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Generating a dynamic ID of a device for personalized application development and engagement

Abstract

Methods that may be performed by a processor of a computing device. Embodiments may include generating general inferences from personal data from the computing device in a manner that disassociates the general inferences from a user identity related to the personal data, coding the general inferences into a dynamic identifier (ID) configured to disassociate the dynamic ID from the user identity related to the personal data, and maintaining the dynamic ID at the computing device for use of the Dynamic ID at the computing device. Embodiments may include making the dynamic ID available for use at the computing device by an advertising software and/or an application developed by an independent software vendor configured to select advertisements at the computing device based on at least one of the general inferences of the dynamic ID.

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Background/Summary

BACKGROUND

(1) User privacy and consent regarding data from computing devices that can be collected and inferred is becoming an increasing concern for users, developers, and governments, alike. Data collected from computing devices can include or can be used to infer incredibly specific, accurate, and personal details related to a user. Attempts to anonymize the data collected from the computing devices, such as by removing user identification data, have been shown to be ineffective. Consumers of the data have developed capabilities to infer user identity for anonymized data based on the specific, accurate, and personal nature of the anonymized data. The consumers of the data can build incredibly specific, accurate, and personal profiles for the users related to the data. The data can be used to target the user for advertisement or more nefarious purposes, such as fraud, theft, etc.

SUMMARY

(2) Various aspects include methods and devices performing the methods for enabling use of inferences based on personal data without revealing personal information. Various aspects may include generating general inferences from personal data from the computing device in a manner that disassociates the general inferences from a user identity related to the personal data, coding the general inferences into a dynamic identifier (ID) configured to disassociate the dynamic ID from the user identity related to the personal data; and maintaining the dynamic ID at the computing device for use of the dynamic ID at the computing device. In some aspects, the advertising software may be configured with an algorithm developed with an independent software vendor configured to select advertisements at the computing device based on the at least one of the general inferences of the dynamic ID.
(3) In some aspects, maintaining the dynamic ID at the computing device for use of the Dynamic ID at the computing device may include making the dynamic ID available for use at the computing device by an advertising software configured to select advertisements at the computing device based on at least one of the general inferences of the dynamic ID. In some aspects, maintaining the dynamic ID at the computing device for use of the Dynamic ID at the computing device may include making the dynamic ID available for use at the computing device by an application developed by an independent software vendor configured to select advertisements at the computing device based on at least one of the general inferences of the dynamic ID. In some aspects, maintaining the dynamic ID at the computing device for use of the Dynamic ID at the computing device further may include preventing advertising software from transmitting the dynamic ID from the computing device.
(4) In some aspects, generating the general inferences from the personal data from the computing device in a manner that disassociates the general inferences from the user identity related to the personal data may include generating a persona inference configured to provide general characteristics of the personal data disassociated from the user identity. In some aspects, generating the general inferences from the personal data from the computing device in a manner that disassociates the general inferences from the user identity related to the personal data may include generating at least one characteristic inference configured to provide an abstraction of at least part of the personal data disassociated from the user identity.
(5) Further aspects include a computing device including a processor configured to perform operations of any of the methods summarized above. Further aspects include a computing device including means for performing functions of any of the methods summarized above. Further aspects include a non-transitory processor readable medium having stored thereon processor-executable instructions configured to cause a processor of a computing device to perform operations of any of the methods summarized above.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) The accompanying drawings, which are incorporated herein and constitute part of this specification, illustrate exemplary embodiments of the claims, and together with the general description given and the detailed description, serve to explain the features herein.
(2) FIG. **1** is a component block diagram illustrating an example computing device suitable for implementing any of the various embodiments.
(3) FIG. **2** is a component block diagram illustrating an example system configured to generate a dynamic identifier (ID) of the computing device for personalized app development and engagement according to some embodiments.
(4) FIG. **3** is a component block diagram illustrating an example computing device configured to generate a dynamic ID of the computing device for personalized app development and engagement

according to some embodiments.
(5) FIG. **4** is a component block diagram illustrating an example dynamic ID the computing device for personalized app development and engagement according to some embodiments.
(6) FIG. **5** is a process flow diagram of an example method to generate a dynamic ID of the computing device for personalized app development and engagement in accordance with some embodiments.
(7) FIG. **6** is a process flow diagram of an example method to generate a dynamic ID of the computing device for personalized app development and engagement in accordance with some embodiments.
(8) FIG. **7** is a component block diagram illustrating an example computing device suitable for use with the various embodiments.
(9) FIG. **8** is a component block diagram illustrating an example server suitable for use with the various embodiments.
(10) FIG. **9** is a component block diagram illustrating an example wireless communication device suitable for use with the various embodiments.

DETAILED DESCRIPTION

(11) Various embodiments will be described in detail with reference to the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts. References made to particular examples and implementations are for illustrative purposes, and are not intended to limit the scope of the claims.
(12) Various embodiments include methods and computing devices for implementing the methods for generating a dynamic identifier (ID) of the computing device for personalized application (app) development and engagement. Embodiments may include generating general inferences from personal data from a computing device in a manner that disassociates the general inferences from a user identity related to the personal data, coding the general inferences into a dynamic ID configured to disassociate the dynamic ID from the user identity related to the personal data, and maintaining the dynamic ID at the computing device for use of the dynamic ID at the computing device. Embodiments may include making the dynamic ID available for use at the computing device by advertising software and/or an application developed by an independent software vendor configured to select advertisements at the computing device based on at least one of the general inferences of the dynamic ID.
(13) The term “system-on-a-chip” (SoC) is used herein to refer to a single integrated circuit (IC) chip that contains multiple resources and/or processors integrated on a single substrate. A single SoC may contain circuitry for digital, analog, mixed-signal, and radio-frequency functions. A single SoC may also include any number of general purpose and/or specialized processors (digital signal processors, modem processors, video processors, etc.), memory blocks (e.g., ROM, RAM, Flash, etc.), and resources (e.g., timers, voltage regulators, oscillators, etc.). SoCs may also include software for controlling the integrated resources and processors, as well as for controlling peripheral devices.
(14) The term “system-in-a-package” (SIP) may be used herein to refer to a single module or package that contains multiple resources, computational units, cores and/or processors on two or more IC chips, substrates, or SoCs. For example, a SIP may include a single substrate on which multiple IC chips or semiconductor dies are stacked in a vertical configuration. Similarly, the SIP may include one or more multi-chip modules (MCMs) on which multiple ICs or semiconductor dies are packaged into a unifying substrate. A SIP may also include multiple independent SoCs coupled together via high-speed communication circuitry and packaged in close proximity, such as on a single motherboard or in a single computing device. The proximity of the SoCs facilitates high speed communications and the sharing of memory and resources.
(15) User privacy and consent regarding data from computing devices that can be collected and inferred is becoming an increasing concern for users, developers, and governments, alike. Data

collected from computing devices can include or can be used to infer incredibly specific, accurate, and personal details related to a user. Attempts to anonymize the data collected from the computing devices, such as by removing user identification data, have been shown to be ineffective. Consumers of the data have developed capabilities to infer user identity for anonymized data based on the specific, accurate, and personal nature of the anonymized data. The consumers of the data can build incredibly specific, accurate, and personal profiles for the users related to the data. The data can be used to target the user for advertisement or more nefarious purposes, such as fraud, theft, etc.

(16) Embodiments address and overcome the privacy and consent concerns of use of data collected from computing devices, including anonymized data, by abstracting a dynamic identifier ID from the data collected from the computing device by generating the dynamic ID using general inferences from personal data from the computing device in a manner that disassociates the general inferences from a user identity related to the personal data. The general inferences may be abstractions of one or more characteristics of the personal data from the computing device such that the general inferences do not provide any of the personal data.

(17) For example, a general inference may include a persona inference, which may be an abstraction of a set of personal data from the computing device used to generally characterize a user without providing any of the personal data. As another example, a general inference may include a characteristic inference, which may be an abstraction of a set of personal data from the computing device used to generally characterize a characteristic of the user without providing any of the personal data. The dynamic ID may be a formatted collection of at least one persona inference and/or at least one characteristic inference.

