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## CANONICALIZING PHONE CONTACTS

Justin Lewis

Ruxandra Davies

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## CANONICALIZING PHONE CONTACTS

### ABSTRACT

A contact update system augments contact telephone numbers with an appropriate country code. The system may receive a contact telephone number that lacks a country code. The system can then determine the country code of the contact's telephone number using various heuristics. The heuristics may include the contact's association with other users (e.g., the contact's comments on social networks, location of the contact, call/message history with the contact, or social graphs). The system can update a record of the contact telephone number by adding the determined country code to the received telephone number.

### PROBLEM STATEMENT

Mobile applications and other services use telephone numbers as unique identifiers for individuals. Generally speaking, telecommunications regulations and policies ensure that no two people have the same telephone number in a country. But once the reach of an application or service expands internationally, this norm might not hold across the application or service's user base. That is, an application may count among its user base two or more users from different countries registered with the same local telephone number.

Mobile applications generally send a variety of updates and notifications to the users. Once two users are registered to the same telephone number in an application, the users are put at risk of having their personal or private data sent to the other user registered with the same telephone number. Traditional mobile applications do not have a mechanism of canonicalizing telephone numbers such that no two users will be registered under the same telephone number.

Accordingly, a method and system for determining unique user identifiers for users with the same local telephone number by augmenting the users' respective telephone numbers with a country code is described.

### CONTACT UPDATE SYSTEM

The system and techniques described in this disclosure relate to a contact update system that augments telephone numbers in a contact list with country codes. The contact update system can be implemented for use by a client device connected to one or more other devices via the Internet, an intranet, or in any client-server environment. The system can include program instructions implemented locally on a client device or implemented across a client device and server environment. The client device can be any electronic device such as a mobile device, a smartphone, a tablet, a handheld electronic device, a wearable device, etc.

Fig. 1 illustrates an example method 100 for updating a contact's telephone number with an appropriate country code. Method 100 can be performed by a system, for example, the contact update system, that determines the country code using various heuristics and augments the contact's telephone number with the determined country code.

As shown in Fig. 1, the system receives a telephone number of a contact (110). The system may receive the telephone number from a user's contact list stored in an electronic device associated with the user. The telephone number may be manually entered by the user in the contact list or the contact list may be automatically updated with new contacts from the user's social networking accounts. The user can store the telephone numbers of the contacts in a memory of the electronic device or in a cloud account associated with the user.

On receiving the telephone number, the system can determine that the telephone number is without a country code (120). The system may compare the format of the telephone number with standardized country specific telephone number formats to check whether the telephone number includes a country code or not.

Based on the format of the telephone number, the system may determine that the telephone number is a service number. For example, the telephone number may be a N-1-1 number where N can be any integer, e.g, 9-1-1 for emergency services or 6-1-1 for telephone company customer service. If the system determines that the telephone number is a service number or the telephone number includes a country code, the system may terminate the method 100 at step 120.

If the telephone number is without a country code, the system can then determine a country code for the telephone number (130). The system may use a combination of heuristics to determine the country code for the contact's telephone number.

One heuristic is the country codes of the user's social contacts. The system can identify social contacts that interact with the user in an application or service. The application or service may include e-mail, messaging or social network programs. The social contacts may have verified their telephone numbers, with corresponding country codes, with the application or service. The system can determine the country code for the contact from the verified telephone numbers of the social contacts. For example, the system may identify the most common country code among the social contacts as the contact's telephone number country code.

A second heuristic is the geographical location of the user when he communicates with the contact. The system may analyze the call logs and/or messaging history of the user in respect

to the user's historical geolocation information. The system can identify the country the user was located, from the user's historic geographic location, when the user previously called or messaged the contact. It can be assumed the contact lives in the same country from which the user communicated with the contact. Hence, the system can determine the country code for the contact's telephone number that corresponds to the identified country.

The system may receive geolocation information for the user from various sources. For example, the system can receive global positioning system (GPS) coordinates from one or more electronic devices associated with the user. Alternatively, or additionally, the system may receive geolocation information for the user determined from locations tagged in the user's social media posts. Alternatively, or additionally, the system can receive geolocation information for the user determined from user data, e.g., based on receipts or travel information as indicated by e-mails or e-tickets and search queries that identify locations, etc.

A third heuristic is telephone numbers similar to the contact's telephone number. The system can analyze the contact lists of the user's social graph. The user's social graph may include anyone associated with the user, e.g., friends, friends of friends, and acquaintances. The social graph can also include people the user interacts with in applications or internet services, e.g., email services or social networking services. Among the user's social graph, there may be an overlapping of contacts. The telephone numbers for particular contacts may be stored in multiple contact lists belonging to different people in the user's social graph. From these contact lists, the system can identify telephone numbers that are similar to the contact's telephone number. For example, the system may identify the telephone number "1-234-5677" as similar to the contact's telephone number of "234-5678." In some instances, the similar telephone number

is identical to the contact's telephone number but with a country code appended. The system can then identify the difference between the similar telephone number and the contact telephone number as the country code. Hence, the system may determine the country code for the contact's telephone number from similar telephone numbers in contact lists within a user's social graph.

