

US Patent & Trademark Office

Patent Public Search | Text View

United States Patent Application Publication

20250260665

Kind Code

A1

Publication Date

August 14, 2025

Inventor(s)

Muthuraman; Krishnappan

SYSTEM TO MANAGE PRIVACY PREFERENCES

Abstract

A first event stream maintains a plurality of privacy preference data from two or more customer relationship management (CRM) systems. A second event stream maintains a plurality of solicitation preference data, each solicitation preference data in the plurality of solicitation preference data determined by applying a set of rules to filter a respective privacy preference data from the plurality of privacy preference data. A request for a current solicitation preference of a client is received from a CRM system of the two or more CRM systems. One or more entries in the second event stream are accessed. The current solicitation preference of the client is determined from the one or more entries in the second event stream. The current solicitation preference associated with the client is provided to the CRM system.

Inventors: Muthuraman; Krishnappan (Charlotte, NC)

Applicant: Wells Fargo Bank, N.A. (San Francisco, CA)

Family ID: 1000007698902

Appl. No.: 18/439138

Filed: February 12, 2024

Publication Classification

Int. Cl.: H04L9/40 (20220101); G06F21/62 (20130101)

U.S. Cl.:

CPC H04L63/0227 (20130101); G06F21/6245 (20130101);

Background/Summary

BACKGROUND

[0001] Enterprises maintain and manage consent preferences of clientele, such as individual customers of the enterprise (e.g., users), as well as third parties doing business with the enterprise (e.g., other enterprises). An enterprise must adhere to a client's consent preferences when providing marketing materials to clientele. For example, a client may have a consent preference to receive solicitation through email, but deny consent to be contacted through phone, or fax.

[0002] The enterprise may manage consent preferences received from a plurality of sources, such as multiple customer relationship management (CRM) systems. Conventional systems for maintaining consent preferences can fail to timely and accurately update clientele preferences. Discrepancies, duplicates, and errors can arise in the maintained consent preferences. For example, the enterprise may inadvertently send the same marketing email ten times, causing frustration for recipients.

[0003] Moreover, the enterprise may have legal requirements for maintaining and adhering to current consent preferences, which can vary by jurisdiction. Clientele may take legal action against an enterprise for violating consent preferences. Conventional systems for managing customer consent preferences are inadequate for maintaining current preferences and expose enterprises to liability.

Description

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0004] To easily identify the discussion of any particular element or act, the most significant digit or digits in a reference number refer to the figure number in which that element is first introduced.

[0005] FIG. 1 is a diagrammatic representation of a networked environment in which the present disclosure may be deployed, according to some examples.

[0006] FIG. 2A is a diagrammatic representation of a networked security system for an external source, according to some examples.

[0007] FIG. 2B is a diagrammatic representation of a networked security system for an internal source, according to some examples.

[0008] FIG. 3 is a diagrammatic representation of a preference management system, according to some examples.

[0009] FIG. 4 illustrates a flowchart showing a technique for preference management, according to some examples.

[0010] FIG. 5A illustrates a flowchart showing a technique for preference management, according to some examples.

[0011] FIG. 5B illustrates a flowchart showing a technique for preference management, according to some examples.

[0012] FIG. 6 illustrates generally an example of a block diagram of a machine upon which any one or more of the techniques discussed herein may perform in accordance with some examples.

DETAILED DESCRIPTION

[0013] The systems, methods, and techniques described herein may be used by an enterprise to maintain and manage current consent preferences of clientele from one or more CRM systems, such as privacy preference(s) and solicitation preference(s). Privacy preferences may include preferences of a client to seclude themselves or information about themselves selectively. Solicitation preferences may include preferences of a client to be contacted for solicitation, such as marketing solicitations.

[0014] The systems, methods, and techniques described herein may include a repository to store contact information, including privacy preference, as well as an engine for applying rules to the privacy preference to determine solicitation preference. The repository can write new or updated

privacy preference of a client to a first event stream. The engine receives data written to the first event stream and applies the rules to the most recent entry to determine the associated solicitation preference. The engine writes the determined solicitation preference to a second event stream. The current privacy preference and solicitation preference associated with a client can be determined by accessing the current entries in the first event stream and second event stream, respectively.

[0015] The systems, methods, and techniques described herein may improve veracity of maintained consent preference, which can improve client experiences and reduce liability and risk for the enterprise. The systems, methods, and techniques described herein may reduce both under communication and over communication with clientele.

[0016] FIG. 1 is a diagrammatic representation of a networked environment in which the present disclosure may be deployed, according to some examples. FIG. 1 includes a block diagram showing an example consent preferences system **100** for communicating over a network **102** (e.g., the Internet). The consent preferences system **100** can include one or more user systems **104**.

According to some examples, each user system **104** is communicatively coupled, via one or more communication networks including the network **102**, to an enterprise server system **106**, one or more CRM systems **108**, and, optionally, third-party servers **110**. Additional systems not shown in FIG. 1 may be included in the consent preferences system **100**.

[0017] The user system **104** can be used by a client (e.g., customer) or prospective client of the enterprise, such as an individual user or a representative user representing an organization (e.g., another enterprise, a non-profit, a government agency, an academic institution, or other third party). The user system **104** can include one or more user devices, such as a computer device **112** or a mobile device **114**, that are communicatively connected to exchange data (e.g., via the network **102**). According to some examples, the computer device **112** is an automated teller machine (ATM).

[0018] The user system **104** can host at least one application **116**. The application **116** may be a local instance of a client application of the enterprise, a client application of a CRM system **108**, or a web browser application. The application **116** can communicate with other locally hosted applications **116** using APIs and can communicate with the network **102** via the user system **104**.

[0019] The user system **104** can interact with the enterprise server system **106**, the CRM systems **108**, and the third-party servers **110** via the network **102**. The data exchanged between the user systems **104**, the CRM systems **108**, the third-party servers **110**, and the enterprise server system **106** over the network **102** can include functions (e.g., commands to invoke functions) and payload data (e.g., files, text, audio, video, or other data).

[0020] The consent preferences system **100** can include one or more CRM systems **108**. A CRM system **108** is a third-party software-as-a-service (SaaS) and can provide various services and operations to manage data about relationships between an enterprise and clients, including prospective clients. The enterprise may use a plurality of CRM systems **108** to manage different clients. For example, the enterprise may use a first CRM system **108** specialized for small businesses and a second CRM system **108** specialized for government entities.

[0021] CRM systems **108** may receive and manage contact information of customers (e.g., users), such as names emails, phone numbers, fax numbers, and other contact mediums. CRM systems **108** may manage additional customer data such as demographic and location data, sales history data, prior communications, and other relevant data about customers. CRM systems **108** may provide functionality to streamline sales, data analytics, and data storage (e.g., a database associated with the CRM system **108**). A CRM system **108** may receive data from a user system **104**. A CRM system **108** can communicate any of the aforementioned data to the enterprise server system **106** via the network **102**.

[0022] The enterprise server system **106** provides server-side functionality via the network **102** to the user systems **104**. While certain functions of the consent preferences system **100** are described herein as being performed by either by the enterprise server system **106** or subsystems thereof, the

location of certain functionality either within the enterprise server system **106** or the application **116** of the user system **104** may be a design choice. For example, it may be technically preferable to initially deploy particular technology and functionality within the enterprise server system **106** but to later migrate this technology and functionality to the application **116** where a user system **104** has sufficient processing capacity. Additionally, or alternatively, the enterprise server system **106** is able to provide, store, and modify device-side data (e.g., browser cookies, web storage such as local or session storage).

[0023] The enterprise server system **106** supports various services and operations. Such operations include receiving requests from, transmitting data to, receiving data from, and processing data from the user system **104** and the one or more CRM systems **108**. This data may include payload data, device information, geolocation information, passwords and user information, among other information. Data exchanges within the consent preferences system **100** are invoked and controlled through functions available via user interfaces (UIs) of the user system **104**.