(18) Software executing on the computing device may be configured for providing advertisements on the computing device based on the dynamic ID. Use of the dynamic ID may further protect personal data from the computing device by configuring the software at the computing device to maintain the dynamic ID at the computing device. In some embodiments, native software developed by a processor, operating system, and/or computing device developer for use of the dynamic ID may be configured without a capability of transmitting the dynamic ID from the computing device, including via wireless and/or wired communication transmission, transmission via physical storage media, etc.

(19) In some embodiments, third party software, such as software developed by an independent software vendor, executing on the computing device may be prevented from transmitting the dynamic ID from the computing device, including via wireless and/or wired communication transmission, transmission via physical storage media, etc. In some embodiments, the third part software may be required to be configured without a capability of transmitting the dynamic ID from the computing device, like the native software, to be installed at the computing device. For example, access and/or use of the dynamic ID may be controlled by the native software, which may be integrated into the third party software. In some embodiments, the computing device may include native software configured to prevent third party software from transmitting the dynamic ID from the computing device.

(20) FIG. **1** is a component block diagram illustrating an example computing device **100** suitable for implementing any of the various embodiments. Various embodiments may be implemented on a number of single processor and multiprocessor computer systems, including a system-on-chip (SoC) or system in a package.

(21) With reference to FIG. **1**, the illustrated example computing device **100** (which may be a system-in-a-package in some embodiments) includes a two SoCs **102**, **104** coupled to a clock **106**, a voltage regulator **108**, at least one subscriber identity module (SIM) **168** and/or a SIM interface, a dynamic random access memory (DRAM) **170**, a Universal FLASH Storage (UFS) device **172**, a wireless transceiver **166** configured to send and receive wireless communications via an antenna (not shown) to/from wireless computing devices, such as a base station, wireless device, and/or

computing device. In some embodiments, the first SoC **102** may operate as central processing unit (CPU) of the computing device **100** that carries out the instructions of software application programs by performing the arithmetic, logical, control and input/output (I/O) operations specified by the instructions. In some embodiments, the second SoC **104** may operate as a specialized processing unit. For example, the second SoC **104** may operate as a specialized 5G processing unit responsible for managing high volume, high speed (e.g., 5 Gbps, etc.), and/or very high frequency short wavelength (e.g., 28 GHz mmWave spectrum, etc.) communications.

(22) The first SoC **102** may include a digital signal processor (DSP) **110**, a modem processor **112**, a graphics processor **114**, an application processor (AP) **116**, one or more coprocessors **118** (e.g., vector co-processor) connected to one or more of the processors, memory **120**, custom circuitry **122**, system components and resources **124**, a host controller **162** for the UFS device **172**, an interconnection/bus module **126**, one or more sensors **130** (e.g., accelerometer, temperature sensor, pressure sensor, optical sensor, infrared sensor, analog sound sensor, etc.), a thermal management unit **132**, and a thermal power envelope (TPE) component **134**. The second SoC **104** may include a low power processor **152**, a power management unit **154**, an interconnection/bus module **164**, a BT controller **156**, memory **158**, and various additional processors **160**, such as an applications processor, packet processor, etc.

(23) Each processor **110**, **112**, **114**, **116**, **118**, **152**, **160** may include one or more cores, and each processor/core may perform operations independent of the other processors/cores. For example, the first SoC **102** may include a processor that executes a first type of operating system (e.g., FreeBSD, LINUX, OS X, etc.) and a processor that executes a second type of operating system (e.g., MICROSOFT WINDOWS 10). In addition, any or all of the processors **110**, **112**, **114**, **116**, **118**, **152**, **160** may be included as part of a processor cluster architecture (e.g., a synchronous processor cluster architecture, an asynchronous or heterogeneous processor cluster architecture, etc.).

(24) The first and second SoC **102**, **104** may include various system components, resources, and custom circuitry for managing sensor data, analog-to-digital conversions, wireless data transmissions, and for performing other specialized operations, such as decoding data packets and processing encoded audio and video signals for rendering in a web browser or audio/video application. For example, the system components and resources **124** of the first SoC **102** may include power amplifiers, voltage regulators, oscillators, phase-locked loops, peripheral bridges, data controllers, memory controllers, system controllers, access ports, timers, and other similar components used to support the processors and software clients running on a computing device. The system components and resources **124** and/or custom circuitry **122** may also include circuitry to interface with peripheral devices, such as cameras, electronic displays, wireless communication devices, external memory chips, etc.

(25) The first and second SoC **102**, **104** may communicate via interconnection/bus module **150**. In some embodiments, the interconnection/bus module may be a connection established by transceiving (i.e., receiving and transmitting) components within both the SoC **102** and SoC **104**. For example, the low power processor **152** may include a universal asynchronous receiver-transmitter (UART) and the application processor **116** may include a multiple signal messages (MSM) UART driver that is communicatively connected to the UART of the low power processor **152**.

(26) The various processors **110**, **112**, **114**, **116**, **118**, may be interconnected to one or more memory elements **120**, system components and resources **124**, and custom circuitry **122**, and a thermal management unit **132** via an interconnection/bus module **126**. Similarly, the low power processor **152** may be interconnected to the power management unit **154**, the BT controller **156**, memory **158**, and various additional processors **160** via the interconnection/bus module **164**. The interconnection/bus module **126**, **150**, **164** may include an array of reconfigurable logic gates and/or implement a bus architecture (e.g., CoreConnect, AMBA, etc.). Communications may be provided by advanced interconnects, such as high-performance networks-on chip (NoCs).

(27) The first and/or second SoCs **102**, **104** may further include an input/output module (not illustrated) for communicating with resources external to the SoC, such as a clock **106**, a voltage regulator **108**, one or more wireless transceivers **166**, and at least one SIM **168** and/or SIM interface (i.e., an interface for receiving one or more SIM cards), a DRAM **170**, a UFS device **172**. Resources external to the SoC (e.g., clock **106**, voltage regulator **108**) may be shared by two or more of the internal SoC processors/cores. The at least one SIM **168** (or one or more SIM cards coupled to one or more SIM interfaces) may store information supporting multiple subscriptions, including a first 5GNR subscription and a second 5GNR subscription, etc.
(28) In addition to the example computing device **100** discussed above, various embodiments may be implemented in a wide variety of computing systems, which may include a single processor, multiple processors, multicore processors, or any combination thereof.
(29) In some embodiments, the various processors of the SoC **102** and SoC **104** may be located within a same SoC. For example, the application processor **116** and low power processor **152** may be located within a same SoC, such as in a single SoC of a wearable device.
(30) FIG. **2** is a component block diagram illustrating an example system **200** configured to generate a dynamic ID of the computing device for personalized app development and engagement according to some embodiments. With reference to FIGS. **1** and **2**, the system **200** may include one or more computing device(s) **202** (e.g., computing device **100**) and external resources **218**, which may communicate via a communication link **224**. External resources **218** may include sources of information outside of the system **200**, external entities participating with the system **200**, or other resources. For example, external resources **218** may be a computing device (e.g., a remote server) that may receive dynamic IDs from the computing devices(s) **202** and transmit advertisements to the computing device(s) **202**. In some embodiments, some or all of the functionality attributed herein to external resources **218** may be provided by resources included in the system **200**. The system **200** may include a plurality of hardware, software, and/or firmware components operating together to provide the functionality attributed herein to the processor **222** (e.g., SoC **102**, processor **110**, **112**, **114**, **116**, **118**, **152**, **160**).
(31) The computing device(s) **202** may include electronic storage **220** (e.g., memory **120**, DRAM **170**, UFS device **172**) that may be configured to store information related to functions implemented by a data engine module **230**, a dynamic ID engine module **232**, a dynamic ID application programming interface (API) module **236**, a native advertising software module **238**, a third party application module **240**, and any other instruction modules.
(32) The electronic storage **220** may include non-transitory storage media that electronically stores information. The electronic storage **220** may include one or both of system storage that is provided integrally (i.e., substantially non-removable) with the system **200** and/or removable storage that is removably connectable to the system **200** via, for example, a port (e.g., a universal serial bus (USB) port, a firewire port, etc.) or a drive (e.g., a disk drive, etc.).
(33) In various embodiments, electronic storage **220** may include one or more of electrical charge-based storage media (e.g., EEPROM, RAM, etc.), solid-state storage media (e.g., flash drive, etc.), optically readable storage media (e.g., optical disks, etc.), magnetically readable storage media (e.g., magnetic tape, magnetic hard drive, floppy drive, etc.), and/or other electronically readable storage media. The electronic storage **220** may include one or more virtual storage resources (e.g., cloud storage, a virtual private network, and/or other virtual storage resources). The electronic storage **220** may store software algorithms, information determined by processor(s) **222**, and/or other information that enables the system **200** to function as described herein.
(34) The computing device(s) **202** may be configured by machine-readable instructions **206**. Machine-readable instructions **206** may include one or more instruction modules. The instruction modules may include computer program modules. The instruction modules may include one or more of the data engine module **230**, the dynamic ID engine module **232**, the dynamic ID API module **236**, the native advertising software module **238**, the third party application module **240**,

