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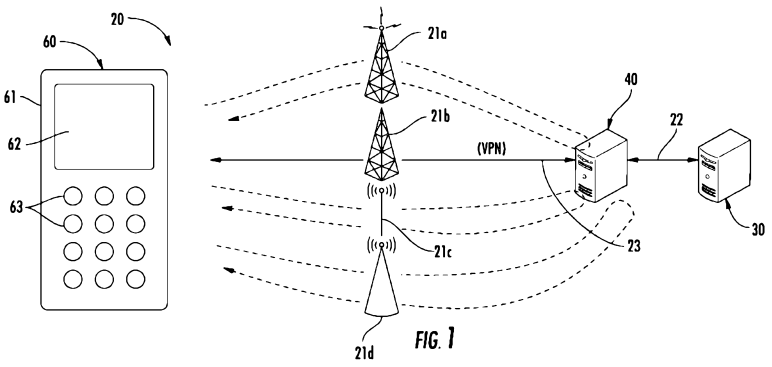

FIG. 1

(57) Abstract: A wireless communications system may include different wireless communications networks, an application server, and an intermediate server configured to communicate with the application server. The wireless communications system may also include a mobile wireless communications device configured to communicate with the intermediate server over each of the different wireless communications networks to determine a selected wireless communications network. The mobile wireless communications device may also be configured to communicate with the application server via the intermediate server over the selected wireless communications network.

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WIRELESS COMMUNICATIONS SYSTEM HAVING SELECTIVE WIRELESS COMMUNICATIONS NETWORK AND RELATED METHODS

Field of the Invention

The present invention relates to the field of wireless communications, and, more particularly, to wireless communications systems and related methods.

Background of the Invention

Mobile communication systems continue to grow in popularity and have become an integral part of both personal and business communications. A mobile communication system may allow internet access via a cellular network, a wireless local area network (WLAN), and/or other type of private or public network, for example. Thus, data service may become available to a mobile wireless communication device, for sending and receiving emails, browsing different websites, placing an internet phone call, streaming video from internet, etc.

When multiple wireless networks are available for communication with the mobile wireless communications device, it may be desirable to select the wireless network having increased performance with respect to the other available wireless networks. For example, based upon a location of the mobile wireless communications device and other conditions, a wireless network may be chosen that may be known to have reduced network congestion and coverage gaps.

Current approaches for selecting a wireless network from among multiple available wireless networks typically use passively measured criteria. For example, a mobile wireless communications device may use criteria such as signal strength, location, and historical data along with statically defined weighing criteria to rate performance of a wireless network. For a currently active connection, that is, the wireless network currently being used by the mobile wireless communications device for communications, other measurements, such as, for example, packet loss and jitter may be used. Passive measurements, especially for wireless networks that are not active, may not provide an accurate picture of the performance of the available wireless networks to the mobile wireless communications device.

U.S. Patent No. 7,610,057 to Bahl et al. discloses a system for selecting a wireless network on a device capable of communicating with multiple wireless networks. More

particularly, a virtual coexistence driver (VCD) obtains operational information regarding active network interfaces. The VCD determines a congestion/interference (C/I) metric for each channel and selects a channel for the same wireless network based upon the C/I metric. If another channel for the same wireless technology is unavailable, an alternative network is selected.

U.S. Patent No. 6,035,196 to Hengeveld et al. is directed to automatic cell transfer based upon reverse channel characteristics. More particularly, one or more of the reverse channel parameters of a reverse channel between a mobile device and a base station are measured and assessed against one or more thresholds. The mobile device searches for a second base station based upon the one or more measured transmission parameters as compared to one or more of the thresholds.

Summary of the Invention

In view of the foregoing background, it is therefore an object of the present invention to provide a communications system that includes a mobile wireless communications device communicating with an application server over a selected wireless communications network.

This and other objects, features, and advantages in accordance with the present invention are provided by a wireless communications system that includes a plurality of different wireless communications networks, an application server, and an intermediate server configured to communicate with the application server. The wireless communications system also includes a mobile wireless communications device configured to communicate with the intermediate server over each of the plurality of different wireless communications networks to determine a selected wireless communications network. The mobile wireless communications device is also configured to communicate with the application server via the intermediate server over the selected wireless communications network.

The wireless communications system may more accurately determine which one of available wireless communications networks to a mobile wireless communications device provides increased performance and switches communications to that wireless communications network through an active approach. For example, in one embodiment, the mobile wireless communications device may be configured to pass test data through the intermediate server and analyze the test data, for example. The mobile wireless communications device may also be

configured to generate scoring data based upon the analyzed test data to determine the selected wireless communications network. The analyzed test data may relate to at least one of a round trip ping time, a packet burst rate, and a signalquality, for example.