[0024] Turning now specifically to the enterprise server system **106**, an Application Program Interface (API) server **120** is connected to and provides programmatic interfaces to a preference management system **118** making the functions of the preference management system **118** accessible to the one or more CRM systems **108**, user systems **104**, and third-party servers **110**, as applicable. The preference management system **118** is communicatively coupled to a database server **122**, facilitating access to a database **124** that stores data associated with the preference management system **118**. Similarly, a web server **126** is coupled to the preference management system **118** and provides web-based interfaces of the preference management system **118**. To this end, the web server **126** processes incoming network requests over the Hypertext Transfer Protocol (HTTP) and several other related protocols. According to some examples, the API server **120** and web server **126** are subsystems of the preference management system **118**.

[0025] The API server **120** receives and transmits data between the preference management system **118** and the one or more CRM systems **108**. The API server **120** may receive and transmit data between the preference management system **118** and the user system **104** (e.g., the application **116**) or the third-party servers **110**, as applicable. Specifically, the API server **120** provides a set of interfaces (e.g., routines and protocols) that can be called or queried to invoke functionality of the preference management system **118**. The API server **120** exposes various functions supported by the preference management system **118**, including account registration; authentication and authorization functionality (e.g., access token, bearer token); transmitting data to and from a CRM system **108** to the preference management system **118**; among other data exchanges described herein. According to some examples, the API server **120** exposes HTTP request methods such as: providing new consent preference(s) (e.g., POST), updating consent preference(s) (e.g., PUT), and retrieving consent preference(s) (e.g., GET).

[0026] The preference management system **118** can host multiple systems and subsystems, described below with reference to FIG. 3.

[0027] FIG. 2A is a diagrammatic representation of a networked security system **202** for an external source **204**, according to some examples. Securing communications is important to protecting data of clientele, such as consent preferences. The networked security system **202** may provide different security protocols for external sources **204** and internal sources.

[0028] The enterprise server system **106** receives data from the external source **204** over the network **102**. The external source **204** may be a CRM system **108** or a user system **104**. The network **102** may be a wide area network (WAN). Components and systems of the enterprise server system **106** may communicate over a local network, such as a local area network (LAN). The data received may be consent preference data of a client.

[0029] The data received by the enterprise server system **106** is processed through the networked security system **202**, according to some examples. The networked security system **202** can include one or more firewalls **206**, **210**, **214** to apply predetermined security rules to incoming data. The

networked security system **202** can further include a secure gateway application **208** and an API gateway **212**.

[0030] The enterprise server system **106** may use multiple firewalls **206, 210, 214** for increased security. For example, the increased security can reduce successful attacks on the privacy and solicitation preferences of clients. The multiple firewalls **206, 210, 214** can create segments with different levels of trust within the local network of the enterprise server system **106**. For example, each successive firewall can provide an increased level of security. Additionally, or alternatively, the multiple firewalls **206, 210, 214** can create redundancies within the local network, preventing a single point of failure during an attack or technical failure. Each of the firewalls **206, 210, 214** may be implemented as a software application (e.g., a software appliance), a hardware device (e.g., a computer appliance), or a virtual appliance that runs on a hypervisor.

[0031] The first firewall **206** may apply predetermined security rules applicable to all incoming network traffic. The first firewall **206** can be the interface between an external network (i.e., the network **102**) and a local network of the enterprise server system **106**. The first firewall **206** prevents unauthorized access to the enterprise server system **106**. The predetermined security rules associated with the first firewall **206** may maintain an enterprise-wide access control list.

[0032] Responsive to passing through the first firewall **206**, the data is received by the secure gateway application **208**. The secure gateway application **208** provides security and protocol mediation to the received data. In some examples, the secure gateway application **208** provides any-to-any message transformation. The secure gateway application **208** may further provide routing capabilities to connect the external source **204** to the preference management system **118**, among other systems.

[0033] After being processed by the secure gateway application **208**, the data may pass through a second firewall **210**. The second firewall **210** may apply predetermined security rules applicable to external API requests. The second firewall **210** may have requirements that are narrower (e.g., stricter) than those of the first firewall **206**. For example, the second firewall **210** prevents unauthorized access to an API gateway **212**. The predetermined security rules associated with the second firewall **210** may maintain an access control list specific to external traffic. The second firewall **210** can validate boundaries of an API gateway **212** segment of the networked security system **202** and, if the boundaries are valid, invoke the API gateway **212**.

[0034] The API gateway **212** provides API management to external traffic, according to some examples. In some examples, responsive to receiving the data, the API gateway **212** may invoke one or more API calls of the API server **120**, for example, to a third firewall **214**.

[0035] The third firewall **214** applies predetermined privacy rules applicable to maintained data. For example, the predetermined privacy rules can be specific to preventing attacks on or tampering with the sensitive contact information maintained by the preference management system **118**. The third firewall **214** may apply predetermined security rules that are narrower than those of the first firewall **206** and the second firewall **210**.

[0036] The third firewall **214** validates the boundaries of a preference management system **118** segment of the networked security system **202** and, if the boundaries are valid, invokes the preference management system **118**. The data is received by the preference management system **118** for further processing and persisting, as described in relation to FIG. 3.

[0037] FIG. 2B is a diagrammatic representation of a networked security system **218** for an internal source **216**, according to some examples. That is, data received from an internal source **216** may be processed differently than data from an external source **204**, according to some examples. The networked security system **218** may comprise an example of the networked security system **202**.

[0038] The enterprise server system **106** receives data from the internal source **216** over the network **102**. The internal source **216** may be a CRM system **108** internal to the enterprise or a user system **104** internal to the enterprise. The network **102** may be a local area network (LAN). For data transmitted over a local network **102**, such as a LAN, firewalls **206, 210, 214** may not be

necessary.

[0039] The networked security system **218** comprises an API gateway **220**. The data received by the enterprise server system **106** is provided to the API gateway **220** for processing. The API gateway **220** can comprise an example of the API gateway **212**. According to some examples, the API gateway **220** provides API management for internal traffic.

[0040] FIG. **3** is a diagrammatic representation of a preference management system **118**, according to some examples. The preference management system **118** receives consent preference data **302**, which includes new or updated consent preferences of a client, such as an individual user or organization. The consent preference data **302** may comprise privacy preference data or solicitation preference data. For example, consent preference data **302** may comprise an indication of a client unsubscribing from a marketing email subscription. According to some examples, the consent preference data **302** is received by the preference management system **118** in JavaScript Object Notation (JSON) format.

[0041] The preference management system **118** receives consent preference data **302**, for example, from the CRM systems **108**. The preference management system **118** may receive a plurality of consent preference data **302** from one or more CRM systems **108**, and the plurality of consent preference data **302** may be associated with a plurality of different clients. Additionally, or alternatively, the plurality of consent preference data **302** may be associated with a single client, representing one or more updates to the client's consent preferences. The consent preference data **302** may be received by the preference management system **118** from a CRM system **108** over the network **102**, as depicted in FIG. **1**. Additionally, or alternatively, the preference management system **118** may receive consent preference data **302** from another subsystem of the enterprise server system **106**.

[0042] The preference management system **118** comprises a contact master **304** and a consent engine **316**. The contact master **304** manages contact information associated with clients and prospective clients, which can include consent preferences of clients and prospective clients. The contact information managed by the contact master **304** may be maintained in a contact repository **306**.

[0043] The contact repository **306** stores data associated with contact information of clients and prospective clients. The contact repository **306** can store contact information such as name of individual(s), name of organization, email, phone number, fax number, mailing address, social media handles, among other means of contacting a client or prospective client. According to some examples, each client or respective client is associated with an identification (ID) number in the contact repository **306**. The contact repository **306** can store data indicating consent preferences, including privacy preferences, associated with each respective means of contact, as applicable. For example, for a particular client, the contact repository **306** may store data indicating the client does not consent to sharing their phone number and does consent to sharing their name and email.

[0044] Additionally, or alternatively, the contact repository **306** may store dates or timestamps of changes to privacy preferences, corresponding privacy policies per the time consent was acquired or denied, and a document or other reference of data through which consent was acquired or denied. According to some examples, the timestamp indicates when the client provided the new or updated privacy preferences. For example, a client provides updated privacy preferences to a CRM system **108** and the CRM system **108** provides the privacy preference data **314** to the preference management system **118** comprising the timestamp indicating the date and time the client making the update. The contact repository **306** may use one or more databases (e.g., database **124**), data lakes, cloud storage, or any other form of data storage system.