and other instruction modules (not illustrated). The computing device(s) **202** may include processor(s) **222** configured to implement the machine-readable instructions **206** and corresponding modules.

(35) The processor(s) **222** may include one of more local processors that may be configured to provide information processing capabilities in the system **200**. As such, the processor(s) **222** may include one or more of a digital processor, an analog processor, a digital circuit designed to process information, an analog circuit designed to process information, a state machine, and/or other mechanisms for electronically processing information. Although the processor(s) **222** is shown in FIG. **2** as a single entity, this is for illustrative purposes only. In some embodiments, the processor(s) **222** may include a plurality of processing units. These processing units may be physically located within the same device, or the processor(s) **222** may represent processing functionality of a plurality of devices distributed in the system **200**.

(36) In some embodiments, the processor(s) **222** executing the data engine module **230** may be configured to collect data from the computing device **202**. The data engine module **230** may be configured to collect data from systems, subsystems, and/or components of the computing device **202**. For example, the data engine module **230** may be configured to collect data processor data from one or more processors **222**, location data (e.g., global navigation satellite system (GNSS) data), sensor data from one or more sensors (e.g., sensors **130**) (e.g., accelerometer, temperature sensor, pressure sensor, optical sensor, infrared sensor, analog sound sensor, etc. data), one or more application lists, etc. of the computing device **202**. The data engine module **230** may be configured to collect raw data from the computing device **202**. The data collected from the computing device **202** may include personal data that may enable identification of the computing device **202** itself and/or a user of the computing device **202**.

(37) In some embodiments, the processor(s) **222** executing the dynamic ID engine module **232** may generate general inferences from the data collected from the computing device **202** and code the general inferences into a dynamic ID. The dynamic ID engine module **232** generating the general inferences from the data collected from the computing device **202**, including personal data, may be configured to disassociate the general inferences from a computing device identity and/or a user identity related to the personal data. The general inferences may be abstractions of one or more characteristics of the data collected from the computing device **202** such that the general inferences do not provide any of the personal data.

(38) For example, a general inference may include a persona inference, which may be an abstraction of a set of personal data from the computing device **202** used to generally characterize a user of the computing device **202** without providing any of the personal data. In some examples, the persona inference may include information relating to location, race, ethnicity, sex, education, employment, activities, etc. without relating to and/or providing identification of the user. As another example, a general inference may include a characteristic inference, which may be an abstraction of a set of personal data from the computing device **202** used to generally characterize a characteristic of the user without providing any of the personal data. In some examples, the characteristic inference may include information relating to habits, abilities, health attributes, computing device usage, etc.

(39) In some examples, the dynamic ID engine module **232** may include standard inference models configured to generate general inferences for any application. In some examples, the dynamic ID engine module **232** may include custom inference models configured by and/or based on requirements from third party developers and configured to generate general inferences for use by the third party developers and/or any application. The dynamic ID engine module **232** may analyze the data collected from the computing device **202**, determining which parts of the data to use for generating the general inferences. For example, the dynamic ID engine module **232** may extract parts of the data that are suitable for input to the different inference models.

(40) The dynamic ID may be a formatted collection of the general inferences. For example, the

dynamic ID may include at least one persona inference and/or at least one characteristic inference. In some examples, the dynamic ID may be a standard format. For example, the standard format may include general inferences generated using standard inference models. In another example, the standard format may be generated using standard inference models and one or more custom inference models. In some examples, the dynamic ID may be a custom format including the standard format of the dynamic ID augmented to include more and/or other general inferences than provided by the standard format, such as including general inferences generated using standard inference models and one or more custom inference models.

(41) In some embodiments, the processor(s) **222** executing the dynamic ID API module **236** may be configured to control access by software applications to a dynamic ID. For example, the different software applications may have different permissions for different parts of the dynamic ID and access control may be implemented to enable the software applications to read full and/or part of the dynamic ID. In some examples, access control may be implemented by masking general inferences of the dynamic ID for which any software applications do not have permission to access. The software applications may be enabled to use one way GET APIs to access the dynamic ID.

(42) In some embodiments, the processor(s) **222** executing the native advertising software module **238** may fetch the dynamic ID via the dynamic ID API module **236**, extract relevant general inferences from the dynamic ID, analyze the relevant general inferences, and fetch advertisements relevant to the dynamic ID. The native advertising software module **238** may be differently configured for different software applications. For example, the native advertising software module **238** may be configured to fetch all and/or part of the dynamic ID for one software application and differently configured to fetch all and/or part of the dynamic ID for another software application, such as by being configured to use differently configured GET APIs.

(43) The native advertising software module **238** may be differently configured, for example, based on interactions with the software application instructing the native advertising software module **238** to fetch all and/or part of the dynamic ID. The native advertising software module **238** may also be differently configured based on interactions with the software application instructing the native advertising software module **238** to extract different relevant general inferences from the dynamic ID, analyze the relevant general inferences, and fetch advertisements relevant to the dynamic ID. Analyzing the relevant general inferences may include evaluating and/or interpreting information of the relevant general inferences for determining which advertisements may correspond to the information of the relevant general inferences. For example, different information of one or a combination of relevant general inferences may correspond with different advertisements. In some embodiments, the native advertising software module **238** may be integrated into the software applications.

(44) In some embodiments, the processor(s) **222** executing the third party application module **240** may interact with the native advertising software module **238**, receive the advertisements relevant to the dynamic ID retrieved by the native advertising software module **238**, and present the advertisements at the computing device. The third party application module **240** may be the software application interacting with the native advertising software module **238**. For example, the third party application module **240** may be configured to instruct the native advertising software module **238** which part of the dynamic ID to retrieve. As another example, the third party application module **240** may be configured to instruct the native advertising software module **238** which part of the dynamic ID to extract and analyze. In some embodiments, the native advertising software module **238** may be integrated into the third party application module **240**.

(45) The description of the functionality provided by the different modules **230**, **232**, **236**, **238**, **240** is for illustrative purposes, and is not intended to be limiting, as any of modules **230**, **232**, **236**, **238**, **240** may provide more or less functionality than is described. For example, one or more of modules **230**, **232**, **236**, **238**, **240** may be eliminated, and some or all of its functionality may be provided by other ones of modules **230**, **232**, **236**, **238**, **240**. As another example, processor(s) **222** may execute

one or more additional modules that may perform some or all of the functionality attributed below to one of modules **230**, **232**, **236**, **238**, **240**.

(46) FIG. **3** is a component block diagram illustrating an example computing device **300** configured to generate a dynamic ID of the computing device for personalized app development and engagement according to some embodiments. With respect to FIGS. **1-3**, the computing device **300** (e.g., computing device **100**, computing device **202**) may include one or more applications **304**, an on-device inference engine **304**, and multiple components **306***a*-**306***h* of the computing device **300** having embedded data collectors **308***a*-**308***h*.

