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NETWORK CONNECTIVITY QUALITY - USER INTERFACE ICONS AND REPORTS

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NETWORK CONNECTIVITY QUALITY - USER INTERFACE ICONS AND REPORTS

ABSTRACT

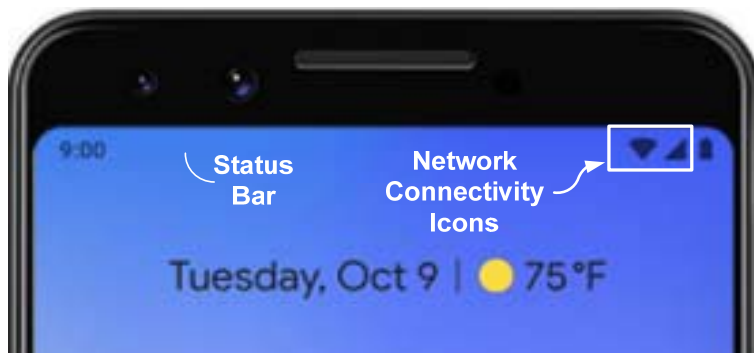
A computing device (e.g. mobile phone, smartphone, tablet computer, etc.) with multiple network connectivities may be configured to display a user interface with an indication of network quality to a user. For example, the displayed user interface may include an icon indicating the network quality (e.g., data transmission speeds, of a selected network connection) in a status bar. The computing device may also generate a network report detailing various performance metrics (e.g. an amount of data used, network speed, network reliability) of a selected network connection for a user-specified or pre-defined time period. The computing device may also provide a user with network usage suggestions based on the user's network connection patterns. The computing device may also monitor changes in the network connection report and suggest a user take actions to correct, improve, or otherwise change network connectivity quality.

DESCRIPTION

A computing device may display a user interface via which a user may interact with the computing device (e.g., to control applications and various functions of the device). The computing device may display the user interface as including a status bar (also known as a tool bar, a task bar, or a notification bar) that includes a variety of icons. These icons may provide quickly viewable information indicating a status of the computing device. For example, a computing device may display an icon (e.g., a set of vertically elongate bars, gradually increasing from left to right) to indicate a strength of signal of a network connection, such as a cellular signal. Such an example icon typically indicates the network signal strength, usually a relative scale of the objective strength of the signal. However, an icon indicating the strength of signal rather than network quality may give a user a false perception of the network connection quality (e.g., data

upload and download speeds) of the network connection. For example, in a crowded sports arena, despite displaying an icon indicating network signal strength as full strength, the computing device may fail to connect a phone call. In such an example, the network signal strength does not represent the network quality (e.g., data upload and download speeds). Thus, currently used status bar icons may not indicate the information particularly relevant to users. It may be desirable for a computing device to display one or more icons in the status bar to indicate the quality of a network connection (e.g., connection speed, data transmission speed, and/or other performance metrics) used by the computing device. Additionally, a user may benefit from reports generated by the computing device detailing network quality and other usage metrics for the one or more network connections.

A computing device configured to connect to one or more network connections may include a user interface, such as the example shown in Figure 1 below. The computing device may be, include, or otherwise be included in a smartphone, tablet computer, laptop computer, computerized watch, computerized eyewear, computerized gloves, personal computer, smart television, personal digital assistant, portable gaming system, media player, mobile television platform, automobile navigation and/or entertainment system, vehicle (e.g., automobile, aircraft) and/or cockpit display, a home or other smart appliance and/or related device (e.g., interconnectable appliance/device via Internet of Things), or any other type of wearable, non-wearable, mobile, or non-mobile computing device. Network connections, for example, are used for accessing the internet via a wired or wireless connection, making or receiving voice calls, and/or sending or receiving text messages. The user interface may include a touch-sensitive display, voice-interactive display, or use input from another wired or wirelessly connected device to utilize various applications, functions, and other features of the computing device.