In another embodiment, the intermediate server may be configured to pass test data through the mobile wireless device and analyze the test data. The intermediate server may also be configured to generate scoring data based upon the analyzed test data and send the scoring data back to the mobile wireless device to determine the selected wireless communications network.

The mobile wireless communications device may be further configured to determine the selected wireless communications network based upon at least one of geographic location, a time of day, and a defined wireless communications network priority, for example. The mobile wireless communications device may include a controller and a plurality of different wireless network interfaces coupled thereto. The mobile wireless communications device and the application server may communicate via the intermediate server as a virtual private network (VPN), for example.

A method aspect is directed to communicating between a mobile wireless communications device and an application server. The method includes communicating, using the mobile wireless communications device, with an intermediate server over each of a plurality of different wireless communications networks to determine a selected wireless communications network. The method also includes communicating, using the mobile wireless communications device, with the application server via the intermediate server over the selected wireless communications network.

Brief Description of the Drawings

FIG. 1 is a schematic view of a wireless communications system in accordance with the present invention.

FIG. 2 is a more detailed schematic block diagram of the wireless communications system of FIG. 1.

FIG. 3 is a flowchart of a method of communicating using the wireless communications device of FIG 2.

FIG. 4 is a detailed schematic block diagram of the wireless communications system in accordance with another embodiment of the present invention.

FIG. 5 is a flowchart of a method of communicating using the intermediate server and the mobile wireless communications device of FIG. 4.

FIG. 6 is a detailed schematic block diagram of the wireless communications system in accordance with yet another embodiment of the present invention.

FIG. 7 is a flowchart of a method of communicating using the intermediate server and the mobile wireless communications device of FIG. 6.

Detailed Description

The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout, and prime and multiple prime notation is used to indicate similar elements in alternative embodiments.

Referring initially to FIGS. 1 and 2, and beginning at Block **82** of the flowchart **80** in FIG. 3, a wireless communications system **20** and a corresponding method of communicating are described. The wireless communications system **20** includes different wireless communications networks **21a-21d**. The different wireless communications networks **21a-21d** may include one or more of a cellular network and a Wi-Fi network, for example. The different wireless communications networks may also include both public and private communications networks. Of course, while four wireless communications networks are illustrated, the wireless communications system **20** may include any number of wireless communications networks.

The wireless communications system also includes an application server **30** and an intermediate server **40** configured to communicate with the application server. The application server **30** communicates with the intermediate server **40** over a network **22**, for example, the Internet.

The application server **30** includes a processor **31** and memory **32** coupled thereto. One or more applications may be stored in the memory **32**, for example, a web application. Of course, other types of applications can be run on the application server **30**.

The intermediate server **40** is coupled to each of the different wireless networks **21a-21d**. The intermediate server 40 also includes a processor **41** and a memory **42** coupled thereto. In other words, the intermediate server **40** functions as a gateway to the application server **30**, and may perform additional functions, as will be described in further detail below.

The wireless communications system **20** also includes a mobile wireless communications device **60**. The mobile wireless communications device **60** illustratively includes a housing **61**, a display **62**, and an input device **63**, for example, input keys, each carried by the housing. The mobile wireless communications device **60** also includes a controller **64**, and different wireless network interfaces **66a-66d** coupled to the controller. The different wireless network interfaces **66a-66d** may define wireless transceiver circuitry, for example, and may cooperate with the controller **64** to communicate data, for example, for an application, via a respective wireless network **21.** Of course, a given wireless network interface **66a-66d** may correspond to more than one wireless network. For example, each network interface **66a-66d** may be able to access different networks which are in the same technology category, but provided by different service providers. A memory **67** is also coupled to the controller **64**.

More particularly, the mobile wireless communications device **60**, via the controller **64**, establishes communication with the intermediate server **50** over an initial one **21b** of the different wireless networks **21a-21d** to the application server **30** (Block **84**). The connection **23** between the mobile wireless communications device **60** and the application server **30** may be considered a virtual connection or communicate as a virtual private network (VPN), for example, a mobile VPN.

The mobile wireless communications device **60** may select the initial wireless network **21b** based upon any of a time of day, a geographic location, and a defined wireless communications network priority. The communications network priority may be based upon the type of communications network, for example. By way of example, one or more of the wireless networks **21a**, **21c-21d** may be known to have decreased performance during peak usage hours,

and thus, the mobile wireless communications device **60** may select the initial wireless network **21b**.