[0045] Responsive to receiving the consent preference data **302**, the contact master **304** cleans the consent preference data **302** using the data cleaning system **308**. According to some examples, the data cleaning system **308** may identify and correct (or remove) errors or corrupted data, remove duplicates, standardize the data formatting, address missing values, and validate data against a set

of rules or constraints to ensure the cleaned consent preference data **302** adheres to expected formats and value ranges. The cleaned consent preference data **302** can be stored in the contact repository **306**.

[0046] Cleaned consent preference data **302** stored in the contact repository **306** provide a record of current consent preferences associated with a respective client. According to some examples, an update to consent preference data **302** writes over a prior entry in the contact repository **306**, and record of the prior entry is lost. For example, important information may be inadvertently scrubbed. Additionally, or alternatively, updates to consent preferences stored in the contact repository **306** can result in duplicate entries, which may cause duplicate solicitations and create liabilities. The contact repository **306** alone is inadequate for maintaining current consent preference data **302** of clients.

[0047] To adequately address an enterprise's need to maintain accurate and current consent preferences, the preference management system **118** comprises a first event stream **310** and a second event stream **312** to persist preference data in a chronology. The contact master **304** generates privacy preference data **314** from the cleaned consent preference data **302** and writes the privacy preference data **314** to the first event stream **310**. The consent engine **316** acquires the privacy preference data **314** from the first event stream **310** and applies rules to generate solicitation preference data **320**, which is written to the second event stream **312**. The first event stream **310** and the second event stream **312** serve as persistent storage for consent preferences, even in the event the original consent preference data **302** is written over in the contact repository **306**.

[0048] Privacy preference data **314** can include data relating to a client's choices regarding collection, use, and sharing of their personal information. More generally, privacy preferences permit a client to maintain control over personal data. A client (e.g., user, organization) can manage their privacy preferences through privacy settings provided by the one or more CRM systems **108** or the enterprise (e.g., web server **126**). New or updated privacy preferences are provided to the preference management system **118** as consent preference data **302**. The contact master **304** generates the privacy preference data **314** from the consent preference data **302**, for example, based on acquiring applicable entries in the consent preference data **302**. Privacy preference data **314** may include data entries relating to: [0049] Communication Type Preference(s): indicating whether and how a user prefers to be contacted by an organization, such as email, phone, text messages, or mail, among others. For example, a client may agree to be contacted by email and decline to be contacted by phone. [0050] Data Collection Preference(s): indicating which types of personal data may be collected, such as contact information, location data, browsing history (e.g., browser cookie preferences), and demographic information. [0051] Data Usage Preference(s): indicating the purposes for which the collected data may be used, such as service improvement or personalized content (e.g., targeted marketing). [0052] Data Sharing Preference(s): indicating whether and with whom the collected data can be shared, such as third-parties or affiliates.

[0053] The contact master **304** writes (e.g., logs, publishes) privacy preference data **314** to a first event stream **310**. The first event stream **310** is a stream of entries, each entry comprising privacy preference data **314** associated with a client. Each entry may further comprise a date and timestamp. According to some examples, entries into the first event stream **310** are immutable. A first event stream **310** with immutable entries can provide a reverse-chronological stream of privacy preference data **314**, enabling the preference management system **118** to efficiently determine a client's current privacy preference by referencing the current entry or entries associated with the client in the first event stream **310**.

[0054] Entries into the first event stream **310** can be received by the consent engine **316**. According to some examples, the contact master **304** and the consent engine **316** belong to a publisher-subscriber software architecture, where the contact master **304** is the publisher of the first event stream **310** and the consent engine **316** is the subscriber of the first event stream **310**. In some

examples, the first event stream **310** can be implemented using Kafka Topic, where each Topic may have one or more partitions. The privacy preference data **314** may be written to the first event stream **310** in JSON format.

[0055] Responsive to receiving cleaned consent preference data **302** from the first event stream **310**, the consent engine **316** processes the privacy preference associated with a client to determine solicitation preference associated with the client by generating solicitation preference data **320**. Solicitation preferences relate to a client's choices about being contacted for marketing, sales, or fundraising purposes. Solicitation preferences dictate whether and how an organization can approach a client for proportional communications. The solicitation preference data **320** may include data entries relating to: [0056] Communication Type Solicitation Preference(s): indicating whether a client can be contacted for solicitation by particular methods of contact, such as email, phone, text messages, or mail, among others. For example, a client may agree to be solicited by email and decline to be solicited by phone. [0057] Frequency of Solicitation Preference(s): setting limits on how often an organization can reach out for solicitation purposes. [0058] Solicitation Content Type Preference(s): indicating whether a client is interested in receiving particular types of content, such as promotional marketing (e.g., commercial product offers, targeted marketing), fundraising content (e.g., philanthropy), informational content (e.g., newsletters), among others. [0059] According to some examples, the consent engine **316** applies a set of rules to the privacy preference data **314** to determine solicitation preference data **320** associated with a client. The set of rules provide conditions, filters, or transformations to ascertain solicitation preference(s) associated with the client from the privacy preference(s). A rule in the set of rules may be, for example, if a client is in a region impacted by natural disaster (e.g., flood or fire), then do not send a solicitation (e.g., marketing email) That is, solicitation preference data **320** can be determined from the received privacy preference data **314**.

[0060] For example, responsive to receiving a marketing email with an opt-out option, a client elects to opt-out of future emails. The preference management system **118** receives consent preference data **302** comprising an indication of the email opt-out update. The contact master **304** updates the contact repository **306** and generates privacy preference data **314** comprising an indication of an update to the communication type preferences, specifically email communication preferences, that the client opts out of email communications. The privacy preference data **314** is written to the first event stream **310**, and received by the consent engine **316**. The consent engine **316** applies the set of rules to determine solicitation preference data **320** comprising an indication of an update to the communication type solicitation preferences, specifically email solicitation preferences, that the client should not receive email solicitations. That is, the consent engine **316** may determine a communication type solicitation preference in solicitation preference data **320** by applying the set of rules to the communication type preference in the privacy preference data **314**.

[0061] In another example, the preference management system **118** receives consent preference data **302** comprising a new phone number from a customer (e.g., a client or a representative of a client), for example, while the customer is traveling. The contact master **304** updates the contact repository **306** and generates privacy preference data **314** comprising an indication of an update to the communication type preferences, specifically phone communication preferences, replacing an old phone number with the new phone number. The privacy preference data **314** is written to the first event stream **310**, and received by the consent engine **316**. The consent engine **316** applies the set of rules to determine solicitation preference data **320** comprising an indication of an update to the communication type solicitation preferences, specifically phone solicitation preferences, indicating the new phone number for solicitation purposes. The consent engine **316** writes the solicitation preference data **320** to the second event stream **312**. One or more CRM systems **108** may request the customer's phone solicitation preference from the preference management system **118**, and in response receive the new phone number accessed from the second event stream **312**. The customer may receive solicitations at the new phone number while traveling responsive to

updating their privacy preferences.

[0062] In another example, the preference management system **118** receives consent preference data **302** comprising an opt-in to data usage for targeted marketing for a client. The contact master **304** generates privacy preference data **314** comprising an indication of the update to the data usage preferences, that the client opts-in for targeted advertising, which is written to the first event stream **310**. The consent engine **316** applies the set of rules to the privacy preference data **314** to determine solicitation preference data **320** comprising an indication of an update to the solicitation content type preferences, that the client can receive solicitations containing targeted marketing. That is, the consent engine **316** may determine solicitation content type preferences in the solicitation preference data **320** by applying the set of rules to the data usage preferences in the privacy preference data **314**.

