AN ANALYSIS OF THE SET OF OPTED IN USER-TO-USER BUSINESS-RELATED CONVERSATIONS AMONG THE GROUP OF USERS CORRESPONDING TO THE ENTITY OCCURRING VIA THE SET OF OPTED IN USER-TO-USER COMMUNICATION APPLICATIONS
310
DETERMINE, BY THE COMPUTER, USING THE NATURAL LANGUAGE PROCESSING AND UNDERSTANDING MODEL, A CONTEXT OF THE SET OF OPTED IN USER-TO-USER BUSINESS-RELATED CONVERSATIONS AMONG THE GROUP OF USERS CORRESPONDING TO THE ENTITY BASED ON THE ANALYSIS OF THE SET OF OPTED IN USER-TO-USER BUSINESS-RELATED CONVERSATIONS
312
IDENTIFY, BY THE COMPUTER, USING THE NATURAL LANGUAGE PROCESSING AND UNDERSTANDING MODEL, EXPRESSED SENTIMENT AND MENTIONED KEYWORDS IN THE SET OF OPTED IN USER-TO-USER BUSINESS-RELATED CONVERSATIONS AMONG THE GROUP OF USERS CORRESPONDING TO THE ENTITY BASED ON THE CONTEXT OF THE SET OF OPTED IN USER-TO-USER BUSINESS-RELATED CONVERSATIONS
A
TO FIG. 3B

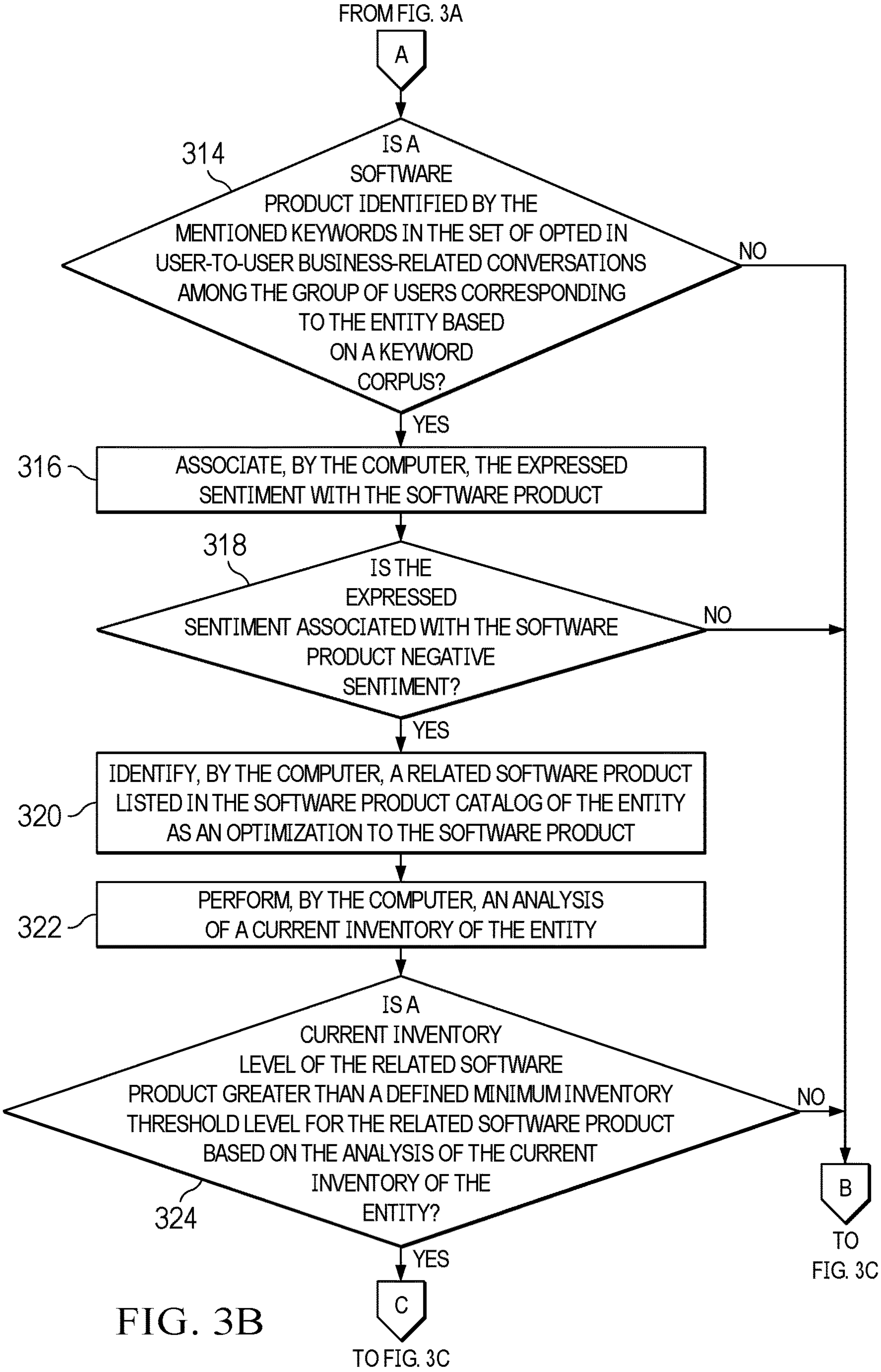

FROM FIG. 3A
A
314
IS A SOFTWARE PRODUCT IDENTIFIED BY THE MENTIONED KEYWORDS IN THE SET OF OPTED IN USER-TO-USER BUSINESS-RELATED CONVERSATIONS AMONG THE GROUP OF USERS CORRESPONDING TO THE ENTITY BASED ON A KEYWORD CORPUS?
NO
YES
316
ASSOCIATE, BY THE COMPUTER, THE EXPRESSED SENTIMENT WITH THE SOFTWARE PRODUCT
318
IS THE EXPRESSED SENTIMENT ASSOCIATED WITH THE SOFTWARE PRODUCT NEGATIVE SENTIMENT?
NO
YES
320
IDENTIFY, BY THE COMPUTER, A RELATED SOFTWARE PRODUCT LISTED IN THE SOFTWARE PRODUCT CATALOG OF THE ENTITY AS AN OPTIMIZATION TO THE SOFTWARE PRODUCT
322
PERFORM, BY THE COMPUTER, AN ANALYSIS OF A CURRENT INVENTORY OF THE ENTITY
IS A CURRENT INVENTORY LEVEL OF THE RELATED SOFTWARE PRODUCT GREATER THAN A DEFINED MINIMUM INVENTORY THRESHOLD LEVEL FOR THE RELATED SOFTWARE PRODUCT BASED ON THE ANALYSIS OF THE CURRENT INVENTORY OF THE ENTITY?
324
NO
B
TO FIG. 3C
YES
C
TO FIG. 3C