The mobile wireless communications device **60**, for example, after the initial wireless communications network has been selected, communicates with each of the different wireless communications networks **21a-21d** (Block **86**). More particularly, in this embodiment, the mobile wireless communications device **60** passes test data through the intermediate server **40** over each of the different wireless communications networks **21a-21d**. For example, the mobile wireless communications device **60** may ping the intermediate server **40**. The test data is passed from the intermediate server **40** back to the mobile wireless communications device **60**. The mobile wireless communications device **60** analyzes the received test data (Block **88**). For example, the received test data may be analyzed to determine a quality of each of the different wireless communications networks. The analyzed test data may relate to one or more a round trip ping time (i.e., delay), a packet burst rate, and a signal quality. Signal quality may include, for example, signal strength, jitter, and bit error rate. Of course, the analyzed test data may relate to other or additional measurement metrics.

In some embodiments, the mobile wireless communications device **60** may not communicate with all of the different wireless networks, but instead, a subset of them. For example, if a given wireless communications network is known to have decreased performance in a geographical area of the mobile wireless communications device **60**, the mobile device will not attempt to communicate with that wireless network. This reduces network traffic and also reduces power consumption of the mobile wireless communications device **60**.

The mobile wireless communications device **60** generates scoring data based upon the analyzed test data (Block **90**). More particularly, the mobile wireless communications device **60** generates a network score for each of the different wireless communications networks **21a-21d**, including the wireless communications network currently being used to communicate with the application server **30**.

The mobile wireless communications device **60** may generate the scoring data also based upon scoring factors, for example, a time of day, a geographical location of the mobile wireless communications device **60**, a proximity to a known wireless communications dead spot, user

preferences (i.e., Wi-Fi over cellular), and/or other historical data. Of course, other factors may be used to generate the scoring data or network score, for example, user preferences or rules.

Additionally, the mobile wireless communications device **60** may weight the generated scoring data (Block **92**). More particularly, the mobile wireless communications device **60** may associate a weight with each of the above-noted scoring factors. For example, each type of wireless network connection (Wi-Fi, cellular) may have a weight for each of the scoring factors. By way of example, round trip time may be a relatively poor indicator of long term evolution (LTE) degradation, and thus may be given a lower weight. The mobile wireless communications device **60** ranks the different wireless networks based upon the weighted scoring data to determine a selected wireless communications network (Block **94**).

The mobile wireless communications device **60** determines a selected wireless communications network based upon the ranking. More particularly, the mobile wireless communications device **60** may switch from the initial wireless communications network **21b** to the selected wireless communication network to communicate with the application server **40**. For example, the wireless communications device **60** may switch to the first ranked, i.e., highest score, wireless communications network if it is not the initial wireless communications network **21b**. Switching to another wireless communications network (Block **98**) may occur if the corresponding wireless communications network score, i.e., scoring data, falls below a predetermined threshold, for example (Block **96**). If the network score is not below the threshold, then scores may be recalculated by again passing test data to the intermediate server **40** (Block **86**).

The mobile wireless communications device **60** may pass test data to the intermediate server **40** at regular intervals over each of the different wireless communications networks **21a-21d**, for example, every minute. Of course, other intervals or periods may be used, or the passing of the test data may be random. Alternatively, or additionally, the passing of the test data may be based upon other criteria, for example, geographic location, time of day, or other criteria. Advantageously, by continually passing the test data to the intermediate server **40**, the mobile wireless communications device **60** may determine, and switch to, a most suitable wireless communications network for communicating with the application server **30** via the intermediate server **40** based upon changing network conditions, for example. Moreover, while

the initial wireless communications network **21b** has been selected as described above, it will be appreciated that the passing and analysis of test data and the generation of scoring data may also be applicable for selecting the initial wireless communications network.

In some embodiments, the controller **64** of the mobile wireless communications device **60** may inform the user of the change to the selected mobile wireless communications network, for example, via the display **62**. Of course, the user may be notified by another output device, or may not be notified at all.

Referring now to FIG. 4 and beginning at Block **82'** in the flowchart **80'** of FIG. 5, in another embodiment, the mobile wireless communications device **60'** does not pass test data through the intermediate server **40'**. Instead, it is the intermediate server **40'** that passes test data through the mobile wireless communications device **60'** (Block **85'**) in a similar fashion to that in the above-described embodiment. More particularly, the intermediate server **40'** analyzes the test data (Block **87'**) and generates scoring data (Block **89'**) much in the same way as the mobile wireless communications device **60** described above. However, the intermediate server **40'** sends the scoring data back to the mobile wireless communications device **60'** (Block **91'**) which weights the scoring data (Block **92'**) and ranks the different wireless communications networks **21a'-21d'** (Block **94'**). The scoring data may be weighted by the intermediate server **40'**. If the weighted network score is below the threshold, the mobile wireless communications device **60'** (Block **96'**), switches to the wireless communications network (Block **98'**) having the highest rank, i.e., based upon the scoring data, or ranking, for communicating with the application server **40'**. Test data is sent again to obtain an updated status of the wireless communications networks **21a'-21d'**.