[0063] The set of rules are managed and stored by a rule repository **318** of the consent engine **316**, according to some examples. The rule repository **318** may update the set of rules responsive to a real-world event. Examples of real-world events can include weather events (e.g., hurricane, earthquake, tornado, other natural disasters or acts of God), political events (e.g., elections, changes in government or policy), economic events (e.g., major shifts in economic indicators, trade agreements), social events (e.g., public health concerns, public awareness campaigns), cultural events (e.g., arts, entertainment, sports, celebrities), scientific events (e.g., scientific discoveries, research findings, technological breakthroughs), and legal events (e.g., court rulings, changes in law), among other current events. The set of rules in the rule repository **318** may be updated automatically (e.g., triggered by keyword) or manually responsive to a real-world event.

[0064] The consent engine **316** writes the solicitation preference data **320** to a second event stream **312**. The second event stream **312** can comprise an example of the first event stream **310**, according to some examples. Each entry may further comprise a date and timestamp. In a publisher-subscriber architecture, the consent engine **316** is a publisher of the second event stream **312** and the contact master **304** is a subscriber. Additionally, or alternatively, the preference management system **118** is a subscriber of the second event stream **312**.

[0065] A second event stream **312** with immutable entries provides a reverse-chronological stream of solicitation preference data **320**, enabling the preference management system **118** to efficiently determine a client's current solicitation preference by referencing the current entry associated with the client in the second event stream **312**. The preference management system **118** may determine a current entry in the second event stream **312** by referencing date and timestamps associated with the client updating their consent preferences. That is, the current entry may differ from the most recent entry written to the second event stream **312**.

[0066] Responsive to a request for consent preferences (e.g., privacy preferences, solicitation preferences), the preference management system **118** can serve the privacy preference data **314** or solicitation preference data **320**, as applicable, from the first event stream **310** or second event stream **312**, respectively.

[0067] For example, prior to soliciting a client, a CRM system **108** sends a request to the preference management system **118** for the solicitation preference(s) of the client. The preference management system **118** accesses the first event stream **310** and determines the current entry comprising the current privacy preference data **314** of the client. If the privacy preference data **314** of the client opts-in to data sharing with the CRM system **108**, the preference management system **118** can share the privacy preference data **314** of the client. The preference management system **118** accesses the second event stream **312** and determines the current entry comprising the current solicitation preference data **320** of the client. The preference management system **118** provides the current solicitation preference data **320** to the CRM system **108** for solicitation.

[0068] The preference management system **118** provides more accurate current consent preferences associated with clients, as previously discussed. Additionally, using publisher-subscriber architecture to implement the first event stream **310** and the second event stream **312** ensures

solicitation preferences are updated responsive to each update to privacy preferences. In publisher-subscriber architecture, a publisher delivers an entry to a subscriber at least once. That is, responsive to the contact master **304** writing each privacy preference data **314**, the consent engine **316** receives the privacy preference data **314** at least once, triggering determination of solicitation preference data **320** at least once. Writing the solicitation preference data **320** to the second event stream **312** more than once would not impact the accuracy of the solicitation preferences maintained by the preference management system **118**. The publisher-subscriber architecture of the preference management system **118** provides more accurate maintenance of consent preferences than conventional approaches, such as databases.

[0069] FIG. **4** illustrates a flowchart showing a technique **400** for preference management, according to some examples. In an example, operations of the technique **400** may be performed by processing circuitry, for example by executing instructions stored in memory. The processing circuitry may include a processor, a system on a chip, or other circuitry (e.g., wiring). For example, technique **400** may be performed by processing circuitry of a device (or one or more hardware or software components thereof), such as those illustrated and described with reference to FIG. **6**. According to some examples, the operations of the technique **400** are performed by the preference management system **118**.

[0070] The technique **400** includes **402** to maintain, using a first event stream, a plurality of privacy preference data from two or more CRM systems. The first event stream may be immutable and can comprise an example of the first event stream **310**. The plurality of privacy preference data maintained by the first event stream may be associated with a plurality of clients. The two or more CRM systems can comprise an example of the CRM systems **108**.

[0071] The technique **400** includes **404** to maintain, using a second event stream, a plurality of solicitation preference data. The second event stream may be immutable and can comprise an example of the second event stream **312**. In some examples, each solicitation preference data in the plurality of solicitation preference data maintained by the second event stream is determined by applying a set of rules to filter a respective privacy preference data from the plurality of privacy preference data maintained by the first event stream. The plurality of solicitation preference data maintained by the second event stream may be associated with a plurality of clients.

[0072] The technique **400** includes **406** to receive a request for a current solicitation preference of a client. The request may be received from a subsystem of the enterprise (e.g., enterprise server system **106**), a CRM (e.g., a first CRM of the two or more CRM systems), or another third-party (e.g., third-party server **110**). The client may be an individual or an organization, such as a representative of the organization. The client may be a user of the user system **104**. The request may be received by the API server **120** or the contact master **304** of the preference management system **118**.

[0073] The technique **400** includes **408** to access one or more entries in the second event stream associated with the client. In some examples, the preference management system **118** has access to the second event stream. According to some examples, the contact master **304** is a subscriber to the second event stream or otherwise has access to the second event stream.

[0074] The technique **400** includes **410** to determine the current solicitation preference of the client from the one or more entries in the second event stream associated with the client. The preference management system **118** may determine the current solicitation preference of the client from the one or more entries in the second event stream associated with the client based on timestamps. In some examples, the timestamps indicate when the client provided the respective privacy preferences (e.g., new or updated) from which the respective solicitation preference data was determined by applying the set of rules.

[0075] The technique **400** includes **412** to provide the current solicitation preference data associated with the client. The current solicitation preference data is provided **412** to the entity that requested **410** the current solicitation preference data. For example, if a CRM system **108** requested

the current solicitation preference, the preference management system **118** provides the current solicitation preference to the CRM system **108**. After receiving the current solicitation preference, the entity may solicit the client based on the current solicitation preference. For example, the entity may proceed to send a marketing email to the client responsive to being permitted by the current solicitation preference of the client.

[0076] The technique **400** provides a more accurate means of managing and maintaining consent preference of clients than conventional techniques. The technique **400** can more accurately persist consent preference from multiple sources, such as a plurality of CRM systems, which reduces liability for the organization using the technique **400**.

[0077] The technique **400** may include additional operations of determining a current privacy preference associated with the client based on the first event stream. According to some examples, the technique **400** at **412** further includes accessing one or more entries in the first immutable event stream associated with the client, and determining a current privacy preference of the client from the one or more entries in the first immutable event stream associated with the client, the current privacy preference comprising a data sharing preference. And, responsive to being permitted by the data sharing preference associated with the client, providing the current solicitation preference associated with the client to the requesting entity (e.g., a CRM system **108**).

[0078] Additionally, or alternatively, the technique **400** may further include each entry in the one or more entries in the second event stream associated with the client comprising a timestamp indicating when the client provided the respective privacy preference data to a respective CRM system of the two or more CRM systems. According to some examples, the current solicitation preference of the client is determined from the one or more entries in the second event stream associated with the client based on determining the most recent timestamp.

[0079] Additionally, or alternatively, the technique **400** may further include, responsive to a real-world event, updating the set of rules, wherein the real-world event is one of a weather event, a political event, an economic event, a social event, a cultural event, a scientific event, or a legal event.

[0080] FIG. 5A illustrates a flowchart showing a technique **500** for preference management, according to some examples. In an example, operations of the technique **500** may be performed by processing circuitry, for example by executing instructions stored in memory. The processing circuitry may include a processor, a system on a chip, or other circuitry (e.g., wiring). For example, technique **500** may be performed by processing circuitry of a device (or one or more hardware or software components thereof), such as those illustrated and described with reference to FIG. 6. According to some examples, the operations of the technique **500** are performed by the preference management system **118**. The technique **500** in FIG. 5A may comprise an example within or continuation of the technique **400** in FIG. 4.

[0081] The technique **500** includes **502** to receive privacy preference data associated with a client. The client may be an individual or an organization (or a representative of the organization). The client may provide new or updated privacy preference to an entity, such as a CRM (e.g., CRM systems **108**) or an enterprise (e.g., enterprise server system **106**). The preference management system **118** receives the privacy preference data from the entity. The privacy preference data may comprise a timestamp indicating a date and time of its receipt by the entity from the client. The privacy preference data may be received, for example, in JSON format. According to some examples, the privacy preference data comprises one or more of: communication type preference (e.g., email communication preference, phone communication preference, etc.), data collection preference, data usage preference, and data sharing preference.