(47) The components **306***a*-**306***h* of the computing device **300** may be any components of the computing device for which data **310** collected from the components **306***a*-**306***h* may be used for generating a dynamic ID **312**. For example, the components **306***a*-**306***h* of the computing device **300** may include components **306***a*-**306***h* from which location data (e.g., GNSS data), sensor data from one or more sensors (e.g., sensors **130**) (e.g., accelerometer, temperature sensor, pressure sensor, optical sensor, infrared sensor, analog sound sensor, etc. data), one or more application lists, etc. of the computing device **300** may be collected by embedded data collectors **308***a*-**308***h*.

(48) As another example, the components **306***a*-**306***h* of the computing device **300** may include an SoC **306***a* (e.g., SoC **102**, **104**; an integrated access point and baseband SoC), an SoC power management integrated circuit (PMIC) **306***b* (e.g., voltage regulator **108**, TPE component **134**, power management unit **154**, system components and resources **124**), an interface power management integrated circuit **306***c* (e.g., voltage regulator **108**, TPE component **134**, power management unit **154**, system components and resources **124**), a battery charger power management integrated circuit **306***d* (e.g., voltage regulator **108**, system components and resources **124**), a cellular modem radio frequency (RF) transceiver **306***e* (e.g., wireless transceiver **166**), an audio CODEC integrated circuit **306***f* (e.g., system components and resources **124**), a fingerprint sensor **306***f* (e.g., system components and resources **124**), and/or an audio speaker amplifier **306***h* (e.g., system components and resources **124**).

(49) The on-device inference engine **304** may include machine-readable instructions (e.g., data engine module **230**, dynamic ID engine module **232**, dynamic ID API module **236**) and may be implemented by a processor (e.g., SoC **102**, processor **110**, **112**, **114**, **116**, **118**, **152**, **160**, **222**). The on-device inference engine **304** may receive the data **310** collected from the components **306***a*-**306***h* of the computing device **300** via the embedded data collectors **308***a*-**308***h*. The on-device inference engine **304** may be configured to receive raw data **310** collected from the components **306***a*-**306***h* of the computing device **300**. The data **310** collected from the components **306***a*-**306***h* of the computing device **300** may include personal data that may enable identification of the computing device **300** itself and/or a user of the computing device **300**.

(50) The on-device inference engine **304** may generate general inferences from the data **310** collected from the components **306***a*-**306***h* of the computing device **300** and code the general inferences into a dynamic ID **312**. The data **310** collected from the components **306***a*-**306***h* of the computing device **300**, and the on-device inference engine **304** may be configured to disassociate the general inferences from a computing device identity and/or a user identity related to the personal data. For example, the general inferences may be abstractions of one or more characteristics of the data **310** collected from the components **306***a*-**306***h* of the computing device **300** such that the general inferences do not provide any of the personal data.

(51) For example, a general inference may include a persona inference, which may be an abstraction of a set of personal data from the computing device **300** used to generally characterize a user of the computing device **300** without providing any of the personal data. In some examples, the persona inference may include information relating to location, race, ethnicity, sex, education, employment, activities, etc. without relating to and/or providing identification of the user. As another example, a general inference may include a characteristic inference, which may be an abstraction of a set of personal data from the computing device **300** used to generally characterize a

characteristic of the user without providing any of the personal data. In some examples, the characteristic inference may include information relating to habits, abilities, health attributes, computing device usage, etc.

(52) In some examples, the on-device inference engine **304** may generate general inferences by implementing standard inference models configured to generate general inferences for any application **302**. In some examples, the on-device inference engine **304** may generate implementing custom inference models configured by and/or based on requirements from third party developers and configured to generate general inferences for use by the third party developers and/or any application **302**. The on-device inference engine **304** may analyze the data **310** collected from the components **306***a*-**306***h* of the computing device **300**, determining which parts of the data **310** to use for generating the general inferences. For example, the on-device inference engine **304** may extract parts of the data **310** that are suitable for input to the different inference models.

(53) The dynamic ID **312** may be a formatted collection of the general inferences. For example, the dynamic ID **312** may include at least one persona inference and/or at least one characteristic inference. In some examples, the dynamic ID **312** may be a standard format. For example, the standard format may include general inferences generated using standard inference models. In another example, the standard format may be generated using standard inference models and one or more custom inference models. In some examples, the dynamic ID **312** may be a custom format including the standard format of the dynamic ID **312** augmented to include more and/or other general inferences than provided by the standard format, such as including general inferences generated using standard inference models and one or more custom inference models.

(54) The dynamic ID **312** may be dynamic in the sense that the dynamic ID **312** may change and/or be updated continuously, periodically, episodically, etc. based on changes in the data **310** collected from the components **306***a*-**306***h* of the computing device **300** over time. In some examples, the dynamic ID **312** may change and/or be updated using data **310** collected from the components **306***a*-**306***h* at a point in time and/or cumulatively over a period of time, including up to a first use of the computing device **300**, a first use of the computing device **300** by a current user/owner of the computing device **300**, a first use of the computing device since a reset of all data at the computing device **300** (e.g., reset to factory settings), etc.

(55) In some embodiments, the on-device inference engine **304** may be configured to control access by the applications **302** to a dynamic ID **312**. For example, the different applications **302** may have different permissions for different parts of the dynamic ID **312** and access control may be implemented to enable the applications **302** to read full and/or part of the dynamic ID **312**. In some examples, access control may be implemented by masking general inferences of the dynamic ID **312** for which any application **302** does not have permission to access.

(56) The applications **302** may include machine-readable instructions (e.g., native advertising software module **238**, third party application module **240**) and may be implemented by a processor (e.g., SoC **102**, processor **110**, **112**, **114**, **116**, **118**, **152**, **160**, **222**). The applications **302** may fetch the dynamic ID **312**, extract relevant general inferences from the dynamic ID **312**, analyze the relevant general inferences, and fetch advertisements relevant to the dynamic ID **312**.

(57) The applications **302** may be enabled to use one way GET APIs to access the dynamic ID **312** from the on-device inference engine **304**. Any of the applications **302** may be differently configured to fetch all and/or part of the dynamic ID **312** for one application **302** and to fetch all and/or part of the dynamic ID **312** for another application **302**, such as by being configured to use differently configured GET APIs. Applications **302** fetching parts of the dynamic ID **312** may fetch different parts of the dynamic ID **312**.

(58) The applications **302** may also be differently configured to extract different relevant general inferences from the dynamic ID **312**, analyze the relevant general inferences, and fetch advertisements relevant to the dynamic ID **312**. Analyzing the relevant general inferences may include evaluating and/or interpreting information of the relevant general inferences for

determining which advertisements may correspond to the information of the relevant general inferences. For example, different information of one or a combination of relevant general inferences may correspond with different advertisements. In some embodiments, the applications **302** may receive the advertisements relevant to the dynamic ID **312** and present the advertisement at the computing device **300**.

(59) In some embodiments, the applications **302** may include controls over use of the dynamic ID and/or general inferences by the applications **302**, such as a by native advertising software module (e.g., native advertising software module **238**). In some embodiments, the applications **302** may implement controls as to whether the applications **302** may transmit the dynamic ID and/or general inferences off of the computing device **300**, such as by preventing transmission of the dynamic ID and/or general inferences off of the computing device **300**.

(60) In some embodiments, the on-device inference engine **304** may reside at a hardware abstraction layer (HAL) and may be configured to bridge communication between hardware and software using a HAL interface definition language (HIDL) **314**. In some embodiments, the applications **302** may reside at an application layer and may be configured to communicate with other processes of the computing device **300**, such as the on-device inference engine **304**, using an Android interface definition language (AIDL) **316**.