Referring now to FIG. 6 and beginning at Block **82''** in the flowchart **80''** of FIG. 7, in yet another embodiment, the mobile wireless communications device **60''** and the intermediate server **40''** cooperate for selecting the wireless communications network **21''**. In other words, the functionality of the mobile wireless communications device **60** described above with reference to FIGS. 1-3 and the functionality of the intermediate server **40'** described above with respect to FIGS. 4 and 5 are combined.

More particularly, the mobile wireless communications device **60''** passes first test data to the intermediate server **40''** (Block **86''**), analyzes the first test data (Block **88''**) returned

from the intermediate server, and generates first scoring data based upon the analyzed first test data (Block **90''**). The intermediate server **40''** passes second test data to the mobile wireless communications device **60''** (Block **85''**), analyzes the second test data returned from the mobile wireless communications device **60''** (Block **87''**), and generates second scoring data based upon the analyzed second test data (Block **89''**). The intermediate server **40''** sends the second scoring data back to the mobile wireless communications device **60''** (Block **91''**). The mobile wireless communications device **60''** determines the selected wireless communications network **21''** based upon the first and second scoring data. For example, the mobile wireless communications device **60''** may average the first and second scoring data to select the wireless communications network **21''**. The mobile wireless communications device **60**'' may weight the combined scoring data, or independently weight the scoring data (Block **92''**). Alternatively or additionally, the mobile wireless communications device **60''** may perform other operations thereon, for example, execute a selection algorithm, to select the wireless communications network. If the score for the current wireless communication network **21b''** is below the threshold (Block **96''**), the mobile wireless communications device **60''** switches to the network having the highest score or rank (Block **98''**). Of course, the process or sending test data (Blocks **85''** and **86''**) is repeated both after a wireless communications network switch is made and if the score for the current wireless network **21b''** is above the threshold.

A method aspect is directed to communicating between a mobile wireless communications device **60** and an application server **30**. The method includes using the mobile wireless communications device **60** to communicate with an intermediate server **40** over each of a plurality of different wireless communications networks **21a-21d** to determine a selected wireless communications network. The method also includes using the mobile wireless communications device **60** to communicate with the application server **30** via the intermediate server **40** over the selected wireless communications network.

Many modifications and other embodiments of the invention will come to the mind of one skilled in the art having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is understood that the invention is not to be limited to the specific embodiments disclosed, and that modifications and embodiments are intended to be included within the scope of the appended claims.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A wireless communications system comprising: a plurality of different wireless communications networks; an application server; an intermediate server configured to communicate with said application server; and a mobile wireless communications device configured to pass first test data through said intermediate server over each of said plurality of different wireless communications networks, analyze the first test data, and generate first scoring data based upon the analyzed first test data; said intermediate server configured to pass second test data through said mobile wireless device, analyze the second test data, generate second scoring data based upon the analyzed second test data, and send the second scoring data back to said mobile wireless device; said mobile wireless communications device further configured to determine a selected wireless communications network based upon the first and second scoring date, and communicate with said application server via said intermediate server over the selected wireless communications network.

2. The wireless communications system of claim 1, wherein the analyzed first test data relates to at least one of a round trip ping time, a packet burst rate, and a signal quality.

3. The wireless communications system of claim 1, wherein the analyzed first and second test data relates to at least one of a round trip ping time, a packet burst rate, and a signal quality.

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4. The wireless communications system of claim 1, wherein said mobile wireless communications device is further configured to determine the selected wireless communications network also based upon at least one of geographic location, a time of day, and a defined wireless communications network priority.

5. The wireless communication system of claim 1, wherein said mobile wireless communications device comprises a controller and a plurality of different wireless network interfaces coupled thereto.

6. The wireless communication system of claim 1, wherein said mobile wireless communications device and said application server communicate via said intermediate server as a virtual private network (VPN).