[0082] The technique **500** includes **504** to write, to a first event stream, a first entry comprising the privacy preference data associated with the client. The first event stream may provide an immutable chronology of event entries comprising privacy preference data associated with the client or a plurality of clients. The first event stream **310** can comprise an example of the first event

stream. According to some examples, the contact master **304** of the preference management system **118** writes **504** the privacy preference data to the first event stream. According to some examples, an engine (e.g., consent engine **316**) receives entries of the first event stream.

[0083] The technique **500** includes **506** to apply a set of rules to the privacy preference data associated with the client to determine solicitation preference data associated with a client. The set of rules may be applied **506** by the engine. The set of rules may be stored in a repository (e.g., rule repository **318**). According to some examples, solicitation preference data comprises one or more of: communication type solicitation preference (e.g., email solicitation preference, phone solicitation preference), frequency of solicitation preference, and solicitation content type preference.

[0084] The technique **500** includes **508** to write, to a second event stream, a second entry comprising the solicitation preference data associated with the client. The second event stream may provide an immutable chronology of entries comprising solicitation preference data associated with the client or a plurality of clients. The second event stream **312** can comprise an example of the second event stream. According to some examples, the engine (e.g., consent engine **316**) of the preference management system **118** writes **508** the solicitation data to the second event stream. According to some examples, the, API server **120**, preference management system **118**, or contact master **304** receive entries of the second event stream.

[0085] The technique **500** may include additional operations of determining a current privacy preference associated with the client based on the first event stream. According to some examples, the technique **500** may include a step to store, in a repository, the privacy preference data associated with the client. The repository may maintain a plurality of privacy preference data associated with a plurality of clients. The repository may be the contact repository **306** of the preference management system **118**.

[0086] Additionally, or alternatively, the technique **500** may further include, responsive to receiving the privacy preference data, cleaning the privacy preference data to standardize data formatting of the privacy preference data, and validating the cleaned privacy preference data against a set of validation rules. The data cleaning system **308** of the preference management system **118** may provide the cleaning and validating operations.

[0087] Additionally, or alternatively, the technique **500** at **502** may further include receiving, at a first firewall, a request comprising the first privacy preference data associated with the client. The first firewall may apply a first set of predetermined security rules applicable to incoming network traffic. The first firewall may comprise an example of the first firewall **206**. The technique **500** at **502** may further include, responsive to being validated by the first firewall, receiving, at a first gateway, the request comprising the first privacy preference data associated with the client. The first gateway may comprise an example of the secure gateway application **208**.

[0088] Additionally, or alternatively, the technique **500** at **502** may further include, responsive to being invoked by the first gateway, receiving, at a second firewall, the request comprising the first privacy preference data associated with the client. The second firewall may apply a second set of predetermined security rules applicable to external requests, the second predetermined security rules being narrower than the first set of predetermined security rules. The second firewall may comprise an example of the second firewall **210**. The technique **500** at **502** may further include responsive to being validated by the second firewall, receiving, at a second gateway, the request comprising the first privacy preference data associated with the client. The second gateway may comprise an example of the API gateway **212**.

[0089] Additionally, or alternatively, the technique **500** at **502** may further include, responsive to being invoked by the second gateway, receiving, at a third firewall, the request comprising the first privacy preference data associated with the client. The third firewall may apply a third set of predetermined security rules applicable to maintained data, the third predetermined security rules being narrower than the second set of predetermined security rules. The third firewall may

comprise an example of the third firewall **214**. The technique **500** at **502** may further include, responsive to being validated by the third firewall, receiving the first privacy preference data associated with the client, for example, at the contact master **304** of the preference management system **118**.

[0090] Additionally, or alternatively, the technique **500** at **506** may further include determining communication type solicitation preference comprised in the solicitation preference data by applying the set of rules to communication type preference comprised in the privacy preference data. For example, an email solicitation preference may be determined by applying the set of rules to filter email communication preference in the privacy preference data.

[0091] Additionally, or alternatively, the technique **500** at **506** may further include determining solicitation content type preference comprised in the solicitation preference data by applying the set of rules to the data usage preference comprised in the privacy preference data. For example, a targeted marketing solicitation content preference may be determined by applying the set of rules to filter targeted marketing privacy preferences.

[0092] FIG. **5B** illustrates a flowchart showing a technique **510** for preference management, according to some examples. The technique **510** can comprise a continuation of the technique **500** of FIG. **5A**.

[0093] After **508** of technique **500**, the technique **510** can include **512** to receive second privacy preference data associated with the client. The second privacy preference data received at **512** can comprise an example of the first privacy preference data received at **502**. For example, the preference management system **118** can receive the second privacy preference data from the same entity as **502**. Alternatively, the preference management system **118** can receive **512** the second privacy preference data from a different entity. In some examples, the first privacy preference data is received **502** from a first CRM system, and the second privacy preference data is received **512** from a second CRM system, the second CRM system being distinct from the first CRM system.

[0094] The technique **510** can include **514** to write, to the first event stream, a third entry comprising the second privacy preference data associated with the client. Writing **514** may comprise an example of the writing **504** of technique **500**. According to some examples, the contact master **304** of the preference management system **118** writes **514** the second privacy preference data to the first event stream.

[0095] The technique **510** can include **516** to apply the set of rules to the second privacy preference data associated with the client to determine second solicitation preference data associated with the client. The second solicitation preference data may comprise an example of the first solicitation preference data.

[0096] The technique **510** can include **518** to write, to the second event stream, a fourth entry comprising the second solicitation preference data associated with the client. Writing at step **518** may comprise an example of the writing at step **508**. According to some examples, an engine (e.g., consent engine **316**) writes **518** the second solicitation preference data to the second event stream.

[0097] According to some examples, the technique **510** can continue after **518** to technique **400** at **406**, followed by determining a current solicitation preference associated with the client based on the second event stream. In some such examples, the preference management system **118** determines whether the first solicitation preference data or the second solicitation preference data is current by referencing date and timestamps associated with the client making the associated edit to their consent preferences that caused the preference management system **118** to receive **502**, **512** the respective privacy preference data. For example, the second solicitation preference data can be the current solicitation preference of the client.

[0098] FIG. **6** illustrates generally an example of a block diagram of a machine **600** upon which any one or more of the techniques (e.g., methodologies) discussed herein may perform in accordance with some embodiments. In alternative embodiments, the machine **600** may operate as a standalone device or may be connected (e.g., networked) to other machines. In a networked

deployment, the machine **600** may operate in the capacity of a server machine, a client machine, or both in server-client network environments. In an example, the machine **600** may act as a peer machine in peer-to-peer (P2P) (or other distributed) network environment. The machine **600** may be a personal computer (PC), a tablet PC, a set-top box (STB), a personal digital assistant (PDA), a mobile telephone, a web appliance, a network router, switch or bridge, or any machine capable of executing instructions (sequential or otherwise) that specify actions to be taken by that machine. Further, while only a single machine is illustrated, the term “machine” shall also be taken to include any collection of machines that individually or jointly execute a set (or multiple sets) of instructions to perform any one or more of the methodologies discussed herein, such as cloud computing, software as a service (SaaS), other computer cluster configurations.

[0099] Examples, as described herein, may include, or may operate on, logic or a number of components, modules, or mechanisms. Modules are tangible entities (e.g., hardware) capable of performing specified operations when operating. A module includes hardware. In an example, the hardware may be specifically configured to carry out a specific operation (e.g., hardwired). In an example, the hardware may include configurable execution units (e.g., transistors, circuits, etc.) and a computer readable medium containing instructions, where the instructions configure the execution units to carry out a specific operation when in operation. The configuring may occur under the direction of the executions units or a loading mechanism. Accordingly, the execution units are communicatively coupled to the computer readable medium when the device is operating. In this example, the execution units may be a member of more than one module. For example, under operation, the execution units may be configured by a first set of instructions to implement a first module at one point in time and reconfigured by a second set of instructions to implement a second module.