(61) FIG. **4** is a component block diagram illustrating an example dynamic ID **400** of the computing device for personalized app development and engagement according to some embodiments. With reference to FIGS. **1-4**, the dynamic ID **400** (e.g., dynamic ID **312**) may include any number of general inferences **402**, **404**, **406**, **408**, **410**, **412**, **414**. The dynamic ID **400** may be of any size, such as any number of bits. The general inferences **402**, **404**, **406**, **408**, **410**, **412**, **414** may each be any size, such as any number of bits, and may include any number of uniformly sized and/or differently sized general inferences **402**, **404**, **406**, **408**, **410**, **412**, **414**. The dynamic ID **400** and the general inferences **402**, **404**, **406**, **408**, **410**, **412**, **414** illustrated FIG. **4** are a non-limiting example used for ease of explanation and clarity. One of skill in the art would recognize that a dynamic ID and general inferences could be of various configurations, such as sizes, orders, combinations, etc.

(62) In the example illustrated in FIG. **4**, the dynamic ID **400** is of a size of 32 bits and includes seven general inferences **402**, **404**, **406**, **408**, **410**, **412**, **414**. The general inference **402** is of a size of eight bits, and the general inferences **404**, **406**, **408**, **410**, **412**, **414** are each of a size of four bits. The general inference **402** may be a persona inference, which may be an abstraction of a set of personal data from a computing device (e.g., computing device **100**, **202**, **300**) used to generally characterize a user of the computing device without providing any of the personal data. The general inferences **404**, **406**, **408**, **410**, **412** may be characteristic inferences, which may be abstractions of sets of personal data from the computing device used to generally characterize characteristics of the user without providing any of the personal data. In some embodiments, the dynamic ID **400** of this configuration may be a standard format of a dynamic ID.

(63) In this non-limiting example, the general inference **402**, or persona inference, may include information representative of location, activity, person of interest, sensor identification, etc. The general inference **404**, or characteristic inference, may include information representative of a driving score for the user. The general inference **406**, or characteristic inference, may include information representative of computing device resource consumption of the computing device. The general inference **408**, or characteristic inference, may include information representative of a graphics processing unit (GPU0 usage of the computing device. The general inference **410**, or characteristic inference, may include information representative of a health score for the user. The general inference **412**, or characteristic inference, may include information representative of an ambient score for the environment of the computing device. The general inference **414**, or characteristic inference, may include information representative of image processing data of the computing device.

(64) FIG. **5** is a process flow diagram of an example method **500** for generating a dynamic ID of a computing device for personalized app development and engagement in accordance with various embodiments. With reference to FIGS. **1-5**, the method **500** may be implemented in a computing device (e.g., computing device **100**, **202**, **300**), in software executing in processor (e.g., SoC **102**, processor **110**, **112**, **114**, **116**, **118**, **152**, **160**, **222**), in general purpose hardware, in dedicated hardware (e.g., on-device inference engine **304**), or in a combination of a software-configured processor and dedicated hardware, such as a processor (e.g., processor **222**) executing software within a system configured to generate a dynamic ID of the computing device for personalized app development and engagement (e.g., system **200**) that includes other individual components, and various memory/cache controllers. In order to encompass the alternative configurations enabled in various embodiments, the hardware implementing the method **500** is referred to herein as a "processing device."

(65) In block **502**, the processing device may collect user device data. The processing device may receive data (e.g., data **310**) collected from the components (e.g., components **306***a*-**306***h*) of a computing device (e.g., computing device **100**, **202**, **300**). The received data may be raw data collected from the components of the computing device. The data collected from the components of the computing device may include personal data that may enable identification of the computing device itself and/or a user of the computing device. The processing device collecting the user device data in block **502** may include a processor (e.g., SoC **102**, processor **110**, **112**, **114**, **116**, **118**, **152**, **160**, **222**) implementing a data engine module (e.g., data engine module **230**) and/or an on-device inference engine (on device inference engine **304**).

(66) In block **504**, the processing device may analyze the user device data. The processing device may analyze the data collected from the components of the computing device, determining which parts of the data to use for generating the general inferences. For example, the processing device may extract parts of the data that are suitable for input to one or more inference models. The processing device analyzing the user device data in block **504** may include the processor implementing a dynamic ID engine module (dynamic ID engine module **232**) and/or the on-device inference engine.

(67) In block **506**, the processing device may generate general inferences (e.g., generate general inferences **402-414**) from the user device data. The processing device may apply one or more inference models to some or all of the computing device data to generate the general inferences. In some examples, the computing device data may be data collected from the components of the computing device at a point in time and/or cumulatively over one or more periods of time of any duration, including up to a first use of the computing device, a first use of the computing device by a current user/owner of the computing device, a first use of the computing device since a reset of all data at the computing device (e.g., reset to factory settings), etc. In some examples, the processing device may generate general inferences by implementing standard inference models configured to generate general inferences for any application (e.g., application **302**). In some examples, the processing device may generate implementing custom inference models configured by and/or based on requirements from third party developers and configured to generate general inferences for use by the third party developers and/or any application. The processing device generating the general inferences from the user device data in block **506** may include the processor implementing the dynamic ID engine module and/or the on-device inference engine.

(68) In block **508**, the processing device may code the general inferences into a dynamic ID (e.g., dynamic ID **400**). The dynamic ID may be a formatted collection of the general inferences. For example, the dynamic ID may include at least one persona inference and/or at least one characteristic inference. In some examples, the dynamic ID may be a standard format. For example, the standard format may include general inferences generated using the standard inference models. In another example, the standard format may be generated using standard inference models and one or more custom inference models. In some examples, the dynamic ID may be a custom format

including the standard format of the dynamic ID augmented to include more and/or other general inferences than provided by the standard format, such as including general inferences generated using the standard inference models and one or more custom inference models. The processing device coding the general inferences into the dynamic ID in block **508** may include the processor implementing the dynamic ID engine module and/or the on-device inference engine.

(69) In block **510**, the processing device may make the dynamic ID available for use. For example, the different applications may have different permissions for different parts of the dynamic ID and the processing device may implement access control to enable the applications to read full and/or part of the dynamic ID. In some examples, access control may be implemented by masking general inferences of the dynamic ID for which any application does not have permission to access. The processing device making the dynamic ID available for use in block **510** may include the processor implementing a dynamic ID API module (e.g., dynamic ID API module **236**) and/or the on-device inference engine.

(70) In block **512**, the processing device may identify general inferences of the dynamic ID on the user device. The processing device identifying the general inferences of the dynamic ID on the computing device in block **512** may include the processor implementing a native advertising software module (e.g., native advertising software module **238**), a third party application module (e.g., third party application module **240**), and/or an application (e.g., application **302**).

(71) The processing device may fetch any combination of all and/or part of the dynamic ID for one or more applications. The processing device may also extract any combination of all and/or some of the relevant general inferences from the dynamic ID for one or more applications. The processing device may analyze the relevant general inferences by evaluating and/or interpreting information of the relevant general inferences for determining which advertisements may correspond to the information of the relevant general inferences. For example, different information of one or a combination of relevant general inferences may correspond with different advertisements.

(72) In some embodiments, the processing device may implement controls over use of the dynamic ID and/or general inferences. In some embodiments, the processing device may implement controls as to whether the transmit the dynamic ID and/or general inferences may be transmitted off of the computing device, such as by preventing transmission of the dynamic ID and/or general inferences off of the computing device.

(73) In block **514**, the processing device may fetch an advertisement relevant to the identified general inferences of the dynamic ID on the user device. Based on the analysis if the general inferences of the dynamic ID on the user device in block **512**, the processing device may fetch the advertisement corresponding to the information of the relevant general inferences. The processing device may retrieve the advertisements from a memory (e.g., DRAM **170**, UFS device **172**, electronic storage **220**), for example, based on association of the advertisement and a location at the memory. The processing device fetching the advertisement relevant to the identified general inferences of the dynamic ID on the user device in block **514** may include the processor implementing the native advertising software module, the third party application module, and/or the application.

(74) In optional block **516**, the processing device may discard the dynamic ID. The processing device may discard by overwriting the dynamic ID in a memory (e.g., memory **120**, DRAM **170**, UFS device **172**, electronic storage **220**), invalidating the dynamic ID in the memory, removing address association of the dynamic ID in memory, etc. The processing device discarding the dynamic ID in optional block **516** may include the processor implementing the native advertising software module, the third party application module, and/or the application.