7. A mobile wireless communications device for communicating with an intermediate server over a plurality of different wireless communications networks, the intermediate server being configured to communicate with an application server, the mobile wireless communications device comprising: a housing; a plurality of different wireless network interfaces carried by said housing; a controller coupled to said plurality of different wireless network interfaces and configured to pass first test data through the intermediate server over each of the plurality of different wireless communications networks, analyze the first test data, generate first scoring data based upon the analyzed first test data, determine a selected wireless communications network based upon the first scoring data and second scoring data received from the intermediate server, the second scoring data being generated by the intermediate server based upon analyzed second test data passed through the mobile wireless communications device, and communicate with the application

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server via the intermediate server over the selected wireless communications network.

8. The mobile wireless communications device of claim 7, wherein the analyzed first test data relates to at least one of a round trip ping time, a packet burst rate, and a signal quality.

9. The mobile wireless communications device of claim 7, wherein said controller is further configured to determine the selected wireless communications network also based upon at least one of geographic location, a time of day, and a defined wireless communications network priority.

10. A method of communicating between a mobile wireless communications device and an application server, the method comprising: communicating using the mobile wireless communications device first test data through an intermediate server over each of a plurality of different wireless communications networks; analyzing using the mobile wireless communications device the first test data; generating first scoring data using the mobile wireless communications device based upon the analyzed first test data; determine using the mobile wireless communications device a selected wireless communications network based upon the first scoring data and second scoring data received from the intermediate server, the second scoring data being generated by the intermediate server based upon analyzed second test data passed through the mobile wireless communications device; and communicating using the mobile wireless communications device with the application server via the intermediate server over the selected wireless communications network.

11. The method of claim 10, wherein analyzing the first test data comprises analyzing first test data relating to at least one of a round trip ping time, a packet burst rate, and a signal quality.

12. The method of claim 10, wherein communicating with the intermediate server over each of the plurality of different wireless communications networks comprises communicating with the intermediate server over each of the plurality of different wireless communications networks to determine the selected wireless communications network also based upon at least one of geographic location, a time of day, and a defined wireless communications network priority.

13. A wireless communications system comprising: a plurality of different wireless communications networks; an application server; an intermediate server configured to communicate with said application server; and a mobile wireless communications device configured to communicate with said intermediate server over each of said plurality of different wireless communications networks to determine a selected wireless communications network, and communicate with said application server via said intermediate server over the selected wireless communications network; said intermediate server further configured to pass test data through said mobile wireless communications device, analyze the test data, generate scoring data based upon the analyzed test data, and send the scoring data back to said mobile wireless communications device to determine the selected wireless network.

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14. The wireless communications system of claim 13, wherein the analyzed test data relates to at least one of a round trip ping time, a packet burst rate, and a signal quality.

15. The wireless communications system of claim 13, wherein said mobile wireless communications device is further configured to determine the selected wireless communications network based upon at least one of geographic location, a time of day, and a defined wireless communications network priority.

16. The wireless communication system of claim 13, wherein said mobile wireless communications device comprises a controller and a plurality of different wireless network interfaces coupled thereto.

17. The wireless communication system of claim 13, wherein said mobile wireless communications device and said application server communicate via said intermediate server as a virtual private network (VPN).

18. A mobile wireless communications device for communicating with an intermediate server over a plurality of different wireless communications networks, the intermediate server being configured to communicate with an application server, the mobile wireless communications device comprising: a housing; a plurality of different wireless network interfaces carried by said housing; a controller coupled to said plurality of different wireless network interfaces and configured to pass test data through the intermediate server over each of the plurality of different wireless communications networks, pass test data received from the intermediate server back to the intermediate server for analysis and generation of scoring data based upon the analyzed test data,

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receive the scoring data back from the intermediate server mobile wireless device to determine a selected wireless communications network, and communicate with the application server via the intermediate server over the selected wireless communications network.

19. The mobile wireless communications device of claim 18, wherein the analyzed test data relates to at least one of a round trip ping time, a packet burst rate, and a signal quality.

20. The mobile wireless communications device of claim 18, wherein said controller is further configured to determine the selected wireless communications network based upon at least one of geographic location, a time of day, and a defined wireless communications network priority. .