[0100] Machine (e.g., computer system) **600** may include a hardware processor(s) **602** (e.g., a CPU, a GPU, a hardware processor core, or any combination thereof), a main memory **604** and a static memory **606**, some or all of which may communicate with each other via an interlink **608** (e.g., a bus). The machine **600** may further include a display device **610**, an alphanumeric input device **612** (e.g., a keyboard), and a UI navigation device **614** (e.g., a mouse). In an example, the display device **610**, alphanumeric input device **612** and UI navigation device **614** may be a touch screen display. The machine **600** may additionally include a storage device **616** (e.g., drive unit), a signal generation device **618** (e.g., a speaker), a network interface device **620**, and one or more sensor(s) **622**, such as a global positioning system (GPS) sensor, compass, accelerometer, or other sensor. The machine **600** may include an output controller **624**, such as a serial (e.g., universal serial bus (USB), parallel, or other wired or wireless (e.g., infrared (IR), near field communication (NFC), etc.) connection to communicate or control one or more peripheral devices (e.g., a printer, card reader, etc.).

[0101] The storage device **616** may include a machine readable machine-readable medium **626** that is non-transitory on which is stored one or more sets of data structures or instructions **628** (e.g., software) embodying or utilized by any one or more of the techniques or functions described herein. The instructions **628** may also reside, completely or at least partially, within the main memory **604**, within static memory **606**, or within the hardware processor(s) **602** during execution thereof by the machine **600**. In an example, one or any combination of the hardware processor(s) **602**, the main memory **604**, the static memory **606**, or the storage device **616** may constitute machine readable media.

[0102] While the machine readable machine-readable medium **626** is illustrated as a single medium, the term “machine readable medium” may include a single medium or multiple media (e.g., a centralized or distributed database, or associated caches and servers) configured to store the one or more instructions **628**.

[0103] The term “machine readable medium” may include any medium that is capable of storing, encoding, or carrying instructions for execution by the machine **600** and that cause the machine **600**

to perform any one or more of the techniques of the present disclosure, or that is capable of storing, encoding or carrying data structures used by or associated with such instructions. Non-limiting machine-readable medium examples may include solid-state memories, and optical and magnetic media. Specific examples of machine-readable media may include: non-volatile memory, such as semiconductor memory devices (e.g., Electrically Programmable Read-Only Memory (EPROM), Electrically Erasable Programmable Read-Only Memory (EEPROM)) and flash memory devices; magnetic disks, such as internal hard disks and removable disks; magneto-optical disks; and CD-ROM and DVD-ROM disks.

[0104] The instructions **628** may further be transmitted or received over a communications network **630** using a transmission medium via the network interface device **620** utilizing any one of a number of transfer protocols (e.g., frame relay, internet protocol (IP), transmission control protocol (TCP), user datagram protocol (UDP), hypertext transfer protocol (HTTP), etc.). Example communication networks may include a local area network (LAN), a wide area network (WAN), a packet data network (e.g., the Internet), mobile telephone networks (e.g., cellular networks), Plain Old Telephone (POTS) networks, and wireless data networks (e.g., Institute of Electrical and Electronics Engineers (IEEE) 802.11 family of standards known as Wi-Fi®, IEEE 802.16 family of standards known as WiMax®, IEEE 802.15.4 family of standards, peer-to-peer (P2P) networks, among others. In an example, the network interface device **620** may include one or more physical jacks (e.g., Ethernet, coaxial, or phone jacks) or one or more antennas to connect to the communications network **630**. In an example, the network interface device **620** may include a plurality of antennas to wirelessly communicate using at least one of single-input multiple-output (SIMO), multiple-input multiple-output (MIMO), or multiple-input single-output (MISO) techniques. The term “transmission medium” shall be taken to include any intangible medium that is capable of storing, encoding or carrying instructions for execution by the machine **600**, and includes digital or analog communications signals or other intangible medium to facilitate communication of such software.

[0105] The above detailed description includes references to the accompanying drawings, which form a part of the detailed description. The drawings show, by way of illustration, specific embodiments in which the invention can be practiced. These embodiments are also referred to herein as “examples.” Such examples can include elements in addition to those shown or described. However, the present inventor also contemplates examples in which only those elements shown or described are provided. Moreover, the present inventor also contemplates examples using any combination or permutation of those elements shown or described (or one or more aspects thereof), either with respect to a particular example (or one or more aspects thereof), or with respect to other examples (or one or more aspects thereof) shown or described herein.

[0106] In this document, the terms “a” or “an” are used, as is common in patent documents, to include one or more than one, independent of any other instances or usages of “at least one” or “one or more.” In this document, the term “or” is used to refer to a nonexclusive or, such that “A or B” can include “A but not B,” “B but not A,” and “A and B,” unless otherwise indicated. In the appended claims, the terms “including” and “in which” are used as the plain-English equivalents of the respective terms “comprising” and “wherein”. Also, in the following claims, the terms “including” and “comprising” are open-ended, that is, a system, device, article, or process that includes elements in addition to those listed after such a term in a claim are still deemed to fall within the scope of that claim. Moreover, in the following claims, the terms “first,” “second,” and “third,” etc. are used merely as labels, and are not intended to impose numerical requirements on their objects.

[0107] The above description is intended to be illustrative, and not restrictive. For example, the above-described examples (or one or more aspects thereof) can be used in combination with each other. Other embodiments can be used, such as by one of ordinary skill in the art upon reviewing the above description. It is submitted with the understanding that it will not be used to interpret or

limit the scope or meaning of the claims. Also, in the above Detailed Description, various features can be grouped together to streamline the disclosure. This should not be interpreted as intending that an unclaimed disclosed feature is essential to any claim. Rather, inventive subject matter can lie in less than all features of a particular disclosed embodiment. Thus, the following claims are hereby incorporated into the Detailed Description, with each claim standing on its own as a separate embodiment, and it is contemplated that such embodiments can be combined with each other in various combinations or permutations. The scope of the invention should be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled.

[0108] The following, non-limiting examples, detail certain aspects of the present subject matter to solve the challenges and provide the benefits discussed herein, among others.

[0109] Example 1 is a method comprising: maintaining, using a first immutable event stream, a plurality of privacy preference data from two or more customer relationship management (CRM) systems; maintaining, using a second immutable event stream, a plurality of solicitation preference data, each solicitation preference data in the plurality of solicitation preference data determined by applying a set of rules to filter a respective privacy preference data from the plurality of privacy preference data maintained by the first immutable event stream; receiving, from a first CRM system of the two or more CRM systems, a request for a current solicitation preference of a client; accessing one or more entries in the second immutable event stream associated with the client; determining the current solicitation preference of the client from the one or more entries in the second immutable event stream associated with the client; and providing, to the first CRM system, the current solicitation preference associated with the client.

[0110] In Example 2, the subject matter of Example 1 includes, wherein the current solicitation preference is a current email solicitation preference indicating whether the client has agreed to be solicited by email.

[0111] In Example 3, the subject matter of Examples 1-2 includes, receiving first privacy preference data associated with the client from the first CRM system; writing, to the first immutable event stream, a first entry comprising the first privacy preference data associated with the client; applying the set of rules to the first privacy preference data to determine first solicitation preference data associated with the client; and writing, to the second immutable event stream, a second entry comprising the first solicitation preference data associated with the client.

[0112] In Example 4, the subject matter of Example 3 includes, receiving second privacy preference data associated with the client from a second CRM system of the two or more CRM systems, the second CRM system being distinct from the first CRM system; writing, to the first immutable event stream, a third entry comprising the second privacy preference data associated with the client; applying the set of rules to the second privacy preference data to determine second solicitation preference data associated with the client; and writing, to the second immutable event stream, a fourth entry comprising the second solicitation preference data associated with the client, the second solicitation preference data being the current solicitation preference of the client.