(75) In block **518**, the processing device may present the advertisement on the user device. The processing device may display the advertisement via a display device (e.g., screen and/or speaker) of the computing device. The processing device presenting the advertisement on the user device in

block **518** may include the processor implementing the native advertising software module, the third party application module, and/or the application.

(76) FIG. **6** is a process flow diagram of an example method **600** for generating a dynamic ID of a computing device for personalized app development and engagement in accordance with various embodiments. With reference to FIGS. **1-6**, the method **500** may be implemented in a computing device (e.g., computing device **100**, **202**, **300**), in software executing in processor (e.g., SoC **102**, processor **110**, **112**, **114**, **116**, **118**, **152**, **160**, **222**), in general purpose hardware, in dedicated hardware (e.g., on-device inference engine **304**), or in a combination of a software-configured processor and dedicated hardware, such as a processor (e.g., processor **222**) executing software within a system configured to generate a dynamic ID of the computing device for personalized app development and engagement (e.g., system **200**) that includes other individual components, and various memory/cache controllers. In order to encompass the alternative configurations enabled in various embodiments, the hardware implementing the method **600** is referred to herein as a "processing device."

(77) Blocks **502**, **504**, **506**, **508**, **510**, **518** may be implemented for the method **600** in a similar manner as described for blocks **502**, **504**, **506**, **508**, **510**, **518** of the method **500** with reference to FIG. **5**.

(78) In optional block **602**, the processing device may identify general inferences (e.g., general inferences **402**, **404**, **406**, **408**, **410**, **412**, **414**) of a dynamic ID (e.g., dynamic ID **400**) on a user device (e.g., computing device **100**, **202**, **300**). The processing device may fetch any combination of all and/or part of the dynamic ID for one or more applications (e.g., application **302**). The processing device may also extract any combination of all and/or some of the relevant general inferences from the dynamic ID for one or more applications. The processing device identifying the general inferences of the dynamic ID in optional block **602** may include a processor (e.g., SoC **102**, processor **110**, **112**, **114**, **116**, **118**, **152**, **160**, **222**) implementing a native advertising software module (e.g., native advertising software module **238**), a third party application module (e.g., third party application module **240**), and/or an application (e.g., application **302**).

(79) In block **604**, the processing device may send the dynamic ID and/or identified general inferences to a remote server (e.g., external resource **218**). The processing device may send the dynamic ID and/or identified general inferences via a wireless and/or wired communication transmission, such as via an internet connection (e.g., communication link **224**), to a remote server. The processing device sending the dynamic ID and/or identified general inferences to the remote server in block **604** may include the processor implementing the native advertising software module, the third party application module, and/or an application, and/or a wireless transceiver (e.g., wireless transceiver **166**).

(80) In block **606**, the processing device may receive an advertisement relevant to the dynamic ID and/or identified general inferences from the remote server. The remote server may identify the relevant advertisements and transmit the advertisements to the processing device via a wireless and/or wired communication transmission, such as via the internet connection. The processing device receiving the advertisement relevant to the dynamic ID and/or identified general inferences from the remote server in block **606** may include the processor implementing the native advertising software module, the third party application module, and/or an application, and/or the wireless transceiver.

(81) The various embodiments (including, but not limited to, embodiments described with reference to FIGS. **1-6**) may be implemented in a wide variety of computing systems, which may include a laptop computer **700** (e.g., computing device **100**, **200**, **320**), an example of which is illustrated in FIG. **7**. With reference to FIGS. **1-7**, a laptop computer may include a touchpad touch surface **717** that serves as the computer's pointing device, and thus may receive drag, scroll, and flick gestures similar to those implemented on computing devices equipped with a touch screen display and described above. A laptop computer **700** will typically include a processor **702** coupled

to volatile memory **712** and a large capacity nonvolatile memory, such as a disk drive **713** of Flash memory. Additionally, the computer **700** may have one or more antenna **708** for sending and receiving electromagnetic radiation that may be connected to a wireless data link and/or cellular telephone transceiver **716** coupled to the processor **702**. The computer **700** may also include a floppy disc drive **714** and a compact disc (CD) drive **715** coupled to the processor **702**. The laptop computer **700** may include a touchpad **717**, a keyboard **718**, and a display **719** all coupled to the processor **702**. Other configurations of the computing device may include a computer mouse or trackball coupled to the processor (e.g., via a USB input) as are well known, which may also be used in conjunction with the various embodiments.

(82) FIG. **8** is a component block diagram of a computing device **800**, such as a server, suitable for use with various embodiments. Such computing devices may include at least the components illustrated in FIG. **8**. With reference to FIGS. **1-8**, the computing device **800** (e.g., computing device **100**, **200**, **320**) may include a processor **801** coupled to volatile memory **802** and a large capacity nonvolatile memory, such as a disk drive **803**.

(83) The computing device **800** may also include a peripheral memory access device such as a floppy disc drive, compact disc (CD) or digital video disc (DVD) drive **806** coupled to the processor **801**. The computing device **800** may also include network access ports **804** (or interfaces) coupled to the processor **801** for establishing data connections with a network, such as the Internet and/or a local area network coupled to other system computers and servers.

(84) The computing device **800** may include one or more antennas **807** for sending and receiving electromagnetic radiation that may be connected to a wireless communication link. The computing device **800** may include additional access ports, such as USB, Firewire, Thunderbolt, and the like for coupling to peripherals, external memory, or other devices.

(85) FIG. **9** is a component block diagram of a computing device **900** suitable for use with various embodiments. With reference to FIGS. **1-9**, various embodiments may be implemented on a variety of computing devices **900** (e.g., computing device **100**, **200**, **320**), an example of which is illustrated in FIG. **9** in the form of a smartphone. The computing device **900** may include a first SoC **202** (e.g., a SoC-CPU) coupled to a second SoC **204** (e.g., a 5G capable SoC). The first and second SoCs **202**, **204** may be coupled to internal memory **916**, a display **912**, and to a speaker **914**. The first and second SoCs **202**, **204** may also be coupled to at least one SIM **268** and/or a SIM interface that may store information supporting a first 5GNR subscription and a second 5GNR subscription, which support service on a 5G non-standalone (NSA) network.

(86) The computing device **900** may include an antenna **904** for sending and receiving electromagnetic radiation that may be connected to a wireless transceiver **266** coupled to one or more processors in the first and/or second SoCs **202**, **204**. The computing device **900** may also include menu selection buttons or rocker switches **920** for receiving user inputs.

(87) The computing device **900** also includes a sound encoding/decoding (CODEC) circuit **910**, which digitizes sound received from a microphone into data packets suitable for wireless transmission and decodes received sound data packets to generate analog signals that are provided to the speaker to generate sound. Also, one or more of the processors in the first and second SoCs **202**, **204**, wireless transceiver **266** and CODEC **910** may include a digital signal processor (DSP) circuit (not shown separately).