FIG. 3B

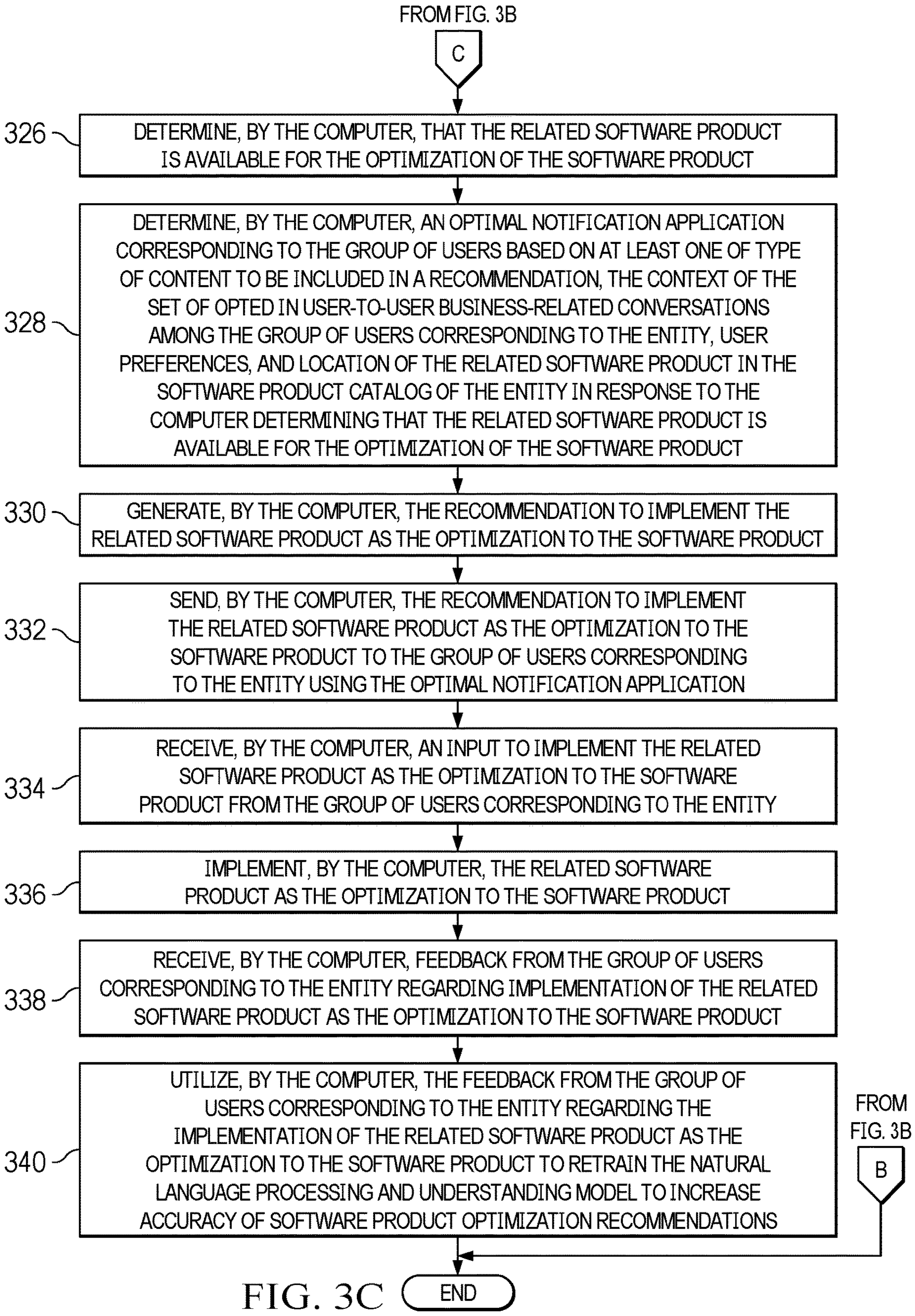

FROM FIG. 3B
C
326
DETERMINE, BY THE COMPUTER, THAT THE RELATED SOFTWARE PRODUCT IS AVAILABLE FOR THE OPTIMIZATION OF THE SOFTWARE PRODUCT
328
DETERMINE, BY THE COMPUTER, AN OPTIMAL NOTIFICATION APPLICATION CORRESPONDING TO THE GROUP OF USERS BASED ON AT LEAST ONE OF TYPE OF CONTENT TO BE INCLUDED IN A RECOMMENDATION, THE CONTEXT OF THE SET OF OPTED IN USER-TO-USER BUSINESS-RELATED CONVERSATIONS AMONG THE GROUP OF USERS CORRESPONDING TO THE ENTITY, USER PREFERENCES, AND LOCATION OF THE RELATED SOFTWARE PRODUCT IN THE SOFTWARE PRODUCT CATALOG OF THE ENTITY IN RESPONSE TO THE COMPUTER DETERMINING THAT THE RELATED SOFTWARE PRODUCT IS AVAILABLE FOR THE OPTIMIZATION OF THE SOFTWARE PRODUCT
330
GENERATE, BY THE COMPUTER, THE RECOMMENDATION TO IMPLEMENT THE RELATED SOFTWARE PRODUCT AS THE OPTIMIZATION TO THE SOFTWARE PRODUCT
332
SEND, BY THE COMPUTER, THE RECOMMENDATION TO IMPLEMENT THE RELATED SOFTWARE PRODUCT AS THE OPTIMIZATION TO THE SOFTWARE PRODUCT TO THE GROUP OF USERS CORRESPONDING TO THE ENTITY USING THE OPTIMAL NOTIFICATION APPLICATION
334
RECEIVE, BY THE COMPUTER, AN INPUT TO IMPLEMENT THE RELATED SOFTWARE PRODUCT AS THE OPTIMIZATION TO THE SOFTWARE PRODUCT FROM THE GROUP OF USERS CORRESPONDING TO THE ENTITY
336
IMPLEMENT, BY THE COMPUTER, THE RELATED SOFTWARE PRODUCT AS THE OPTIMIZATION TO THE SOFTWARE PRODUCT
338
RECEIVE, BY THE COMPUTER, FEEDBACK FROM THE GROUP OF USERS CORRESPONDING TO THE ENTITY REGARDING IMPLEMENTATION OF THE RELATED SOFTWARE PRODUCT AS THE OPTIMIZATION TO THE SOFTWARE PRODUCT
340
UTILIZE, BY THE COMPUTER, THE FEEDBACK FROM THE GROUP OF USERS CORRESPONDING TO THE ENTITY REGARDING THE IMPLEMENTATION OF THE RELATED SOFTWARE PRODUCT AS THE OPTIMIZATION TO THE SOFTWARE PRODUCT TO RETRAIN THE NATURAL LANGUAGE PROCESSING AND UNDERSTANDING MODEL TO INCREASE ACCURACY OF SOFTWARE PRODUCT OPTIMIZATION RECOMMENDATIONS
FROM FIG. 3B
B
END

FIG. 3C

SOFTWARE PRODUCT OPTIMIZATION IDENTIFICATION THROUGH NATURAL LANGUAGE PROCESSING

BACKGROUND

[0001] The disclosure relates generally to software and more specifically to software product optimization.