[0113] In Example 5, the subject matter of Examples 3-4 includes, wherein receiving the first privacy preference data associated with the client comprises: receiving, at a first firewall, a request comprising the first privacy preference data associated with the client; responsive to being validated by the first firewall, receiving, at a first gateway, the request comprising the first privacy preference data associated with the client; responsive to being invoked by the first gateway, receiving, at a second firewall, the request comprising the first privacy preference data associated with the client; responsive to being validated by the second firewall, receiving, at a second gateway, the request comprising the first privacy preference data associated with the client; responsive to being invoked by the second gateway, receiving, at a third firewall, the request comprising the first privacy preference data associated with the client; and responsive to being validated by the third firewall, receiving the first privacy preference data associated with the client.

[0114] In Example 6, the subject matter of Example 5 includes, wherein each of the first firewall, the second firewall, and the third firewall apply respective predetermined security rules to incoming data, wherein the first firewall applies first predetermined security rules applicable to incoming network traffic, wherein the second firewall applies second predetermined security rules applicable to external requests, the second predetermined security rules being narrower than the first predetermined security rules, and wherein the third firewall applies third predetermined security rules applicable to maintained data, the third predetermined security rules being narrower than the second predetermined security rules.

[0115] In Example 7, the subject matter of Examples 1-6 includes, wherein each entry in the one or more entries in the second immutable event stream associated with the client comprise a timestamp indicating when the client provided the respective privacy preference data to a respective CRM system of the two or more CRM systems, and wherein the current solicitation preference of the client is determined from the one or more entries in the second immutable event stream associated with the client based on determining a most recent timestamp.

[0116] In Example 8, the subject matter of Examples 1-7 includes, wherein privacy preference data comprises one or more of: communication type preference, data collection preference, data usage preference, and data sharing preference.

[0117] In Example 9, the subject matter of Example 8 includes, wherein solicitation preference data comprises one or more of: communication type solicitation preference, frequency of solicitation preference, and solicitation content type preference.

[0118] In Example 10, the subject matter of Examples 1-9 includes, accessing one or more entries in the first immutable event stream associated with the client; determining a current privacy preference of the client from the one or more entries in the first immutable event stream associated with the client, the current privacy preference comprising a data sharing preference; and responsive to being permitted by the data sharing preference associated with the client, providing the current solicitation preference associated with the client to the first CRM system.

[0119] In Example 11, the subject matter of Examples 1-10 includes, responsive to a real-world event, updating the set of rules, wherein the real-world event is one of a weather event, a political event, an economic event, a social event, a cultural event, a scientific event, or a legal event.

[0120] Example 12 is a system comprising: processing circuitry; and memory, including instructions, which when executed by the processing circuitry, causes the processing circuitry to perform operations to: maintain, using a first immutable event stream, a plurality of privacy preference data from two or more customer relationship management (CRM) systems; maintain, using a second immutable event stream, a plurality of solicitation preference data, each solicitation preference data in the plurality of solicitation preference data determined by applying a set of rules to filter a respective privacy preference data from the plurality of privacy preference data maintained by the first immutable event stream; receive, from a first CRM system of the two or more CRM systems, a request for a current solicitation preference of a client; access one or more entries in the second immutable event stream associated with the client; determine the current solicitation preference of the client from the one or more entries in the second immutable event stream associated with the client; and provide, to the first CRM system, the current solicitation preference associated with the client.

[0121] In Example 13, the subject matter of Example 12 includes, wherein the current solicitation preference is a current email solicitation preference indicating whether the client has agreed to be solicited by email.

[0122] In Example 14, the subject matter of Examples 12-13 includes, wherein the instructions further cause the processing circuitry to: receive first privacy preference data associated with the client from the first CRM system; write, to the first immutable event stream, a first entry comprising the first privacy preference data associated with the client; apply the set of rules to the first privacy preference data to determine first solicitation preference data associated with the

client; and write, to the second immutable event stream, a second entry comprising the first solicitation preference data associated with the client.

[0123] In Example 15, the subject matter of Example 14 includes, wherein the instructions further cause the processing circuitry to: receive second privacy preference data associated with the client from a second CRM system of the two or more CRM systems, the second CRM system being distinct from the first CRM system; write, to the first immutable event stream, a third entry comprising the second privacy preference data associated with the client; apply the set of rules to the second privacy preference data to determine second solicitation preference data associated with the client; and write, to the second immutable event stream, a fourth entry comprising the second solicitation preference data associated with the client, the second solicitation preference data being the current solicitation preference of the client.

[0124] In Example 16, the subject matter of Examples 14-15 includes, wherein receiving the first privacy preference data associated with a client comprises: receive, at a first firewall, a request comprising the first privacy preference data associated with the client; responsive to being validated by the first firewall, receive, at a first gateway, the request comprising the first privacy preference data associated with the client; responsive to being invoked by the first gateway, receive, at a second firewall, the request comprising the first privacy preference data associated with the client; responsive to being validated by the second firewall, receive, at a second gateway, the request comprising the first privacy preference data associated with the client; responsive to being invoked by the second gateway, receive, at a third firewall, the request comprising the first privacy preference data associated with the client; and responsive to being validated by the third firewall, receive the first privacy preference data associated with the client.

[0125] In Example 17, the subject matter of Example 16 includes, wherein each of the first firewall, the second firewall, and the third firewall apply respective predetermined security rules to incoming data, wherein the first firewall applies first predetermined security rules applicable to incoming network traffic, wherein the second firewall applies second predetermined security rules applicable to external requests, the second predetermined security rules being narrower than the first predetermined security rules, and wherein the third firewall applies third predetermined security rules applicable to maintained data, the third predetermined security rules being narrower than the second predetermined security rules.

[0126] In Example 18, the subject matter of Examples 12-17 includes, wherein each entry in the one or more entries in the second immutable event stream associated with the client comprise a timestamp indicating when the client provided the respective privacy preference data to a respective CRM system of the two or more CRM systems, and wherein the current solicitation preference of the client is determined from the one or more entries in the second immutable event stream associated with the client based on determining a most recent timestamp.

[0127] Example 19 is a non-transitory computer-readable storage medium, the non-transitory computer-readable storage medium including instructions that when executed by a computer, cause the computer to: maintain, using a first immutable event stream, a plurality of privacy preference data from two or more customer relationship management (CRM) systems; maintain, using a second immutable event stream, a plurality of solicitation preference data, each solicitation preference data in the plurality of solicitation preference data determined by applying a set of rules to filter a respective privacy preference data from the plurality of privacy preference data maintained by the first immutable event stream; receive, from a first CRM system of the two or more CRM systems, a request for a current solicitation preference of a client; access one or more entries in the second immutable event stream associated with the client; determine the current solicitation preference of the client from the one or more entries in the second immutable event stream associated with the client; and provide, to the first CRM system, the current solicitation preference associated with the client.

[0128] In Example 20, the subject matter of Example 19 includes, wherein the current solicitation

preference is a current email solicitation preference indicating whether the client has agreed to be solicited by email.

[0129] Example 21 is at least one machine-readable medium including instructions that, when executed by processing circuitry, cause the processing circuitry to perform operations to implement of any of Examples 1-20.

[0130] Example 22 is an apparatus comprising means to implement of any of Examples 1-20.

[0131] Example 23 is a system to implement of any of Examples 1-20.

[0132] Example 24 is a method to implement of any of Examples 1-20.

[0133] Method examples described herein may be machine or computer-implemented at least in part. Some examples may include a computer-readable medium or machine-readable medium encoded with instructions operable to configure an electronic device to perform methods as described in the above examples. An implementation of such methods may include code, such as microcode, assembly language code, a higher-level language code, or the like. Such code may include computer readable instructions for performing various methods. The code may form portions of computer program products. Further, in an example, the code may be tangibly stored on one or more volatile, non-transitory, or non-volatile tangible computer-readable media, such as during execution or at other times. Examples of these tangible computer-readable media may include, but are not limited to, hard disks, removable magnetic disks, removable optical disks (e.g., compact disks and digital video disks), magnetic cassettes, memory cards or sticks, random access memories (RAMs), read only memories (ROMs), and the like.

