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Selective connection to Wi-Fi networks

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ABSTRACT

Devices such as mobile phones, tablets, wearables, head mounted displays, and computers auto-connect to a wireless network (e.g., a Wi-Fi network) regardless of the speed or quality of the connection offered by the network. In some instances, a Wi-Fi network can deliver lower speed and can be less reliable than a cellular data connection. In such instances, the cellular data connection can be preferable to the Wi-Fi connection. Testing connection speeds of various available connections require connecting to the network first, can cause delays in connection, and requires extra network usage and battery power. This disclosure describes techniques that utilize prior information about the comparative quality of available Wi-Fi and cellular networks, and automatically connects the user device to a preferred network. The prior information includes, e.g., scores for various Wi-Fi networks and expected cellular speed at locations.

KEYWORDS:

- Automatic connection
- Wi-Fi throughput
- Cellular data speed
- Wireless hotspot

BACKGROUND

Mobile devices such as smartphones, tablets, laptop computers, wearables, head mounted displays etc. can access wireless local area networks (e.g., Wi-Fi networks) as well as cellular data networks. Such devices include wireless transceivers for both Wi-Fi and cellular networks. Wi-Fi networks (e.g., networks provided by Wi-Fi hotspots) are often free or cheaper than cellular data networks. Hotspots are available in shops, restaurants, offices, public transportation hubs such as railway stations and airports, etc. Municipal Wi-Fi networks in some cities provide Wi-Fi coverage across large parts of the city. Users of mobile devices often prefer to connect to a Wi-Fi network, e.g., because network access over a Wi-Fi network is free or cheaper, and does not count against a cellular data plan, because the user believes that the Wi-Fi network offers better speed.

However, some Wi-Fi networks are slow, e.g., due to a limitation of the backhaul Internet connection of the Wi-Fi access point that provides the Wi-Fi network, presence of other users simultaneously connected to the Wi-Fi network, signal quality, etc. When Wi-Fi networks are slow in comparison with cellular networks, some users prefer to utilize the cellular data connection.

Currently, mobile devices need to first connect to an available Wi-Fi network to determine whether the quality of the Wi-Fi network is superior to a cellular network. In switching between Wi-Fi and cellular networks, devices can experience interruptions in connectivity, e.g., due to a change in the device IP address, dropped data packets, etc.

DESCRIPTION

This disclosure describes techniques for a mobile device to selectively join a Wi-Fi network. Such determination is made automatically without user input.
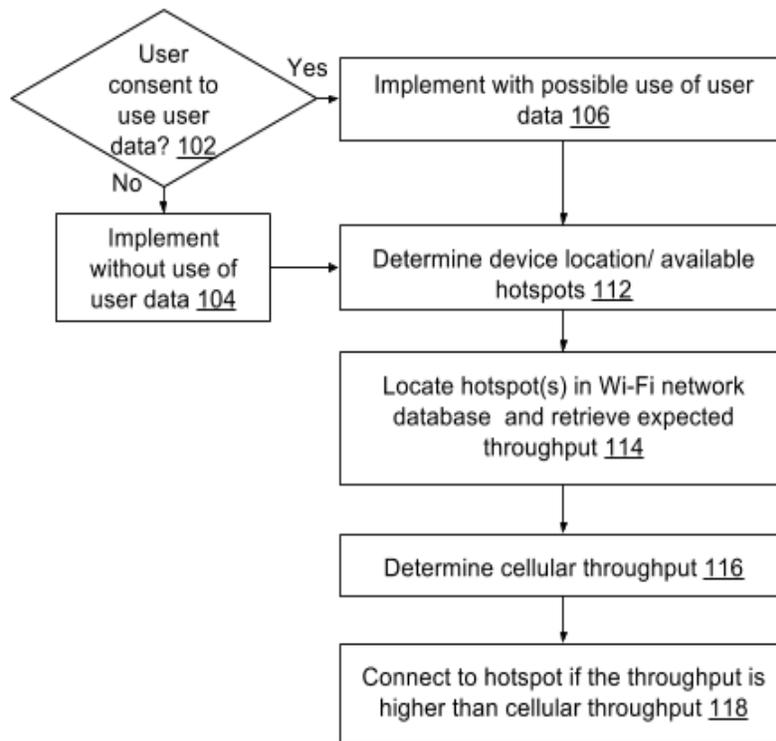
Fig. 1: Selective connection to a Wi-Fi network