[0002] Software is a set of instructions or commands that tell a computer or other type of data processing device or system what to do. A software product is a software program or application that has been developed for the benefit of users to satisfy a user or entity need. This includes, for example, software products sold as a download, such as a mobile application, software products sold as a service, such as, for example, a news feed, and software products sold in physical form, such as compact disc. There are two main types of software products, generic software products and customized software products. A generic software product is developed with a broad user base in mind and includes "off the shelf" software products that have more general features and functionalities, such as, for example, word processing software products, spreadsheet software products, and the like. A customized software product is developed for a specific entity or user base and has more specific features and functionalities, such as, for example, an airline reservation software product, a software product developed for an internal team of a particular entity, and the like.

SUMMARY

[0003] According to one illustrative embodiment, a computer-implemented method for software product optimization is provided. A computer associates expressed sentiment in a set of opted in user-to-user business-related conversations among a group of users corresponding to an entity with a software product in response to the computer, using a natural language processing and understanding model, determining that the software product is identified by mentioned keywords in the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity based on a keyword corpus. The computer, using the natural language processing and understanding model, determines whether the expressed sentiment associated with the software product is negative sentiment. The computer identifies a related software product listed in a software product catalog of the entity as an optimization to the software product in response to the computer, using the natural language processing and understanding model, determining that the expressed sentiment associated with the software product is negative sentiment. The computer generates a recommendation to implement the related software product as the optimization to the software product. The computer sends the recommendation to implement the related software product as the optimization to the software product to the group of users corresponding to the entity using an optimal notification application. According to other illustrative embodiments, a computer system and computer program product for software product optimization are provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] FIG. **1** is a pictorial representation of a computing environment in which illustrative embodiments may be implemented;

[0005] FIG. **2** is a diagram illustrating an example of a software product optimization process in accordance with an illustrative embodiment; and

[0006] FIGS. **3A-3C** are a flowchart illustrating a process for software product optimization in accordance with an illustrative embodiment.

DETAILED DESCRIPTION

[0007] Various aspects of the present disclosure are described by narrative text, flowcharts, block diagrams of computer systems and/or block diagrams of the machine logic included in computer program product (CPP) embodiments. With respect to any flowcharts, depending upon the technology involved, the operations can be performed in a different order than what is shown in a given flowchart. For example, again depending upon the technology involved, two operations shown in successive flowchart blocks may be performed in reverse order, as a single integrated step, concurrently, or in a manner at least partially overlapping in time.

[0008] A computer program product embodiment ("CPP embodiment" or "CPP") is a term used in the present disclosure to describe any set of one, or more, storage media (also called "mediums") collectively included in a set of one, or more, storage devices that collectively include machine readable code corresponding to instructions and/or data for performing computer operations specified in a given CPP claim. A "storage device" is any tangible device that can retain and store instructions for use by a computer processor. Without limitation, the computer-readable storage medium may be an electronic storage medium, a magnetic storage medium, an optical storage medium, an electromagnetic storage medium, a semiconductor storage medium, a mechanical storage medium, or any suitable combination of the foregoing. Some known types of storage devices that include these mediums include: diskette, hard disk, random access memory (RAM), read-only memory (ROM), erasable programmable read-only memory (EPROM or Flash memory), static random access memory (SRAM), compact disc read-only memory (CD-ROM), digital versatile disk (DVD), memory stick, floppy disk, mechanically encoded device (such as punch cards or pits/lands formed in a major surface of a disc), or any suitable combination of the foregoing. A computer-readable storage medium, as that term is used in the present disclosure, is not to be construed as storage in the form of transitory signals per se, such as radio waves or other freely propagating electromagnetic waves, electromagnetic waves propagating through a waveguide, light pulses passing through a fiber optic cable, electrical signals communicated through a wire, and/or other transmission media. As will be understood by those of skill in the art, data is typically moved at some occasional points in time during normal operations of a storage device, such as during access, de-fragmentation or garbage collection, but this does not render the storage device as transitory because the data is not transitory while it is stored.

[0009] With reference now to the figures, and in particular, with reference to FIG. **1**, a diagram of data processing environments is provided in which illustrative embodiments may be implemented. It should be appreciated that FIG. **1** is only meant as an example and is not intended to assert or imply any limitation with regard to the environments in which different embodiments may be implemented. Many modifications to the depicted environment may be made.

[0010] FIG. **1** shows a pictorial representation of a computing environment in which illustrative embodiments may be implemented. Computing environment **100** contains an example of an environment for the execution of at least some of the computer code involved in performing the inventive methods of illustrative embodiments, such as software product optimization code **200**. For example, software product optimization code **200** monitors and processes natural language conversations between users within user-to-user communications, such as, for example, web conferences, teleconferences, instant messages, text messages, emails, and the like, corresponding to an entity (e.g., enterprise, business, company, organization, institution, agency, or the like). Software product optimization code **200** also connects to and accesses a software product catalog, which includes a software-as-a-service (SaaS) catalog, corresponding to the entity. Software product optimization code **200** performs keyword and sentiment analysis using a natural language processing and understanding model or algorithm to identify software product optimizations or customizations corresponding to software products in the software product catalog that were discussed within the user-to-user communications to expand at least one of usage, performance, functionality, capability, and the like of currently utilized software products of the entity.

[0011] As a result, by connecting with the entity-specific software product catalog, software product optimization code **200** can identify software product optimization or customization opportunities for one or more software products currently utilized by the entity through the analysis of the user-to-user communications and sentiment expressed in the user-to-user communications regarding the one or more software products using a set of related software products listed in the entity-specific software product catalog as the optimization or customization. Thus, software product optimization code **200** has an internal entity-oriented focus to optimize or customize software products of the entity rather than the consumer-oriented focus of current solutions.

[0012] For example, software product optimization code **200** seamlessly integrates with the entity-specific software product catalog, which includes a SaaS catalog, along with application or license management tools to process the software product data in a secure and compliant manner. Software product optimization code **200** utilizes the natural language processing and understanding model to accurately process and understand the context and terminology specific to internal communications between users corresponding to the entity. This includes software product optimization code **200** utilizing a knowledge corpus that includes industry-specific keywords and terminology used in the user-to-user business-related conversations corresponding to the entity.

[0013] Software product optimization code **200** utilizes the sentiment analysis to discern the tone and intent in these user-to-user business-related conversations. This sentiment analysis of software product optimization code **200** includes an ability to detect nuances, such as, for example, hesitation, urgency, satisfaction, or the like, in these user-to-user business-related conversations that may not be evident in general conversations.

[0014] Software product optimization code **200** processes these user-to-user business-related conversations in real time or near real time and immediately generates contextually relevant recommendations regarding the software product optimizations or customizations for the one or more software products currently utilized by the entity with speed and accuracy. For example, software product optimization code **200** identifies relevant keywords regarding the one or more software products currently utilized by the entity within these user-to-user business-related conversations based on the context of these user-to-user business-related conversations. Furthermore, software product optimization code **200** only processes opted in conversations between users of the entity who previously consented to software product optimization code **200** processing their business-related conversations.