**FIG. 1**

The user interface of the computing device may include a status bar, taskbar, toolbar, and/or notification bar, sometimes at the top of a display of the computing device, such as in example Figure 1. The computing device may include in the status bar one or more icons to provide information about a status of the computing device. Such icons may be included in the status bar because of their particular relevance to a user. For example, an icon may display a current time, battery charge level, signal strength of one or more network connections, ringer volume, weather information, network connection status, alarms, notifications, alerts, or other status icons. As an example, the status bar shown in Figure 1 includes the current time icon in the upper left corner. The upper right corner includes the battery charge level icon, represented by a battery shape shaded to a level proportional to the charge remaining of a battery of the computing device. The status bar also includes icons indicating the network connection status of the computing device (identified as Network Connectivity Icons in Figure 1) next to the battery charge level icon. In the example status bar, Wi-Fi network signal strength is represented by a shaded-in vertically symmetric wedge shape, and mobile network signal strength is represented by a right triangle gradually increasing from left to right. Network connectivity icons may include these example icons among others. Network connectivity icons typically indicate the relative strength of signal for a network connection of the computing device. The computing device may, within the menus

of the user interface, display an objective strength of signal (e.g., a numerical value measured in decibels (dB)). To make this information more accessible, the computing device may generate a relative strength of signal and display a network connectivity icon in the status bar of the user interface. For example, the computing device may display a completely filled-in icon in the status bar when placed next to a network connection location, indicating to the user that the network signal strength is strong. In contrast, the computing device may display an unfilled icon, or icon including an “X,” when far away from a network connection location to indicate to the user that the network signal strength is poor or lost altogether.

Icons indicating network signal strength of the network connection may not present a relevant representation of network connection quality to a user. For example, in a crowded sports arena or concert venue, a computing device may display a network connection icon indicating a strong signal (e.g., full bars), but when a user attempts to place a call, send a text message, or access the internet, the user may be unable to do so. This may result from too many computing devices accessing network services. In such an example situation, among others, a user may benefit from a computing device that displays network connection icons indicating network quality (e.g., data network speed, rather than signal strength). Network quality may include data download speed, data upload speed, round trip time, latency, bandwidth, throughput, signal strength, or other performance metric, either individually, or in combination.

To better present relevant computing device status information to a user, a computing device may display an icon in the status bar indicating network quality of a network connection. Example icons are shown in Figures 2A through 2D. As these icons are software based, the example icons may use different shapes, colors, sizes, or other characteristics and still present the same network quality information to the user.

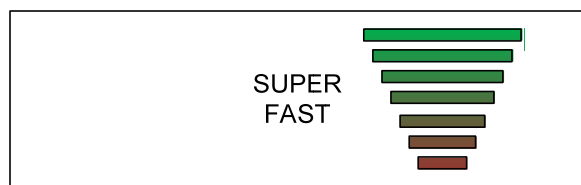


FIG. 2A



FIG. 2B

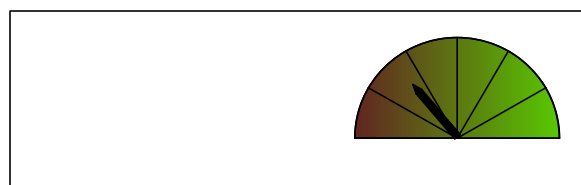


FIG. 2C

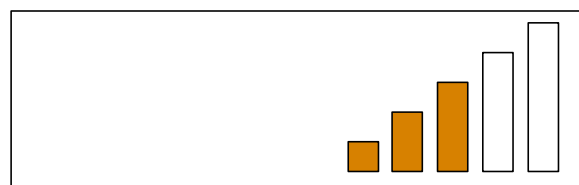


FIG. 2D

An example network quality icon, as shown in Figure 2A, may include a series of horizontal rectangles gradually increasing in width, stacked vertically. The better the network quality, the more bars are filled in, beginning with the bottom-most horizontal bar. The network quality icon may also include a quality rating word such as “Super Fast” to indicate with text the network quality. In another example, shown in Figure 2B, the network quality icon may include a vertically elongate rectangle, filled in proportionally to the network quality of the connection. The better the network quality, the more the icon is filled in. For example, the best network quality may be a solid-colored vertically elongate rectangle. In another example, shown in Figure 2C, a network quality icon may include a hemisphere with a rotating pointer, similar to a speedometer, indicating a better network quality as the pointer rotates around its base in a clockwise direction. In another example, shown in Figure 2D, the network quality icon may include a set of vertically elongate bars gradually increasing in height from left to right. As described by this publication, the example icons shown in Figure 2A through 2D indicate network quality of a network connection. As described previously, network quality may include data transmission speed. In such an example, the best network quality may be defined as “Super Fast” and indicate data transmission speeds of greater than 100 Mbps. In the example icon of Figure 2A, this is indicated by all bars being filled in. Continuing with the previous example, “Fast” may indicate data