Fig. 1 illustrates an example process to selectively establish connection to an available Wi-Fi network (hotspot). It is determined whether the user has provided for use of user data (102), e.g., location, connection information, etc. If the user declines consent, the technique is not implemented, or implemented without use of location data and data about network availability (104). If the user declines consent, the selective connection techniques are not implemented, and the user device defaults to such techniques of establishing connection as possible without the use of user data. If the user provides consent, the technique is implemented with possible use of user data (106).

First, when permitted by the user, a location of the user device and/ or hotspots (Wi-Fi networks) available to the user device is determined (112). In determination of the location, only

such information is used as permitted by the user. For example, if the user permits access to data from one or more sensors, such as GPS, data from such sensors is used to determine the location. If the user permits, location is determined using triangulation techniques. Location determination techniques that require access to data for which the user has not provided permission are not used. Based on the device location and available hotspots, a Wi-Fi network database is looked up to retrieve expected throughput of the available hotspots or hotspots that are known to be available at the device location (114). In performing the lookup, no device-specific information is used. The lookup is performed prior to the user device connecting to a Wi-Fi network. The cellular data network throughput at the location is determined (116). For example, the cellular data throughput can be determined ahead of time, e.g., prior to the user device reaching the location, or in real-time while the user device is at the location. In determination of the cellular data throughput, no user data is utilized. Optionally, the Wi-Fi network database results are filtered to retrieve only those Wi-Fi networks that have a greater throughput than cellular network throughput (e.g., determined based on prior throughput data) at the user device location. However, if it is determined that the user device currently has no connectivity to the cellular data network, one or more of the filtered hotspots can be included, e.g., to ensure that the user device has more connectivity options.

The expected throughput of the available hotspots and of the cellular network are compared to determine if any available hotspot has throughput higher than the cellular network. In addition to throughput, other network metrics such as reliability can also be determined and compared. For example, a score can be retrieved for each available hotspot and compared with the cellular network.

Upon determination that an available hotspot has greater throughput, the user device is

automatically connected to the hotspot (118). Based on user preferences, prior to the automatic connection, the user is provided with information that one or more available hotspots have higher throughput and an option to connect to the hotspots. If no hotspot is identified that has throughput higher than the cellular network, the user device does not connect to any hotspot, even when hotspots are available. By selectively connecting to Wi-Fi networks in this manner, service interruptions are avoided and an improved user experience provided, e.g., by making the fastest connection available. User information that is specifically permitted by the user for use in establishing Wi-Fi connections is used.

In situations in which certain implementations discussed herein may collect or use personal information about users (e.g., user data, information about a user's social network, user's location and time at the location, user's biometric information, user's activities and demographic information), users are provided with one or more opportunities to control whether information is collected, whether the personal information is stored, whether the personal information is used, and how the information is collected about the user, stored and used. That is, the systems and methods discussed herein collect, store and/or use user personal information specifically upon receiving explicit authorization from the relevant users to do so. For example, a user is provided with control over whether programs or features collect user information about that particular user or other users relevant to the program or feature. Each user for which personal information is to be collected is presented with one or more options to allow control over the information collection relevant to that user, to provide permission or authorization as to whether the information is collected and as to which portions of the information are to be collected. For example, users can be provided with one or more such control options over a communication network. In addition, certain data may be treated in one or more ways before it

is stored or used so that personally identifiable information is removed. As one example, a user's identity may be treated so that no personally identifiable information can be determined. As another example, a user's geographic location may be generalized to a larger region so that the user's particular location cannot be determined.

CONCLUSION

  This disclosure describes techniques to compare quality (e.g., throughput, reliability, etc.) of an available Wi-Fi hotspot with a cellular connection. Upon determination that the Wi-Fi hotspot has greater throughput than the cellular connection, a user device is selectively connected to the Wi-Fi hotspot. The techniques enable a user device to automatically connect to a network of higher quality, and avoid connection interruptions, e.g., associated with switching from cellular to Wi-Fi and vice versa.