[0015] Moreover, software product optimization code **200** links the software product optimizations or customizations to current real time software product inventory of the entity, which includes both digital and physical software product inventory, to ensure that the recommended related software product for the optimization or customization of the currently used software product by the entity is currently available. For example, during a business-related conversation among a group of users of the entity, software product optimization code **200**, using the natural language processing and understanding model, determines that one or more of the group of users are expressing concern that a current software product utilized by the entity lacks a needed level of data security. In response to detecting the concern regarding the lack of data security in that software product, software product optimization code **200** identifies and recommends, for example, a data security software product, which is related to the software product of concern, from the software product catalog to optimize or customize that software product for increased data security. This involves software product optimization code **200** connecting to and accessing the inventory management system of the entity.

[0016] In addition, software product optimization code **200** utilizes a feedback loop to continuously improve the accuracy of the software product optimization or customization recommendations based on user interactions and feedback that indicate the effectiveness of previously recommended software product optimizations or customizations. Software product optimization code **200** utilizes the user interactions and feedback to further train the natural language processing and understanding model.

[0017] In addition to software product optimization code **200**, computing environment **100** includes, for example, computer **101**, wide area network (WAN) **102**, end user device (EUD) **103**, remote server **104**, public cloud **105**, and private cloud **106**. In this embodiment, computer **101** includes processor set **110** (including processing circuitry **120** and cache **121**), communication fabric **111**, volatile memory **112**, persistent storage **113** (including operating system **122** and software product optimization code **200**, as identified above), peripheral device set **114** (including user interface (UI) device set **123**, storage **124**, and Internet of Things (IoT) sensor set **125**), and network module **115**. Remote server **104** includes remote database **130**. Public cloud **105** includes gateway **140**, cloud orchestration module **141**, host physical machine set **142**, virtual machine set **143**, and container set **144**.

[0018] Computer **101** may take the form of a mainframe computer, quantum computer, desktop computer, laptop computer, tablet computer, or any other form of computer now known or to be developed in the future that is capable of, for example, running a program, accessing a network, and querying a database, such as remote database **130**. As is well understood in the art of computer technology, and depending upon the technology, performance of a computer-implemented method may be distributed among multiple computers and/or between multiple locations. On the other hand, in this presentation of computing environment **100**, detailed discussion is focused on a single computer, specifically computer **101**, to keep the presentation as simple as possible. Computer **101** may be located in a cloud, even though it is not shown in a cloud in FIG. **1**. On the other hand, computer **101** is not required to be in a cloud except to any extent as may be affirmatively indicated.

[0019] Processor set **110** includes one, or more, computer processors of any type now known or to be developed in the future. Processing circuitry **120** may be distributed over multiple packages, for example, multiple, coordinated integrated circuit chips. Processing circuitry **120** may implement multiple processor threads and/or multiple processor cores. Cache **121** is memory that is located in the processor chip package(s) and is typically used for data or code that should be available for rapid access by the threads or cores running on processor set **110**. Cache memories are typically organized into multiple levels depending upon relative proximity to the processing circuitry. Alternatively, some, or all, of the cache for the processor set may be located "off chip." In some computing environments, processor set **110** may be designed for working with qubits and performing quantum computing.

[0020] Computer-readable program instructions are typically loaded onto computer **101** to cause a series of operational steps to be performed by processor set **110** of computer **101** and thereby effect a computer-implemented method, such that the instructions thus executed will instantiate the methods specified in flowcharts and/or narrative descriptions of computer-implemented methods included in this document (collectively referred to as "the inventive methods"). These computer-readable program instructions are stored in various types of computer-readable storage media, such as cache **121** and the other storage media discussed below. The program instructions, and associated data, are accessed by processor set **110** to control and direct performance of the inventive methods. In computing environment **100**, at least some of the instructions for performing the inventive methods of illustrative embodiments may be stored in software product optimization code **200** in persistent storage **113**.

[0021] Communication fabric **111** is the signal conduction path that allows the various components of computer **101** to communicate with each other. Typically, this fabric is made of switches and electrically conductive paths, such as the switches and electrically conductive paths that make up buses, bridges, physical input/output ports, and the like. Other types of signal communication paths may be used, such as fiber optic communication paths and/or wireless communication paths.

[0022] Volatile memory **112** is any type of volatile memory now known or to be developed in the future. Examples include dynamic type random access memory (RAM) or static type RAM. Typically, volatile memory **112** is characterized by random access, but this is not required unless affirmatively indicated. In computer **101**, the volatile memory **112** is located in a single package and is internal to computer **101**, but, alternatively or additionally, the volatile memory may be distributed over multiple packages and/or located externally with respect to computer **101**.

[0023] Persistent storage **113** is any form of non-volatile storage for computers that is now known or to be developed in the future. The non-volatility of this storage means that the stored data is maintained regardless of whether power is being supplied to computer **101** and/or directly to persistent storage **113**. Persistent storage **113** may be a read only memory (ROM), but typically at least a portion of the persistent storage allows writing of data, deletion of data, and re-writing of data. Some familiar forms of persistent storage include magnetic disks and solid-state storage devices. Operating system **122** may take several forms, such as various known proprietary operating systems or open-source Portable Operating System Interface-type operating systems that employ a kernel.

[0024] Peripheral device set **114** includes the set of peripheral devices of computer **101**. Data communication connections between the peripheral devices and the other components of computer **101** may be implemented in various ways, such as Bluetooth connections, Near-Field Communication (NFC) connections, connections made by cables (such as universal serial bus (USB) type cables), insertion-type connections (for example, secure digital (SD) card), connections made through local area communication networks, and even connections made through wide area networks such as the internet. In various embodiments, UI device set **123** may include components such as a display screen, speaker, microphone, wearable devices (such as smart glasses and smart watches), keyboard, mouse, printer, touchpad, and haptic devices. Storage **124** is external storage, such as an external hard drive, or insertable storage, such as an SD card. Storage **124** may be persistent and/or volatile. In some embodiments, storage **124** may take the form of a quantum computing storage device for storing data in the form of qubits. In embodiments where computer **101** is required to have a large amount of storage (e.g., where computer **101** locally stores and manages a large database) then this storage may be provided by peripheral storage devices designed for storing very large amounts of data, such as a storage area network (SAN) that is shared by multiple, geographically distributed computers. IoT sensor set **125** is made up of sensors that can be used in Internet of Things applications. For example, one sensor may be a thermometer and another sensor may be a motion detector.

[0025] Network module **115** is the collection of computer software, hardware, and firmware that allows computer **101** to communicate with other computers through WAN **102**. Network module **115** may include hardware, such as modems or Wi-Fi signal transceivers, software for packetizing and/or de-packetizing data for communication network transmission, and/or web browser software for communicating data over the internet. In some embodiments, network control functions and network forwarding functions of network module **115** are performed on the same physical hardware device. In other embodiments (e.g., embodiments that utilize software-defined networking (SDN)), the control functions and the forwarding functions of network module **115** are performed on physically separate devices, such that the control functions manage several different network hardware devices. Computer-readable program instructions for performing the inventive methods can typically be downloaded to computer **101** from an external computer or external storage device through a network adapter card or network interface included in network module **115**.