Dated this 22nd day of May 2015

Harris Corporation
Patent Attorneys for the Applicant
PETER MAXWELL AND ASSOCIATES

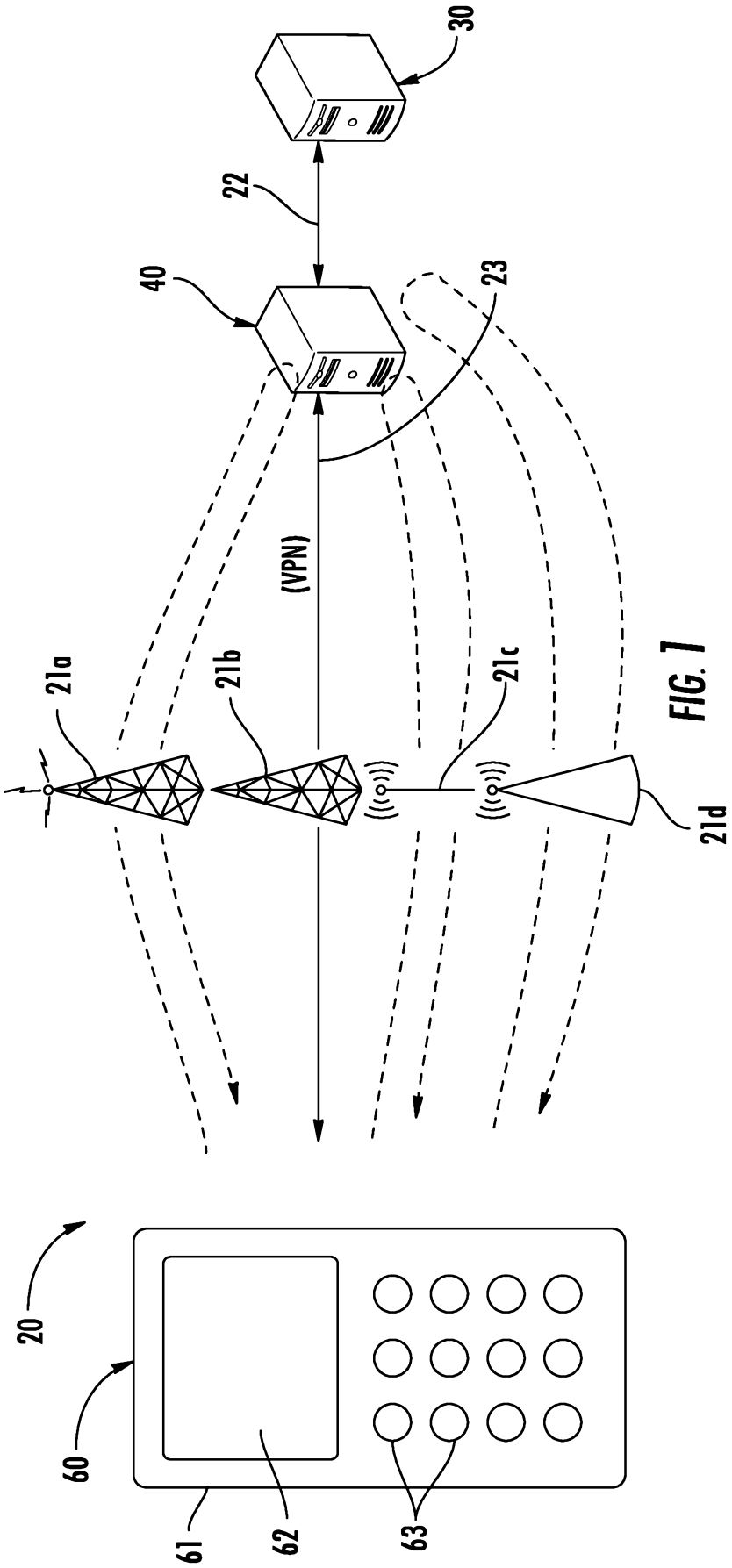

FIG. 1

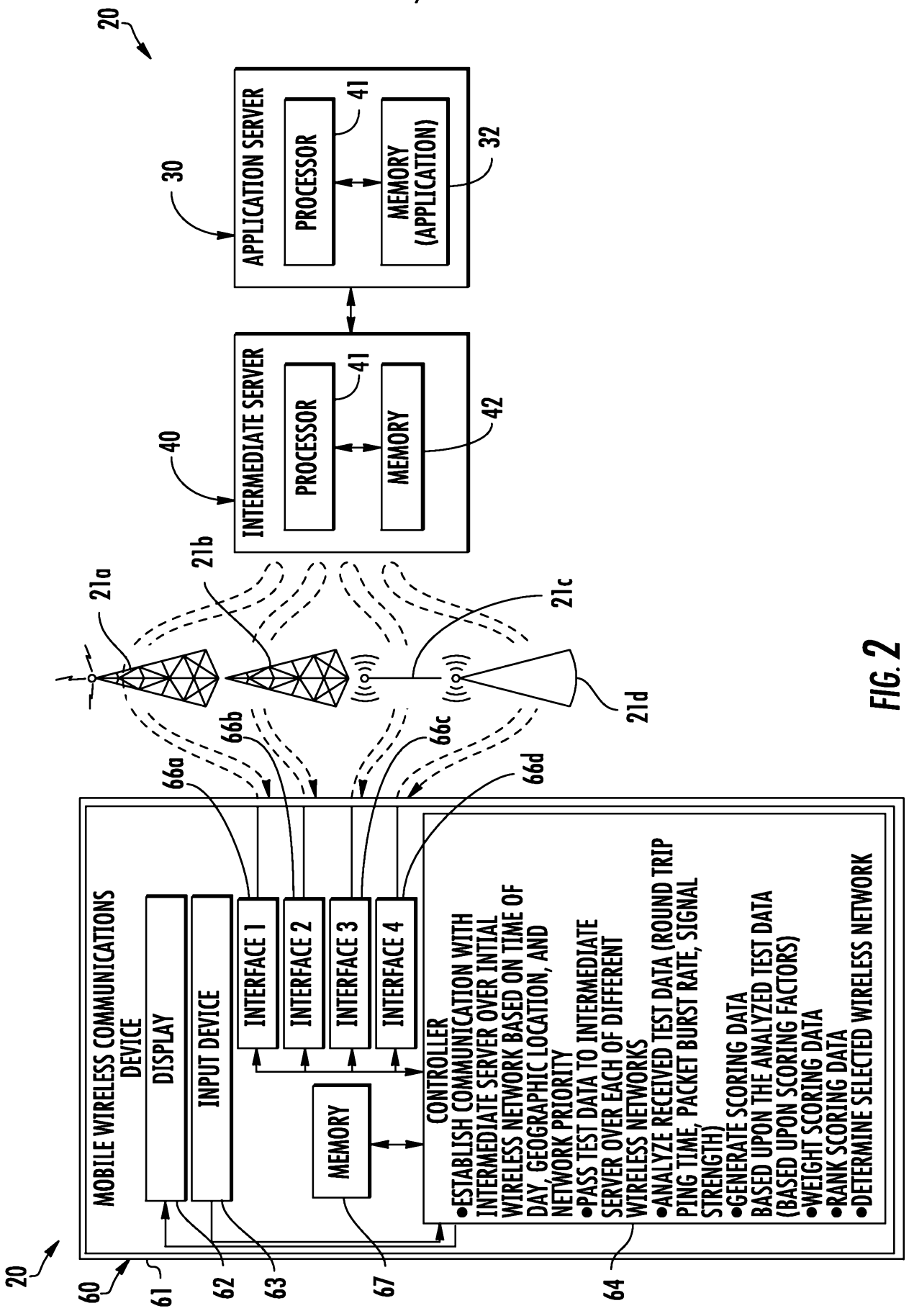
20
APPLICATION SERVER
30
PROCESSOR
41
MEMORY (APPLICATION)
32
INTERMEDIATE SERVER
40
PROCESSOR
41
MEMORY
42
21a
21b
21c
21d
66a
66b
66c
66d
MOBILE WIRELESS COMMUNICATIONS DEVICE
DISPLAY
INPUT DEVICE
INTERFACE 1
INTERFACE 2
INTERFACE 3
INTERFACE 4
MEMORY
CONTROLLER
•ESTABLISH COMMUNICATION WITH INTERMEDIATE SERVER OVER INTIAL WIRELESS NETWORK BASED ON TIME OF DAY, GEOGRAPHIC LOCATION, AND NETWORK PRIORITY
•PASS TEST DATA TO INTERMEDIATE SERVER OVER EACH OF DIFFERENT WIRELESS NETWORKS
•ANALYZE RECEIVED TEST DATA (ROUND TRIP PING TIME, PACKET BURST RATE, SIGNAL STRENGTH)
•GENERATE SCORING DATA BASED UPON THE ANALYZED TEST DATA (BASED UPON SCORING FACTORS)
•WEIGHT SCORING DATA
•RANK SCORING DATA
•DETERMINE SELECTED WIRELESS NETWORK
20
60
61
62
63
67
64