A fourth heuristic is the location of the contact. When the user initiates any communication, e.g., calls, messages, or invites to a video call, with the contact, the system can determine the current location of the contact, as described above. The system may determine the country code for the contact that corresponds to the country the contact is currently located in. For example, if the user messages the contact when the contact is located in the U.S., the system can determine that the contact's telephone number has a country code of "+1."

A fifth heuristic is the country code of the user's telephone number. The user may have verified his or her phone in one of the services or applications used by the user. The system can determine that the contact's telephone number has the same country code as the user's telephone number.

The system may use a combination of the above-described heuristics to determine the country code of the contact's telephone number. Alternatively, or additionally, the system can analyze the heuristics in a sequential fashion, with each heuristic producing a candidate country code with an associated confidence score. The system may take the first candidate country code with a confidence score that satisfies a predetermined threshold or take the candidate country code with the greatest confidence score. The system can dynamically alter the order of the heuristics analyzed based on which heuristic provides country codes with the greatest confidence scores in particular scenarios.

The system can update the contact's telephone number to include the determined country code (140). The system may update the contact's telephone number in the contact list of the user and any other contact list that includes the contact. By augmenting the contact's telephone number with the determined country code, the system canonicalizes phone contacts into unique user identifiers for all the services and applications. Method 100 may also be used to influence ranking of contacts in the user's contact list, such that contacts with telephone numbers missing country codes are ranked lower than other contacts.

Fig. 2 is a block diagram of an exemplary environment that shows components of a system for implementing the techniques described in this disclosure. The environment includes client devices 210, servers 230, and network 240. Network 240 connects client devices 210 to servers 230. Client device 210 is an electronic device. Client device 210 may be capable of requesting and receiving data/communications over network 240. Example client devices 210 are personal computers (e.g., laptops), mobile communication devices, (e.g. smartphones, tablet computing devices), set-top boxes, game-consoles, embedded systems, and other devices 210' that can send and receive data/communications over network 240. Client device 210 may execute an application, such as a web browser 212 or 214 or a native application 216. Web applications 213 and 215 may be displayed via a web browser 212 or 214. Server 230 may be a web server capable of sending, receiving and storing web pages 232. Web page(s) 232 may be stored on or accessible via server 230. Web page(s) 232 may be associated with web application 213 or 215 and accessed using a web browser, e.g., 212. When accessed, webpage(s) 232 may be transmitted and displayed on a client device, e.g., 210 or 210'. Resources 218 and 218' are resources available to the client device 210 and/or applications thereon, or server(s) 230 and/or

web pages(s) accessible therefrom, respectively. Resources 218' may be, for example, memory or storage resources; a text, image, video, audio, JavaScript, CSS, or other file or object; or other relevant resources. Network 240 may be any network or combination of networks that can carry data communication.

The subject matter described in this disclosure can be implemented in software and/or hardware (for example, computers, circuits, or processors). The subject matter can be implemented on a single device or across multiple devices (for example, a client device and a server device). Devices implementing the subject matter can be connected through a wired and/or wireless network. Such devices can receive inputs from a user (for example, from a mouse, keyboard, or touchscreen) and produce an output to a user (for example, through a display). Specific examples disclosed are provided for illustrative purposes and do not limit the scope of the disclosure.