[0026] WAN **102** is any wide area network (e.g., the internet) capable of communicating computer data over non-local distances by any technology for communicating computer data, now known or to be developed in the future. In some embodiments, the WAN **102** may be replaced and/or supplemented by local area networks (LANs) designed to communicate data between devices located in a local area, such as a Wi-Fi network. The WAN and/or LANs typically include computer hardware such as copper transmission cables, optical transmission fibers, wireless transmission, routers, firewalls, switches, gateway computers, and edge servers.

[0027] EUD **103** is any computer system that is used and controlled by an end user (e.g., a user corresponding to an entity that utilizes the software product optimization services provided by computer **101**), and may take any of the forms discussed above in connection with computer **101**. It should be noted that EUD **103** can represent a plurality of end user devices operated by a plurality of different users. EUD **103** typically receives helpful and useful data from the operations of computer **101**. For example, in a hypothetical case where computer **101** is designed to provide a software product optimization or customization recommendation to the end user, this recommendation would typically be communicated from network module **115** of computer **101** through WAN **102** to EUD **103**. In this way, EUD **103** can display, or otherwise present, the software product optimization or customization recommendation to the end user. In some embodiments, EUD **103** may be a client device, such as thin client, heavy client, mainframe computer, desktop computer, laptop computer, tablet computer, smart phone, smart watch, and so on.

[0028] Remote server **104** is any computer system that serves at least some data and/or functionality to computer **101**. Remote server **104** may be controlled and used by the same entity that operates computer **101**. Remote server **104** represents the machine(s) that collect and store helpful and useful data for use by other computers, such as computer **101**. For example, in a hypothetical case where computer **101** is designed and programmed to provide a software product optimization or customization recommendation based on historical data, then this historical data may be provided to computer **101** from remote database **130** of remote server **104**.

[0029] Public cloud **105** is any computer system available for use by multiple entities that provides on-demand availability of computer system resources and/or other computer capabilities, especially data storage (cloud storage) and computing power, without direct active management by the user. Cloud computing typically leverages sharing of resources to achieve coherence and economies of scale. The direct and active management of the computing resources of public cloud **105** is performed by the computer hardware and/or software of cloud orchestration module **141**. The computing resources provided by public cloud **105** are typically implemented by virtual computing environments that run on various computers making up the computers of host physical machine set **142**, which is the universe of physical computers in and/or available to public cloud **105**. The virtual computing environments (VCEs) typically take the form of virtual machines from virtual machine set **143** and/or containers from container set **144**. It is understood that these VCEs may be stored as images and may be transferred among and between the various physical machine hosts, either as images or after instantiation of the VCE. Cloud orchestration module **141** manages the transfer and storage of images, deploys new instantiations of VCEs and manages active instantiations of VCE deployments. Gateway **140** is the collection of computer software, hardware, and firmware that allows public cloud **105** to communicate through WAN **102**.

[0030] Some further explanation of virtualized computing environments (VCEs) will now be provided. VCEs can be stored as "images." A new active instance of the VCE can be instantiated from the image. Two familiar types of VCEs are virtual machines and containers. A container is a VCE that uses operating-system-level virtualization. This refers to an operating system feature in which the kernel allows the existence of multiple isolated user-space instances, called containers. These isolated user-space instances typically behave as real computers from the point of view of programs running in them. A computer program running on an ordinary operating system can utilize all resources of that computer, such as connected devices, files and folders, network shares, CPU power, and quantifiable hardware capabilities. However, programs running inside a container can only use the contents of the container and devices assigned to the container, a feature which is known as containerization.

[0031] Private cloud **106** is similar to public cloud **105**, except that the computing resources are only available for use by a single entity. While private cloud **106** is depicted as being in communication with WAN **102**, in other embodiments a private cloud may be disconnected from the internet entirely and only accessible through a local/private network. A hybrid cloud is a composition of multiple clouds of different types (for example, private, community or public cloud types), often respectively implemented by different vendors. Each of the multiple clouds remains a separate and discrete entity, but the larger hybrid cloud architecture is bound together by standardized or proprietary technology that enables orchestration, management, and/or data/application portability between the multiple constituent clouds. In this embodiment, public cloud **105** and private cloud **106** are both part of a larger hybrid cloud.

[0032] Public cloud **105** and private cloud **106** are programmed and configured to deliver cloud computing services and/or microservices (not separately shown in FIG. **1**). Unless otherwise indicated, the word "microservices" shall be interpreted as inclusive of larger "services" regardless of size. Cloud services are infrastructure, platforms, or software that are typically hosted by third-party providers and made available to users through the internet. Cloud services facilitate the flow of user data from front-end clients (for example, user-side servers, tablets, desktops, laptops), through the internet, to the provider's systems, and back. In some embodiments, cloud services may be configured and orchestrated according to as "as a service" technology paradigm where something is being presented to an internal or external customer in the form of a cloud computing service. As-a-Service offerings typically provide endpoints with which various customers interface. These endpoints are typically based on a set of application programming interfaces (APIs). One category of as-a-service offering is Platform as a Service (PaaS), where a service provider provisions, instantiates, runs, and manages a modular bundle of code that customers can use to instantiate a computing platform and one or more applications, without the complexity of building and maintaining the infrastructure typically associated with these things. Another category is Software as a Service (SaaS) where software is centrally hosted and allocated on a subscription basis. SaaS is also known as on-demand software, web-based software, or web-hosted software. Four technological sub-fields involved in cloud services are: deployment, integration, on demand, and virtual private networks.

[0033] As used herein, when used with reference to items, "a set of" means one or more of the items. For example, a set of clouds is one or more different types of cloud environments. Similarly, "a number of," when used with reference to items, means one or more of the items. Moreover, "a group of" or "a plurality of" when used with reference to items, means two or more of the items.

[0034] Further, the term "at least one of," when used with a list of items, means different combinations of one or more of the listed items may be used, and only one of each item in the list may be needed. In other words, "at least one of" means any combination of items and number of items may be used from the list, but not all of the items in the list are required. The item may be a particular object, a thing, or a category.

[0035] For example, without limitation, "at least one of item A, item B, or item C" may include item A, item A and item B, or item B. This example may also include item A, item B, and item C or item B and item C. Of course, any combinations of these items may be present. In some illustrative examples, "at least one of" may be, for example, without limitation, two of item A; one of item B; and ten of item C; four of item B and seven of item C; or other suitable combinations.

[0036] For many entities, both large and small, the ability to utilize quality software products is important. However, there are times when an entity is not aware of all of the software products in a software product catalog of the entity that are available to optimize or customize other related software products currently utilized by the entity. Illustrative embodiments identify these software product optimizations or customizations for software products currently utilized by a client entity.