(88) The processors of the computer **700**, the computing device **800**, and the computing device **900** may be any programmable microprocessor, microcomputer or multiple processor chip or chips that can be configured by software instructions (applications) to perform a variety of functions, including the functions of the various embodiments described below. In some mobile devices, multiple processors may be provided, such as one processor within an SoC **204** dedicated to wireless communication functions and one processor within an SoC **202** dedicated to running other applications. Software applications may be stored in memory **220**, **916** before they are accessed and loaded into the processor. The processors may include internal memory sufficient to store the

application software instructions.
(89) Implementation examples are described in the following paragraphs. While some of the following implementation examples are described in terms of example methods that may be performed in a computing device by a host controller, further example implementations may include: a computing device including a host controller configured to perform the methods of the following implementation examples; a computing device including means for performing functions of the following implementation examples, a host controller suitable for use in a computing device, in which the host controller includes a processor configured to perform the methods of the following implementation examples; and a non-transitory, processor-readable memory having stored thereon processor-executable instructions configured to cause a host controller in a computing device configured to perform the methods of the following implementation examples.
(90) Example 1. A method performed by a processor of a computing device including: generating general inferences from personal data from the computing device in a manner that disassociates the general inferences from a user identity related to the personal data, coding the general inferences into a dynamic identifier (ID) configured to disassociate the dynamic ID from the user identity related to the personal data; and maintaining the dynamic ID at the computing device for use of the dynamic ID at the computing device.
(91) Example 2. The method of example 1, in which maintaining the dynamic ID at the computing device for use of the Dynamic ID at the computing device includes making the dynamic ID available for use at the computing device by an advertising software configured to select advertisements at the computing device based on at least one of the general inferences of the dynamic ID.
(92) Example 3. The method of example 2, in which the advertising software is configured with an algorithm developed with an independent software vendor configured to select advertisements at the computing device based on the at least one of the general inferences of the dynamic ID.
(93) Example 4. The method of any of examples 1-3, in which maintaining the dynamic ID at the computing device for use of the Dynamic ID at the computing device includes making the dynamic ID available for use at the computing device by an application developed by an independent software vendor configured to select advertisements at the computing device based on at least one of the general inferences of the dynamic ID.
(94) Example 5. The method of example 4, in which maintaining the dynamic ID at the computing device for use of the Dynamic ID at the computing device further includes preventing advertising software from transmitting the dynamic ID from the computing device.
(95) Example 6. The method of any of examples 1-5, in which generating the general inferences from the personal data from the computing device in a manner that disassociates the general inferences from the user identity related to the personal data includes generating a persona inference configured to provide general characteristics of the personal data disassociated from the user identity.
(96) Example 7. The method of any of examples 1-6, in which generating the general inferences from the personal data from the computing device in a manner that disassociates the general inferences from the user identity related to the personal data includes generating at least one characteristic inference configured to provide an abstraction of at least part of the personal data disassociated from the user identity.
(97) As used in this application, the terms “component,” “module,” “system,” and the like are intended to include a computer-related entity, such as, but not limited to, hardware, firmware, a combination of hardware and software, software, or software in execution, which are configured to perform particular operations or functions. For example, a component may be, but is not limited to, a process running on a processor, a processor, an object, an executable, a thread of execution, a program, and/or a computer. By way of illustration, both an application running on a computing device and the computing device may be referred to as a component. One or more components may

reside within a process and/or thread of execution and a component may be localized on one processor or core and/or distributed between two or more processors or cores. In addition, these components may execute from various non-transitory computer readable media having various instructions and/or data structures stored thereon. Components may communicate by way of local and/or remote processes, function or procedure calls, electronic signals, data packets, memory read/writes, and other known network, computer, processor, and/or process related communication methodologies.

(98) A number of different cellular and mobile communication services and standards are available or contemplated in the future, all of which may implement and benefit from the various embodiments. Such services and standards include, e.g., third generation partnership project (3GPP), Long Term Evolution (LTE) systems, third generation wireless mobile communication technology (3G), fourth generation wireless mobile communication technology (4G), fifth generation wireless mobile communication technology (5G) as well as later generation 3GPP technology, global system for mobile communications (GSM), universal mobile telecommunications system (UMTS), 3GSM, general Packet Radio service (GPRS), code division multiple access (CDMA) systems (e.g., cdmaOne, CDMA1020™), enhanced data rates for GSM evolution (EDGE), advanced mobile phone system (AMPS), digital AMPS (IS-136/TDMA), evolution-data optimized (EV-DO), digital enhanced cordless telecommunications (DECT), Worldwide Interoperability for Microwave Access (WiMAX), wireless local area network (WLAN), Wi-Fi Protected Access I & II (WPA, WPA2), and integrated digital enhanced network (iDEN). Each of these technologies involves, for example, the transmission and reception of voice, data, signaling, and/or content messages. It should be understood that any references to terminology and/or technical details related to an individual telecommunication standard or technology are for illustrative purposes only, and are not intended to limit the scope of the claims to a particular communication system or technology unless specifically recited in the claim language.

(99) Various embodiments illustrated and described are provided merely as examples to illustrate various features of the claims. However, features shown and described with respect to any given embodiment are not necessarily limited to the associated embodiment and may be used or combined with other embodiments that are shown and described. Further, the claims are not intended to be limited by any one example embodiment. For example, one or more of the operations of the methods may be substituted for or combined with one or more operations of the methods.

(100) The foregoing method descriptions and the process flow diagrams are provided merely as illustrative examples and are not intended to require or imply that the operations of various embodiments must be performed in the order presented. As will be appreciated by one of skill in the art the order of operations in the foregoing embodiments may be performed in any order. Words such as “thereafter,” “then,” “next,” etc. are not intended to limit the order of the operations; these words are simply used to guide the reader through the description of the methods. Further, any reference to claim elements in the singular, for example, using the articles “a,” “an” or “the” is not to be construed as limiting the element to the singular.

(101) The various illustrative logical blocks, modules, circuits, and algorithm operations described in connection with the embodiments disclosed herein may be implemented as electronic hardware, computer software, or combinations of both. To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and operations have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the claims.

(102) The hardware used to implement the various illustrative logics, logical blocks, modules, and

circuits described in connection with the embodiments disclosed herein may be implemented or performed with a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (TCUASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general-purpose processor may be a microprocessor, but, in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration. Alternatively, some operations or methods may be performed by circuitry that is specific to a given function.

(103) In one or more embodiments, the functions described may be implemented in hardware, software, firmware, or any combination thereof. If implemented in software, the functions may be stored as one or more instructions or code on a non-transitory computer-readable medium or non-transitory processor-readable medium. The operations of a method or algorithm disclosed herein may be embodied in a processor-executable software module, which may reside on a non-transitory computer-readable or processor-readable storage medium. Non-transitory computer-readable or processor-readable storage media may be any storage media that may be accessed by a computer or a processor. By way of example but not limitation, such non-transitory computer-readable or processor-readable media may include RAM, ROM, EEPROM, FLASH memory, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium that may be used to store desired program code in the form of instructions or data structures and that may be accessed by a computer. Disk and disc, as used herein, includes compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk, and Blu-ray disc where disks usually reproduce data magnetically, while discs reproduce data optically with lasers. Combinations of the above are also included within the scope of non-transitory computer-readable and processor-readable media. Additionally, the operations of a method or algorithm may reside as one or any combination or set of codes and/or instructions on a non-transitory processor-readable medium and/or computer-readable medium, which may be incorporated into a computer program product.

(104) The preceding description of the disclosed embodiments is provided to enable any person skilled in the art to make or use the claims. Various modifications to these embodiments will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other embodiments without departing from the scope of the claims. Thus, the present disclosure is not intended to be limited to the embodiments shown herein but is to be accorded the widest scope consistent with the following claims and the principles and novel features disclosed herein.

Claims

1. A method performed by a processor of a computing device, comprising: generating general inferences from personal data from the computing device in a manner that disassociates the general inferences from a user identity related to the personal data; coding the general inferences into a dynamic identifier (ID), wherein the dynamic ID is disassociated from the user identity related to the personal data; maintaining the dynamic ID at the computing device for use of the dynamic ID at the computing device; receiving, from a first application of the computing device, a first request to access the general inferences coded into the dynamic ID; outputting, based on permissions associated with the first application, a first set of general inferences from the dynamic ID for the first application; receiving, from a second application of the computing device, a second request to access the general inferences coded into the dynamic ID; and outputting, based on permissions associated with the second application, a second set of general inferences from the dynamic ID for