DRAWINGS

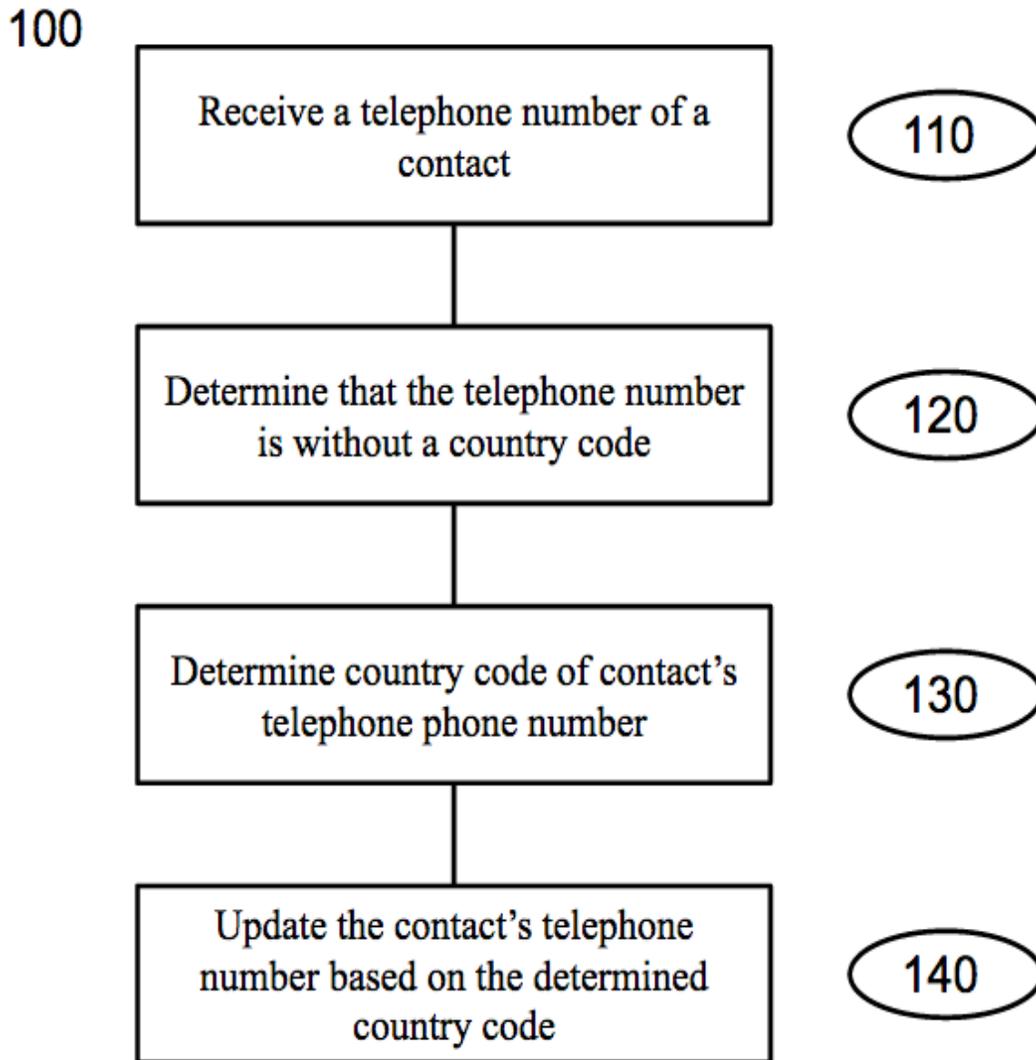


Fig. 1

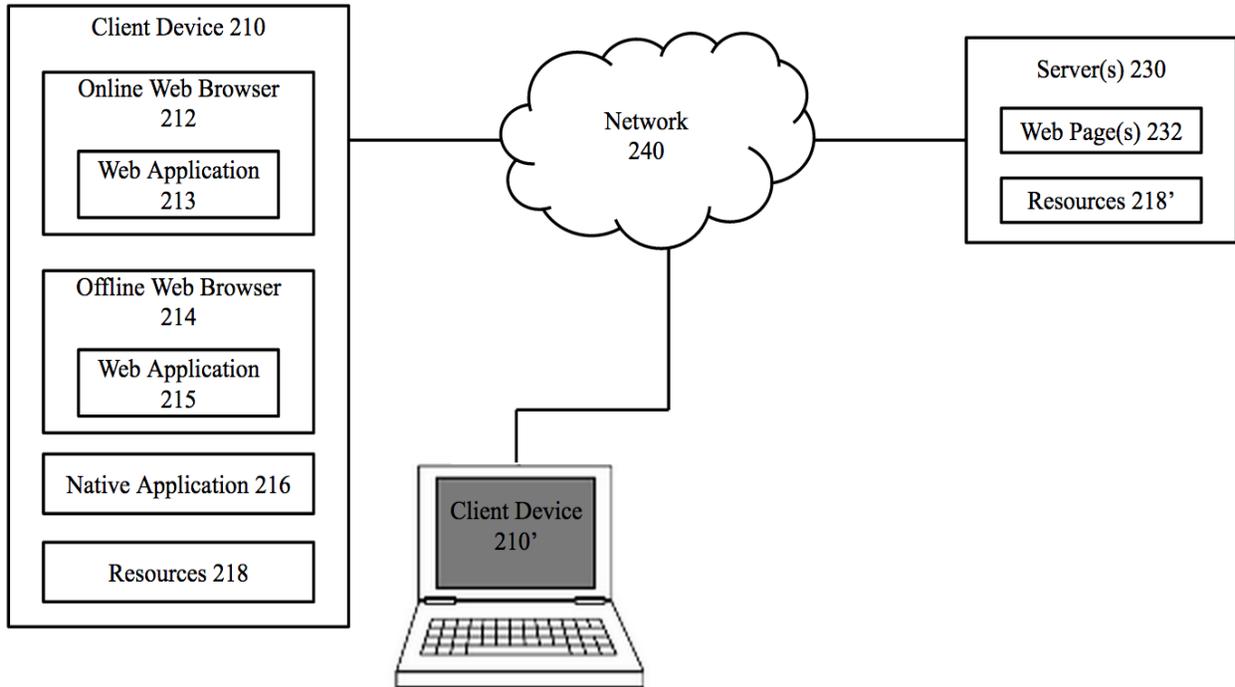


Fig. 2