[0037] For example, illustrative embodiments utilize natural language processing and understanding to identify and notify client entities of available software product optimizations or customizations, which can increase at least one of usage, performance, functionality, capability, and the like of currently utilized software products of the client entities. Illustrative embodiments are capable of detecting these software product optimizations or customizations within user-to-user business-related conversations based on context of the conversations utilizing natural language processing and understanding, while providing a seamless and non-intrusive experience for the client entities.

[0038] Illustrative embodiments first receive consent or permission from each of a group of users corresponding to the entity for illustrative embodiments to monitor and process user-to-user business-related conversations regarding software products corresponding to the entity. In addition, illustrative embodiments receive consent or permission from the group of users to connect to and access a set of user-to-user communication applications utilized by the group of users to conduct these user-to-user business-related conversations. In other words, during a registration process for the software product optimization services provided by illustrative embodiments, each respective user of the group of users opts in to the monitoring and processing of the user-to-user business-related conversations by illustrative embodiments via the opted in set of user-to-user communication applications. It should be noted that the opted in user-to-user business-related conversations include both verbal and textual conversations or communications, such as, for example, web conferences, teleconferences, instant messages, text messages, emails, and the like.

[0039] Illustrative embodiments connect or integrate with a software product catalog, which includes a SaaS catalog, corresponding to the entity. In addition, illustrative embodiments connect or integrate with a software product or license management tool to determine, for example, whether a particular software product optimization or customization recommendation will work with a particular software product currently being utilized by the entity, whether that particular software product optimization or customization is allowed or not for that particular software product currently being utilized by the entity, and the like. Further, illustrative embodiments connect or integrate with a knowledge corpus or contractual processing component to determine, for example, whether that particular software product optimization or customization has already been implemented in that particular software product currently being utilized by the entity, whether that particular software product optimization or customization complies with contractual terms regarding that particular software product currently being utilized by the entity, and the like.

[0040] Furthermore, for each respective software product listed in the software product catalog of the entity, illustrative embodiments utilize a list of keywords in association with the knowledge corpus based on relevant contextual factors. The keywords may include, for example, adjacent context, specific language or terminology, and the like. Illustrative embodiments utilize the keywords in specific context of user-to-user business-related conversations for determining software product optimization or customization recommendations.

[0041] Illustrative embodiments process the opted in user-to-user business-related conversations among the group of users utilizing, for example, speech-to-text conversion of web conferences, teleconferences, and the like. Illustrative embodiments also utilize natural language processing and understanding to process the speech-to-text conversions and other textual communications, such as, for example, instant messages, text messages, emails, and the like, among the group of users. In addition, illustrative embodiments perform sentiment analysis to determine negative sentiment (e.g., hesitation, concern, worry, or the like) or positive sentiment (e.g., satisfaction, peace of mind, relief, delight, or the like) expressed by one or more of the group of users in the user-to-user business-related conversations regarding a software product currently being utilized by the entity. In other words, illustrative embodiments determine what was said regarding the software product currently being utilized by the entity and how it was said to determine a set of related software products listed in the software product catalog of the entity that illustrative embodiments can utilize to optimize or customize the software product to enhance the capabilities, functionalities, performance, usage, or the like of that particular software product to meet the current needs of the entity.

[0042] Moreover, illustrative embodiments identify the context of the user-to-user business-related conversations to determine applicable or relevant software product optimizations or customizations for the software product currently being used by the entity. For example, illustrative embodiments identify when a particular keyword or term was mentioned by a user in the user-to-user business-related conversation regarding the software product currently being used by the entity and any other keywords that were mentioned along with their corresponding context. Illustrative embodiments also identify whether the software product is mentioned while the software product is currently executing or after execution of the software product to determine context. In addition, illustrative embodiments identify how the entity is utilizing the software product to determine context.

[0043] Illustrative embodiments then generate a recommendation for a software product optimization or customization of the software product currently being utilized by the entity based on the natural language processing and understanding of the user-to-user business-related conversations identifying any user expressed sentiment and mentioned keywords with corresponding context regarding the software product. Illustrative embodiments also determine whether the optimizing or customizing software product for the currently used software product is available based on the current software product inventory of the entity. Illustrative embodiments may utilize a defined minimum inventory level for the optimizing or customizing software product. For example, if illustrative embodiments determine that the optimizing or customizing software product is currently available (i.e., the current inventory level of that optimizing or customizing software product is greater than the defined minimum inventory level for that optimizing or customizing software product), then illustrative embodiments send the software product optimization or customization recommendation to the group of users for implementation. Alternatively, in addition to sending the software product optimization or customization recommendation to the group of users, illustrative embodiments can automatically implement the optimizing or customizing software product in the currently used software product. Moreover, illustrative embodiments collect feedback from the group of user regarding the software product optimization or customization of the software product currently being used by the entity. Illustrative embodiments utilize the feedback from the group of user to increase the recommendation accuracy of future software product optimizations or customizations.

[0044] Thus, illustrative embodiments provide one or more technical solutions that overcome a technical problem with an inability of current solutions to identify software product optimization opportunities using natural language processing and understanding of user-to-user business-related conversations among a group of users corresponding to an entity. As a result, these one or more technical solutions provide a technical effect and practical application in the field of software product optimization.

[0045] With reference now to FIG. **2**, a diagram illustrating an example of a software product optimization process is depicted in accordance with an illustrative embodiment. Software product optimization process **201** may be implemented in a computer, such as, for example, computer **101** in FIG. **1**. For example, software product optimization process **201** may be implemented by software product optimization code **200** in FIG. **1**.

[0046] In this example, software product optimization process **201** starts at **202** where the computer receives consent from a group of users corresponding to entity to opt in to processing of user-to-user business-related conversations among the group of users. The computer may receive the consent from the group of users during, for example, a registration process for the software product optimization services provided by the computer.

[0047] At **204**, in response to receiving the consent from the group of users corresponding to the entity, the computer integrates with a product software catalog of the entity that includes a plurality of different software products corresponding to the entity. In addition, at **206**, the computer integrates with a set of communication applications as opted in by the group of users. Further, at **208**, the computer accesses a keyword corpus associated with each software product within the software product catalog of the entity.

[0048] At **210**, the computer processes the user-to-user business-related conversations among the group of users using natural language processing and understanding. At **212**, the computer, using natural language processing and understanding, identifies sentiment expressed by one or more of the group of users in the user-to-user business-related conversations. At **214**, the computer, using natural language processing and understanding, also identifies keywords mentioned in the user-to-user business-related conversations.

[0049] At **216**, the computer, using natural language processing and understanding, makes a determination as to whether the keywords correspond to a software product corresponding to the entity. If the computer determines that the keywords do not correspond to a software product corresponding to the entity, then software product optimization process **201** terminates thereafter. If the computer determines that the keywords do correspond to a software product corresponding to the entity, then, at **218**, the computer makes another determination as to whether one or more of the group of users are expressing negative sentiment regarding the software product.