transmission speeds between 25 and 100 Mbps, “Good” may indicate speeds between 10 Mbps and 25 Mbps, “Fair” may indicate speeds between 1 and 10 Mbps, and “Poor” may indicate speeds less than 1 Mbps. In some network quality icons, such as those in Figures 2A and 2B, the network quality rating word (e.g. Super Fast, Fast, Good, Fair, Poor) may be included, allowing a user to read the indicated network quality. Other network quality icons may display an icon without the accompanying quality rating word, such as the examples in Figures 2C and 2D. Other network icons may display only the network quality word.

The computing device, in another example, via the user interface, may display two or more icons in the status bar to indicate network quality of two or more network connections. For example, the single network connectivity icons shown in Figures 2A through 2D may be separated into two different icons, a first icon to indicate the network quality of a voice network connection and a second icon to indicate the network quality for a data network connection. One example set of network quality icons indicating the described information is shown in Figure 3A. The phone-shaped icon may indicate network quality of a voice network connection, and the downward and upward facing arrows may indicate network quality of a data network connection. Use of two or more network quality icons may allow a user to quickly view network quality for multiple network connectivities (e.g., understand whether a webpage will load quickly, a call may be placed, or there may be network connectivity problems). For example, displaying two or more icons may indicate it is better to place a voice call rather than a video call when mobile data network quality is “Poor,” but voice network quality is “Fast.” Any of the example icons shown in Figures 2A through 2D may be used instead of, or in addition to, the icons of Figure 3A to convey network connectivity quality for a network connection. For example, instead of using a single filled in rectangle to indicate network quality, Figure 3A may use the stacked horizontal bar icon of Figure 2A.

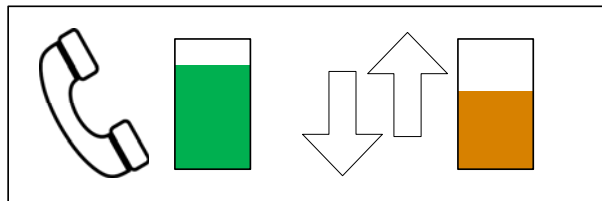


FIG. 3A

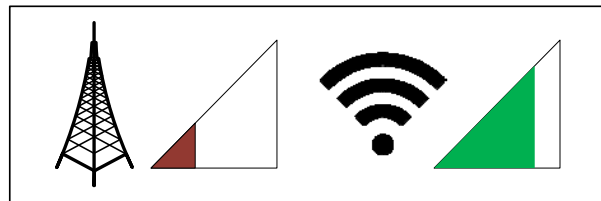


FIG. 3B

In another example, the computing device may display a single icon in the status bar to indicate network quality of individual carrier provided network connections. For example, if “Cell Co.” provides voice calling and mobile data services to the computing device, while “Internet Co.” provides wireless or ethernet internet connectivity, the computing device may display in the status bar via the user interface two icons, one to indicate network quality of the Cell Co. network connection and one to indicate network quality of the Internet Co. network connection. One example set of network quality icons is shown in Figure 3B. Cell Co. network quality may be indicated by the cellular tower icon shown on the left and the accompanying increasing from left to right wedge icon. Internet Co. network quality may be indicated by the vertically symmetric wedge icon and the accompanying increasing from left to right wedge icon. Such example icons included in the status bar may allow a user to quickly view the relevant information regarding network connection quality for multiple network connections. Additionally, if a “Multi Co.” provides voice calling, mobile data services (e.g., cellular data), and wireless internet (e.g., Wi-Fi data) to the computing device, the computing device may display a single icon for Multi Co. regardless of the modality of the current connection (e.g., regardless of cellular or Wi-Fi).