Claims

1. A method comprising: maintaining, using a first immutable event stream, a plurality of privacy preference data from two or more customer relationship management (CRM) systems; maintaining, using a second immutable event stream, a plurality of solicitation preference data, each solicitation preference data in the plurality of solicitation preference data determined by applying a set of rules to filter a respective privacy preference data from the plurality of privacy preference data maintained by the first immutable event stream; receiving, from a first CRM system of the two or more CRM systems, a request for a current solicitation preference of a client; accessing one or more entries in the second immutable event stream associated with the client; determining the current solicitation preference of the client from the one or more entries in the second immutable event stream associated with the client; and providing, to the first CRM system, the current solicitation preference associated with the client.

2. The method of claim 1, wherein the current solicitation preference is a current email solicitation preference indicating whether the client has agreed to be solicited by email.

3. The method of claim 1, further comprising: receiving first privacy preference data associated with the client from the first CRM system; writing, to the first immutable event stream, a first entry comprising the first privacy preference data associated with the client; applying the set of rules to the first privacy preference data to determine first solicitation preference data associated with the client; and writing, to the second immutable event stream, a second entry comprising the first solicitation preference data associated with the client.

4. The method of claim 3, further comprising: receiving second privacy preference data associated with the client from a second CRM system of the two or more CRM systems, the second CRM system being distinct from the first CRM system; writing, to the first immutable event stream, a third entry comprising the second privacy preference data associated with the client; applying the set of rules to the second privacy preference data to determine second solicitation preference data associated with the client; and writing, to the second immutable event stream, a fourth entry comprising the second solicitation preference data associated with the client, the second solicitation preference data being the current solicitation preference of the client.

5. The method of claim 3, wherein receiving the first privacy preference data associated with the client comprises: receiving, at a first firewall, a request comprising the first privacy preference data associated with the client; responsive to being validated by the first firewall, receiving, at a first gateway, the request comprising the first privacy preference data associated with the client; responsive to being invoked by the first gateway, receiving, at a second firewall, the request comprising the first privacy preference data associated with the client; responsive to being validated by the second firewall, receiving, at a second gateway, the request comprising the first privacy preference data associated with the client; responsive to being invoked by the second gateway, receiving, at a third firewall, the request comprising the first privacy preference data associated with the client; and responsive to being validated by the third firewall, receiving the first privacy preference data associated with the client.

6. The method of claim 5, wherein each of the first firewall, the second firewall, and the third firewall apply respective predetermined security rules to incoming data, wherein the first firewall applies first predetermined security rules applicable to incoming network traffic, wherein the second firewall applies second predetermined security rules applicable to external requests, the second predetermined security rules being narrower than the first predetermined security rules, and wherein the third firewall applies third predetermined security rules applicable to maintained data, the third predetermined security rules being narrower than the second predetermined security rules.

7. The method of claim 1, wherein each entry in the one or more entries in the second immutable event stream associated with the client comprise a timestamp indicating when the client provided the respective privacy preference data to a respective CRM system of the two or more CRM systems, and wherein the current solicitation preference of the client is determined from the one or more entries in the second immutable event stream associated with the client based on determining a most recent timestamp.

8. The method of claim 1, wherein privacy preference data comprises one or more of: communication type preference, data collection preference, data usage preference, and data sharing preference.

9. The method of claim 8, wherein solicitation preference data comprises one or more of: communication type solicitation preference, frequency of solicitation preference, and solicitation content type preference.

10. The method of claim 1, further comprising: accessing one or more entries in the first immutable event stream associated with the client; determining a current privacy preference of the client from the one or more entries in the first immutable event stream associated with the client, the current privacy preference comprising a data sharing preference; and responsive to being permitted by the data sharing preference associated with the client, providing the current solicitation preference associated with the client to the first CRM system.

11. The method of claim 1, further comprising: responsive to a real-world event, updating the set of rules, wherein the real-world event is one of a weather event, a political event, an economic event, a social event, a cultural event, a scientific event, or a legal event.

12. A system comprising: processing circuitry; and memory, including instructions, which when executed by the processing circuitry, causes the processing circuitry to perform operations to: maintain, using a first immutable event stream, a plurality of privacy preference data from two or more customer relationship management (CRM) systems; maintain, using a second immutable event stream, a plurality of solicitation preference data, each solicitation preference data in the plurality of solicitation preference data determined by applying a set of rules to filter a respective privacy preference data from the plurality of privacy preference data maintained by the first immutable event stream; receive, from a first CRM system of the two or more CRM systems, a request for a current solicitation preference of a client; access one or more entries in the second immutable event stream associated with the client; determine the current solicitation preference of the client from the one or more entries in the second immutable event stream associated with the

client; and provide, to the first CRM system, the current solicitation preference associated with the client.

13. The system of claim 12, wherein the current solicitation preference is a current email solicitation preference indicating whether the client has agreed to be solicited by email.

14. The system of claim 12, wherein the instructions further cause the processing circuitry to: receive first privacy preference data associated with the client from the first CRM system; write, to the first immutable event stream, a first entry comprising the first privacy preference data associated with the client; apply the set of rules to the first privacy preference data to determine first solicitation preference data associated with the client; and write, to the second immutable event stream, a second entry comprising the first solicitation preference data associated with the client.

15. The system of claim 14, wherein the instructions further cause the processing circuitry to: receive second privacy preference data associated with the client from a second CRM system of the two or more CRM systems, the second CRM system being distinct from the first CRM system; write, to the first immutable event stream, a third entry comprising the second privacy preference data associated with the client; apply the set of rules to the second privacy preference data to determine second solicitation preference data associated with the client; and write, to the second immutable event stream, a fourth entry comprising the second solicitation preference data associated with the client, the second solicitation preference data being the current solicitation preference of the client.

16. The system of claim 14, wherein receiving the first privacy preference data associated with a client comprises: receive, at a first firewall, a request comprising the first privacy preference data associated with the client; responsive to being validated by the first firewall, receive, at a first gateway, the request comprising the first privacy preference data associated with the client; responsive to being invoked by the first gateway, receive, at a second firewall, the request comprising the first privacy preference data associated with the client; responsive to being validated by the second firewall, receive, at a second gateway, the request comprising the first privacy preference data associated with the client; responsive to being invoked by the second gateway, receive, at a third firewall, the request comprising the first privacy preference data associated with the client; and responsive to being validated by the third firewall, receive the first privacy preference data associated with the client.

17. The system of claim 16, wherein each of the first firewall, the second firewall, and the third firewall apply respective predetermined security rules to incoming data, wherein the first firewall applies first predetermined security rules applicable to incoming network traffic, wherein the second firewall applies second predetermined security rules applicable to external requests, the second predetermined security rules being narrower than the first predetermined security rules, and wherein the third firewall applies third predetermined security rules applicable to maintained data, the third predetermined security rules being narrower than the second predetermined security rules.

18. The system of claim 12, wherein each entry in the one or more entries in the second immutable event stream associated with the client comprise a timestamp indicating when the client provided the respective privacy preference data to a respective CRM system of the two or more CRM systems, and wherein the current solicitation preference of the client is determined from the one or more entries in the second immutable event stream associated with the client based on determining a most recent timestamp.

19. A non-transitory computer-readable storage medium, the non-transitory computer-readable storage medium including instructions that when executed by a computer, cause the computer to: maintain, using a first immutable event stream, a plurality of privacy preference data from two or more customer relationship management (CRM) systems; maintain, using a second immutable event stream, a plurality of solicitation preference data, each solicitation preference data in the plurality of solicitation preference data determined by applying a set of rules to filter a respective

privacy preference data from the plurality of privacy preference data maintained by the first immutable event stream; receive, from a first CRM system of the two or more CRM systems, a request for a current solicitation preference of a client; access one or more entries in the second immutable event stream associated with the client; determine the current solicitation preference of the client from the one or more entries in the second immutable event stream associated with the client; and provide, to the first CRM system, the current solicitation preference associated with the client.

20. The non-transitory computer-readable storage medium of claim 19, wherein the current solicitation preference is a current email solicitation preference indicating whether the client has agreed to be solicited by email.