the second application, the second set of general inferences being different from the first set of general inferences.
2. The method of claim 1, wherein maintaining the dynamic ID at the computing device for use of the dynamic ID at the computing device comprises making the dynamic ID available for use at the computing device by an advertising software configured to select advertisements at the computing device based on at least one of the general inferences of the dynamic ID.
3. The method of claim 2, wherein the advertising software is configured with an algorithm developed with an independent software vendor configured to select advertisements at the computing device based on the at least one of the general inferences of the dynamic ID.
4. The method of claim 1, wherein maintaining the dynamic ID at the computing device for use of the dynamic at the computing device comprises making the dynamic ID available for use at the computing device by an application developed by an independent software vendor configured to select advertisements at the computing device based on at least one of the general inferences of the dynamic ID.
5. The method of claim 4, wherein maintaining the dynamic ID at the computing device for use of the dynamic at the computing device further comprises preventing advertising software from transmitting the dynamic ID from the computing device.
6. The method of claim 1, wherein generating the general inferences from the personal data from the computing device in a manner that disassociates the general inferences from the user identity related to the personal data comprises generating a persona inference configured to provide general characteristics of the personal data disassociated from the user identity.
7. The method of claim 1, wherein generating the general inferences from the personal data from the computing device in a manner that disassociates the general inferences from the user identity related to the personal data comprises generating at least one characteristic inference configured to provide an abstraction of at least part of the personal data disassociated from the user identity.
8. A computing device, comprising: a memory; and processor coupled to the memory and configured to: generate general inferences from personal data from the computing device in a manner that disassociates the general inferences from a user identity related to the personal data; code the general inferences into a dynamic identifier (ID), wherein the dynamic ID is disassociated from the user identity related to the personal data; maintain the dynamic ID at the computing device for use of the dynamic ID at the computing device; receive, from a first application of the computing device, a first request to access the general inferences coded into the dynamic ID; output, based on permissions associated with the first application, a first set of general inferences from the dynamic ID for the first application; receive, from a second application of the computing device, a second request to access the general inferences coded into the dynamic ID; and output, based on permissions associated with the second application, a second set of general inferences from the dynamic ID for the second application, the second set of general inferences being different from the first set of general inferences.
9. The computing device of claim 8, wherein the processor is further configured to maintain the dynamic ID at the computing device for use of the dynamic at the computing device by making the dynamic ID available for use at the computing device by an advertising software configured to select advertisements at the computing device based on at least one of the general inferences of the dynamic ID.
10. The computing device of claim 9, wherein the advertising software is configured with an algorithm developed with an independent software vendor configured to select advertisements at the computing device based on the at least one of the general inferences of the dynamic ID.
11. The computing device of claim 8, wherein the processor is further configured to maintain the dynamic ID at the computing device for use of the dynamic at the computing device by making the dynamic ID available for use at the computing device by an application developed by an independent software vendor configured to select advertisements at the computing device based on

at least one of the general inferences of the dynamic ID.
12. The computing device of claim 11, wherein the processor is further configured to prevent advertising software from transmitting the dynamic ID from the computing device.
13. The computing device of claim 8, wherein the processor is further configured to generate the general inferences from the personal data from the computing device in a manner that disassociates the general inferences from the user identity related to the personal data by generating a persona inference configured to provide general characteristics of the personal data disassociated from the user identity.
14. The computing device of claim 8, wherein the processor is further configured to generate the general inferences from the personal data from the computing device in a manner that disassociates the general inferences from the user identity related to the personal data comprises generating at least one characteristic inference configured to provide an abstraction of at least part of the personal data disassociated from the user identity.
15. A computing device, comprising: means for generating general inferences from personal data from the computing device in a manner that disassociates the general inferences from a user identity related to the personal data; means for coding the general inferences into a dynamic identifier (ID), wherein the dynamic ID is disassociated from the user identity related to the personal data; means for maintaining the dynamic ID at the computing device for use of the dynamic ID at the computing device; means for receiving, from a first application of the computing device, a first request to access the general inferences coded into the dynamic ID; means for outputting, based on permissions associated with the first application, a first set of general inferences from the dynamic ID for the first application; means for receiving, from a second application of the computing device, a second request to access the general inferences coded into the dynamic ID; and means for outputting, based on permissions associated with the second application, a second set of general inferences from the dynamic ID for the second application, the second set of general inferences being different from the first set of general inferences.
16. The computing device of claim 15, wherein means for maintaining the dynamic ID at the computing device for use of the dynamic at the computing device comprises means for making the dynamic ID available for use at the computing device by an advertising software configured to select advertisements at the computing device based on at least one of the general inferences of the dynamic ID.
17. The computing device of claim 16, wherein the advertising software is configured with an algorithm developed with an independent software vendor configured to select advertisements at the computing device based on the at least one of the general inferences of the dynamic ID.
18. The computing device of claim 15, wherein means for maintaining the dynamic ID at the computing device for use of the dynamic at the computing device comprises means for making the dynamic ID available for use at the computing device by an application developed by an independent software vendor configured to select advertisements at the computing device based on at least one of the general inferences of the dynamic ID.
19. The computing device of claim 18, wherein means for maintaining the dynamic ID at the computing device for use of the dynamic ID at the computing device further comprises means for preventing advertising software from transmitting the dynamic ID from the computing device.
20. The computing device of claim 15, wherein means for generating the general inferences from the personal data from the computing device in a manner that disassociates the general inferences from the user identity related to the personal data comprises means for generating a persona inference configured to provide general characteristics of the personal data disassociated from the user identity.
21. The computing device of claim 15, wherein means for generating the general inferences from the personal data from the computing device in a manner that disassociates the general inferences from the user identity related to the personal data comprises means for generating at least one

characteristic inference configured to provide an abstraction of at least part of the personal data disassociated from the user identity.

22. A non-transitory processor-readable medium having stored thereon processor-executable instructions configured to cause a processor of a computing device to perform operations comprising: generating general inferences from personal data from the computing device in a manner that disassociates the general inferences from a user identity related to the personal data; coding the general inferences into a dynamic identifier (ID), wherein the dynamic ID is disassociated from the user identity related to the personal data; maintaining the dynamic ID at the computing device for use of the dynamic ID at the computing device; receiving, from a first application of the computing device, a first request to access the general inferences coded into the dynamic ID; outputting, based on permissions associated with the first application, a first set of general inferences from the dynamic ID for the first application; receiving, from a second application of the computing device, a second request to access the general inferences coded into the dynamic ID; and outputting, based on permissions associated with the second application, a second set of general inferences from the dynamic ID for the second application, the second set of general inferences being different from the first set of general inferences.

23. The non-transitory processor-readable medium of claim 22, wherein the stored processor-executable instructions are configured to cause the processor of the computing device to perform operations such that maintaining the dynamic ID at the computing device for use of the dynamic at the computing device comprises making the dynamic ID available for use at the computing device by an advertising software configured to select advertisements at the computing device based on at least one of the general inferences of the dynamic ID.

24. The non-transitory processor-readable medium of claim 23, wherein the advertising software is configured with an algorithm developed with an independent software vendor configured to select advertisements at the computing device based on the at least one of the general inferences of the dynamic ID.

25. The non-transitory processor-readable medium of claim 22, wherein the stored processor-executable instructions are configured to cause the processor of the computing device to perform operations such that maintaining the dynamic ID at the computing device for use of the dynamic at the computing device comprises making the dynamic ID available for use at the computing device by an application developed by an independent software vendor configured to select advertisements at the computing device based on at least one of the general inferences of the dynamic ID.

26. The non-transitory processor-readable medium of claim 25, wherein the stored processor-executable instructions are configured to cause the processor of the computing device to perform operations such that maintaining the dynamic ID at the computing device for use of the dynamic at the computing device further comprises preventing advertising software from transmitting the dynamic ID from the computing device.

27. The non-transitory processor-readable medium of claim 22, wherein the stored processor-executable instructions are configured to cause the processor of the computing device to perform operations such that generating the general inferences from the personal data from the computing device in a manner that disassociates the general inferences from the user identity related to the personal data comprises generating a persona inference configured to provide general characteristics of the personal data disassociated from the user identity.

28. The non-transitory processor-readable medium of claim 22, wherein the stored processor-executable instructions are configured to cause the processor of the computing device to perform operations such that generating the general inferences from the personal data from the computing device in a manner that disassociates the general inferences from the user identity related to the personal data comprises generating at least one characteristic inference configured to provide an abstraction of at least part of the personal data disassociated from the user identity.