The user interface may also indicate network quality of all signals available to a user (e.g., when the computing device is not transmitting or receiving any data or information from the particular connection). For example, the computing device may be exchanging data via a wireless internet connection with a “Poor” connection network quality. The computing device may also have available a mobile network connection with a “Fast” network quality rating. The computing

device may display two icons in the status bar to indicate to the network quality of each respective network connection. This may enable a user to recognize that switching to the available “Fast” network connection may allow the computing device to transmit and receive data at higher speeds. Displaying network quality icons may allow a user to quickly view the relevant information regarding network quality status of the various network connections available to the computing device.

The computing device may also present via the user interface network reports detailing various performance metrics of the network connections used by the computing device. Such performance metrics may include information such as the frequency the computing device connected to a particular cellular network, Wi-Fi network, CBRS network, or other wireless or wired data transmission network. This, in some instances, may also include the frequency with which the computing device connected to different carriers, if, for example, a computing device uses multiple SIM cards or otherwise connects to multiple carriers or providers. The network report may also provide information about an amount of data the computing device used through a particular network, carrier, or provider. For example, the network report may detail an amount of data accessed via a wireless network and a mobile network during a previous month’s billing cycle. The network report may also indicate an amount of data used by an individual application stored on the computing device. The user may access the network reports, in some instances, by navigating the user interface to access a detailed connectivity information page. In some instances, the user may receive a notification daily, weekly, bi-weekly, monthly, or other durational period, with access to the report. The computing device may also output a notification to the user via the user interface as a notification icon in the status bar, email message, text message, audio message, link to webpage, or other notification on or via the computing device. Various parameters in the

detailed connectivity page may allow a user to generate reports for a specified period of time, certain network type, certain network quality, or other metrics that may provide useful analytic information.

The computing device may also present via the user interface a network report on the network quality connection percentage time. For example, a network report generated for a user-specified time period may show the computing device connected to a “Super Fast” network quality connection for 15% of the specified period, a “Fast” network quality for 80% of the specified period, and a “Poor” network quality connection for the remaining 5% of the specified period. As described by the previous example, a user may access this report by navigating the computing device user interface to access the detailed connectivity information, or the computing device may output a notification on or via the computing device.

The computing device may also provide network usage suggestions. Network usage suggestions may recommend the user take certain actions to improve network connection quality. Network usage suggestions may be based on user specific network connection patterns, general network connection advice, or advice for use with a particular computing device or other network connection hardware. For example, the computing device may recommend changing a home Wi-Fi access point to a 5 GHz access point, install a Wi-Fi repeater in the home, enable auto-connect to certain Wi-Fi access points, switch to a different service provider, or purchase a higher speed internet plan. In another example, the computing device may calculate an amount of data used during each month for one or more network connections and suggest changes to the amount of data the user purchases.

The computing device may also monitor changes in the network report over a period of time. By monitoring for changes in the network report over a period of time, the computing device

may suggest the user take certain actions. For example, the computing device may recommend checking the home wireless network connection if, after a specified period of time, the network quality rating lowers from “Super Fast” to “Fair.” This may allow for the computing device to detect certain problems in a network connection. A user may then make changes to the network connection before experiencing a diminished network quality experience.

By displaying network quality status icons, a computing device may present quickly accessible and relevant information to a user via the user interface about various network connections. Computing device generated network reports may provide a user detailed information about various performance metrics for one or more network connections and may provide suggestions to improve the computing network quality. The above examples of various network quality icons and network reports are not limited to the described examples, as other symbols, designs, or features may indicate similar network quality information.

It is noted that the techniques of this disclosure may be combined with any other suitable technique or combination of techniques. As one example, the techniques of this disclosure may be combined with the techniques described in US Patent Application Publication 2017/0272995A1. As another example, the techniques of this disclosure may be combined with the techniques described in US Patent Application Publication 2009/0054074A1. As another example, the techniques of this disclosure may be combined with the techniques described by Vivek Chaudhary “How to Show Real-Time Internet Speed in Android Status Bar,” available at <https://www.easycodeway.com/2017/01/show-internet-speed-in-android-status-bar.html>. As another example, the techniques of this disclosure may be combined with the techniques described by Cameron Summerson et al. “How to Monitor (and Reduce) Your Data Usage on Android,”

available at <https://www.howtogeek.com/140261/how-to-minimize-your-android-data-usage-and-avoid-overage-charges/>.