[0050] If the computer determines that the group of users are not expressing negative sentiment regarding the software product, then software product optimization process **201** terminates thereafter. If the computer determines that one or more of the group of users are expressing negative sentiment regarding the software product, then, at **220**, the computer identifies a related software product in the software production catalog of the entity as an optimization to the software product. At **222**, the computer sends a recommendation to the group of users to implement the related software product as an optimization to the software product. Thereafter, software product optimization process **201** terminates.

[0051] With reference now to FIGS. **3A-3C**, a flowchart illustrating a process for software product optimization is shown in accordance with an illustrative embodiment. The process shown in FIGS. **3A-3C** may be implemented in a computer, such as, for example, computer **101** in FIG. **1**. For example, the process shown in FIGS. **3A-3C** may be implemented by software product optimization code **200** in FIG. **1**.

[0052] The process begins when the computer receives consent from a group of users corresponding to an entity to access and process a set of opted in user-to-user business-related conversations among the group of users occurring via a set of opted in user-to-user communication applications that includes at least one of verbal communications and textual communications among the group of users (step **302**). In response to receiving the consent from the group of users, the computer accesses a software product catalog corresponding to the entity that includes a plurality of software products corresponding to the entity (step **304**). In addition, the computer accesses the set of opted in user-to-user communication applications to process the set of opted in user-to-user business-related conversations among the group of users (step **306**).

[0053] The computer, using a natural language processing and understanding model, performs an analysis of the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity occurring via the set of opted in user-to-user communication applications (step **308**). The computer, using the natural language processing and understanding model, determines a context of the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity based on the analysis of the set of opted in user-to-user business-related conversations (step **310**). Further, the computer, using the natural language processing and understanding model, identifies expressed sentiment and mentioned keywords in the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity based on the context of the set of opted in user-to-user business-related conversations (step **312**).

[0054] The computer, using the natural language processing and understanding model, determines whether a software product is identified by the mentioned keywords in the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity based on a keyword corpus (step **314**). If the computer, using the natural language processing and understanding model, determines that a software product is not identified by the mentioned keywords in the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity based on the keyword corpus, no output of step **314**, then the process terminates thereafter. If the computer, using the natural language processing and understanding model, determines that a software product is identified by the mentioned keywords in the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity based on the keyword corpus, no output of step **314**, then the computer associates the expressed sentiment with the software product (step **316**).

[0055] Afterward, the computer, using the natural language processing and understanding model, makes a determination as to whether the expressed sentiment associated with the software product is negative sentiment (step **318**). If the computer, using the natural language processing and understanding model, determines that the expressed sentiment associated with the software product is not negative sentiment, no output of step **318**, then the process terminates thereafter. If the computer, using the natural language processing and understanding model, determines that the expressed sentiment associated with the software product is negative sentiment, yes output of step **318**, then the computer identifies a related software product listed in the software product catalog of the entity as an optimization to the software product (step **320**).

[0056] Moreover, the computer performs an analysis of a current inventory of the entity (step **322**). The computer makes a determination as to whether a current inventory level of the related software product is greater than a defined minimum inventory threshold level for the related software product based on the analysis of the current inventory of the entity (step **324**). If the computer determines that the current inventory level of the related software product is not greater than the defined minimum inventory threshold level for the related software product based on the analysis of the current inventory of the entity, no output of step **324**, then the process terminates thereafter. If the computer determines that the current inventory level of the related software product is greater than the defined minimum inventory threshold level for the related software product based on the analysis of the current inventory of the entity, yes output of step **324**, then the computer determines that the related software product is available for the optimization of the software product (step **326**).

[0057] Furthermore, the computer determines an optimal notification application corresponding to the group of users based on at least one of type of content (e.g., at least one of verbal content and textual content) to be included in a recommendation, the context of the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity, user preferences, and location of the related software product in the software product catalog of the entity in response to the computer determining that the related software product is available for the optimization of the software product (step **328**). The computer generates the recommendation to implement the related software product as the optimization to the software product (step **330**). The computer sends the recommendation to implement the related software product as the optimization to the software product to the group of users corresponding to the entity using the optimal notification application (step **332**).

[0058] Subsequently, the computer receives an input to implement the related software product as the optimization to the software product from the group of users corresponding to the entity (step **334**). In response to receiving the input, the computer implements the related software product as the optimization to the software product (step **336**).

[0059] Afterward, the computer receives feedback from the group of users corresponding to the entity regarding implementation of the related software product as the optimization to the software product (step **338**). The computer utilizes the feedback from the group of users corresponding to the entity regarding the implementation of the related software product as the optimization to the software product to retrain the natural language processing and understanding model to increase accuracy of software product optimization recommendations (step **340**). Thereafter, the process terminates.

[0060] Thus, illustrative embodiments of the present disclosure provide a computer-implemented method, computer system, and computer program product for software product optimization. The descriptions of the various embodiments of the present disclosure have been presented for purposes of illustration, but are not intended to be exhaustive or limited to the embodiments disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art without departing from the scope and spirit of the described embodiments. The terminology used herein was chosen to best explain the principles of the embodiments, the practical application or technical improvement over technologies found in the marketplace, or to enable others of ordinary skill in the art to understand the embodiments disclosed herein.

What is claimed is:

1. A computer-implemented method for software product optimization, the computer-implemented method comprising:

associating, by a computer, expressed sentiment in a set of opted in user-to-user business-related conversations among a group of users corresponding to an entity with a software product in response to the computer, using a natural language processing and understanding model, determining that the software product is identified by mentioned keywords in the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity based on a keyword corpus;

determining, by the computer, using the natural language processing and understanding model, whether the expressed sentiment associated with the software product is negative sentiment;

identifying, by the computer, a related software product listed in a software product catalog of the entity as an optimization to the software product in response to the computer, using the natural language processing and understanding model, determining that the expressed sentiment associated with the software product is negative sentiment;

generating, by the computer, a recommendation to implement the related software product as the optimization to the software product; and

sending, by the computer, the recommendation to implement the related software product as the optimization to the software product to the group of users corresponding to the entity using an optimal notification application.

2. The computer-implemented method of claim **1**, further comprising:

receiving, by the computer, an input to implement the related software product as the optimization to the software product; and

implementing, by the computer, the related software product as the optimization to the software product in response to receiving the input.

3. The computer-implemented method of claim **1**, further comprising:

receiving, by the computer, feedback from the group of users corresponding to the entity regarding implementation of the related software product as the optimization to the software product; and

utilizing, by the computer, the feedback from the group of users corresponding to the entity regarding the implementation of the related software product as the optimization to the software product to retrain the natural language processing and understanding model to increase accuracy of software product optimization recommendations.

4. The computer-implemented method of claim **1**, further comprising:

performing, by the computer, an analysis of a current inventory of the entity;

determining, by the computer, whether a current inventory level of the related software product is greater than a defined minimum inventory threshold level for the related software product based on the analysis of the current inventory of the entity; and

determining, by the computer, that the related software product is available for the optimization of the software product in response to the computer determining that the current inventory level of the related software product is greater than the defined minimum inventory threshold level for the related software product based on the analysis of the current inventory of the entity.

5. The computer-implemented method of claim **1**, further comprising:

determining, by the computer, the optimal notification application corresponding to the group of users based on at least one of type of content to be included in the recommendation, context of the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity, user preferences, and location of the related software product in the software product catalog of the entity.

6. The computer-implemented method of claim **1**, further comprising:

receiving, by the computer, consent from the group of users corresponding to the entity to access and process the set of opted in user-to-user business-related conversations among the group of users occurring via the set of opted in user-to-user communication applications that includes at least one of verbal communications and textual communications among the group of users;

accessing, by the computer, the software product catalog corresponding to the entity that includes a plurality of software products corresponding to the entity; and

accessing, by the computer, the set of opted in user-to-user communication applications to process the set of opted in user-to-user business-related conversations among the group of users.

7. The computer-implemented method of claim **1**, further comprising:

performing, by the computer, using the natural language processing and understanding model, an analysis of the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity occurring via the set of opted in user-to-user communication applications;

determining, by the computer, using the natural language processing and understanding model, a context of the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity based on the analysis of the set of opted in user-to-user business-related conversations; and

identifying, by the computer, using the natural language processing and understanding model, the expressed sentiment and the mentioned keywords in the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity based on the context of the set of opted in user-to-user business-related conversations.

8. The computer-implemented method of claim **1**, wherein the optimization of the software product using the related software product expands at least one of usage, performance, functionality, and capability of the software product.

9. A computer system for software product optimization, the computer system comprising:

a communication fabric;

a set of computer-readable storage media connected to the communication fabric, wherein the set of computer-readable storage media collectively stores program instructions; and

a set of processors connected to the communication fabric, wherein the set of processors executes the program instructions to:

associate expressed sentiment in a set of opted in user-to-user business-related conversations among a group of users corresponding to an entity with a software product in response to determining, using a natural language processing and understanding model, that the software product is identified by mentioned keywords in the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity based on a keyword corpus;

determining, using the natural language processing and understanding model, whether the expressed sentiment associated with the software product is negative sentiment;

identifying a related software product listed in a software product catalog of the entity as an optimization to the software product in response to determining, using the natural language processing and understanding model, that the expressed sentiment associated with the software product is negative sentiment;

generate a recommendation to implement the related software product as the optimization to the software product; and

send the recommendation to implement the related software product as the optimization to the software product to the group of users corresponding to the entity using an optimal notification application.

10. The computer system of claim **9**, wherein the set of processors further executes the program instructions to:

receive an input to implement the related software product as the optimization to the software product; and

implement the related software product as the optimization to the software product in response to receiving the input.

11. The computer system of claim **9**, wherein the set of processors further executes the program instructions to:

receive feedback from the group of users corresponding to the entity regarding implementation of the related software product as the optimization to the software product; and

utilize the feedback from the group of users corresponding to the entity regarding the implementation of the related software product as the optimization to the software product to retrain the natural language processing and understanding model to increase accuracy of software product optimization recommendations.

12. The computer system of claim **9**, wherein the set of processors further executes the program instructions to:

perform an analysis of a current inventory of the entity;

determine whether a current inventory level of the related software product is greater than a defined minimum inventory threshold level for the related software product based on the analysis of the current inventory of the entity; and

determine that the related software product is available for the optimization of the software product in response to determining that the current inventory level of the related software product is greater than the defined minimum inventory threshold level for the related software product based on the analysis of the current inventory of the entity.

13. The computer system of claim **9**, wherein the set of processors further executes the program instructions to:

determine the optimal notification application corresponding to the group of users based on at least one of type of content to be included in the recommendation, context of the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity, user preferences, and location of the related software product in the software product catalog of the entity.

14. A computer program product for software product optimization, the computer program product comprising a set of computer-readable storage media having program instructions collectively stored therein, the program instructions executable by a computer to cause the computer to:

associate expressed sentiment in a set of opted in user-to-user business-related conversations among a group of users corresponding to an entity with a software product in response to determining, using a natural language processing and understanding model, that the software product is identified by mentioned keywords in the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity based on a keyword corpus;

determining, using the natural language processing and understanding model, whether the expressed sentiment associated with the software product is negative sentiment;

identifying a related software product listed in a software product catalog of the entity as an optimization to the software product in response to determining, using the natural language processing and understanding model, that the expressed sentiment associated with the software product is negative sentiment;

generate a recommendation to implement the related software product as the optimization to the software product; and

send the recommendation to implement the related software product as the optimization to the software product to the group of users corresponding to the entity using an optimal notification application.

15. The computer program product of claim **14**, wherein the program instructions further cause the computer to:

receive an input to implement the related software product as the optimization to the software product; and

implement the related software product as the optimization to the software product in response to receiving the input.

16. The computer program product of claim **14**, wherein the program instructions further cause the computer to:

receive feedback from the group of users corresponding to the entity regarding implementation of the related software product as the optimization to the software product; and utilize the feedback from the group of users corresponding to the entity regarding the implementation of the related software product as the optimization to the software product to retrain the natural language processing and understanding model to increase accuracy of software product optimization recommendations.

17. The computer program product of claim **14**, wherein the program instructions further cause the computer to:

perform an analysis of a current inventory of the entity;

determine whether a current inventory level of the related software product is greater than a defined minimum inventory threshold level for the related software product based on the analysis of the current inventory of the entity; and

determine that the related software product is available for the optimization of the software product in response to determining that the current inventory level of the related software product is greater than the defined minimum inventory threshold level for the related software product based on the analysis of the current inventory of the entity.

18. The computer program product of claim **14**, wherein the program instructions further cause the computer to:

determine the optimal notification application corresponding to the group of users based on at least one of type of content to be included in the recommendation, context of the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity, user preferences, and location of the related software product in the software product catalog of the entity.

19. The computer program product of claim **14**, wherein the program instructions further cause the computer to:

receive consent from the group of users corresponding to the entity to access and process the set of opted in user-to-user business-related conversations among the group of users occurring via the set of opted in user-to-user communication applications that includes at least one of verbal communications and textual communications among the group of users;

access the software product catalog corresponding to the entity that includes a plurality of software products corresponding to the entity; and

access the set of opted in user-to-user communication applications to process the set of opted in user-to-user business-related conversations among the group of users.

20. The computer program product of claim **14**, wherein the program instructions further cause the computer to:

perform, using the natural language processing and understanding model, an analysis of the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity occurring via the set of opted in user-to-user communication applications;

determine, using the natural language processing and understanding model, a context of the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity based on the analysis of the set of opted in user-to-user business-related conversations; and

identify, using the natural language processing and understanding model, the expressed sentiment and the mentioned keywords in the set of opted in user-to-user business-related conversations among the group of users corresponding to the entity based on the context of the set of opted in user-to-user business-related conversations.

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