FIG. 2

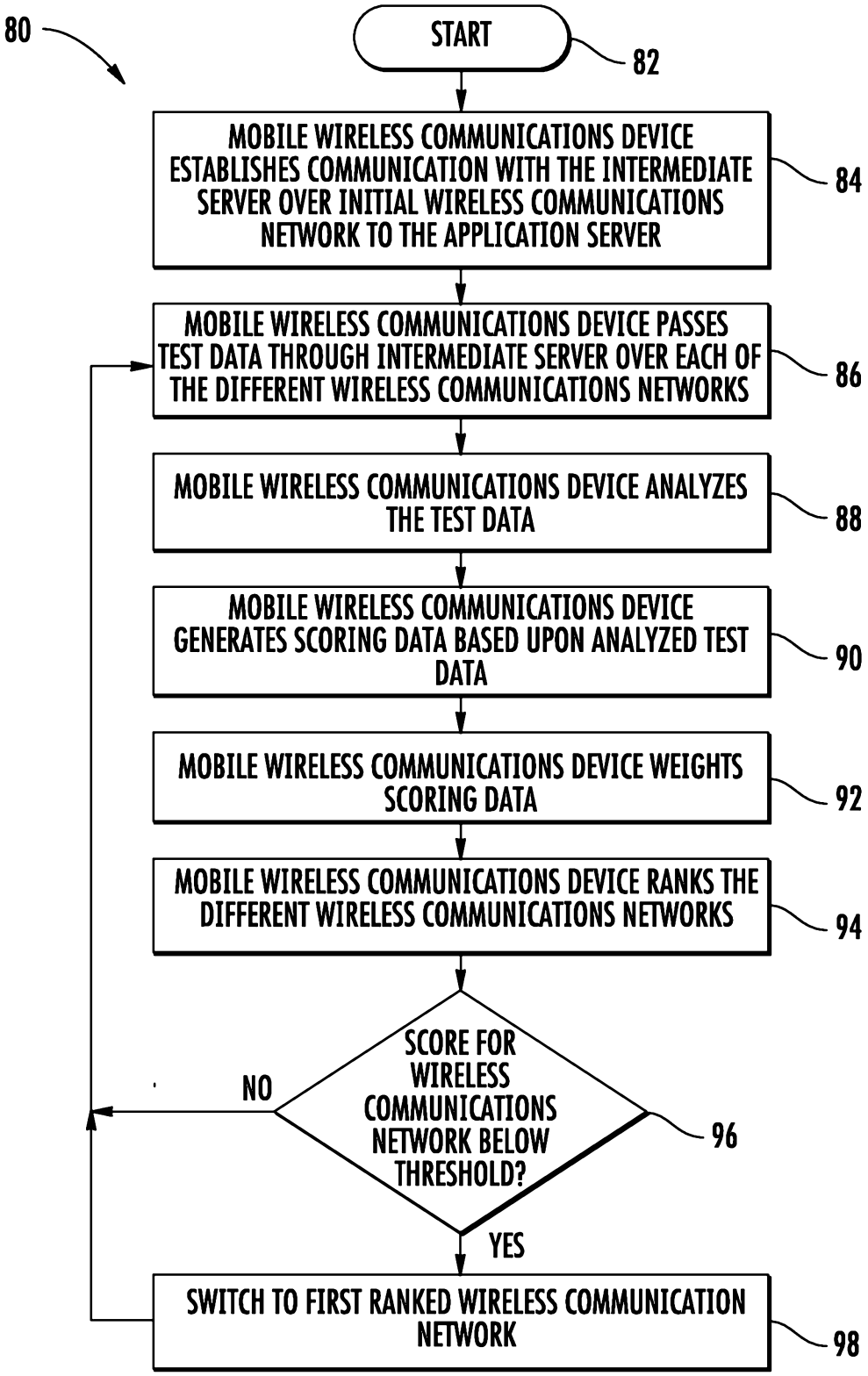
80
START
82
MOBILE WIRELESS COMMUNICATIONS DEVICE ESTABLISHES COMMUNICATION WITH THE INTERMEDIATE SERVER OVER INITIAL WIRELESS COMMUNICATIONS NETWORK TO THE APPLICATION SERVER
84
MOBILE WIRELESS COMMUNICATIONS DEVICE PASSES TEST DATA THROUGH INTERMEDIATE SERVER OVER EACH OF THE DIFFERENT WIRELESS COMMUNICATIONS NETWORKS
86
MOBILE WIRELESS COMMUNICATIONS DEVICE ANALYZES THE TEST DATA
88
MOBILE WIRELESS COMMUNICATIONS DEVICE GENERATES SCORING DATA BASED UPON ANALYZED TEST DATA
90
MOBILE WIRELESS COMMUNICATIONS DEVICE WEIGHTS SCORING DATA
92
MOBILE WIRELESS COMMUNICATIONS DEVICE RANKS THE DIFFERENT WIRELESS COMMUNICATIONS NETWORKS
94
SCORE FOR WIRELESS COMMUNICATIONS NETWORK BELOW THRESHOLD?
96
NO
YES
SWITCH TO FIRST RANKED WIRELESS COMMUNICATION NETWORK
98

FIG. 3

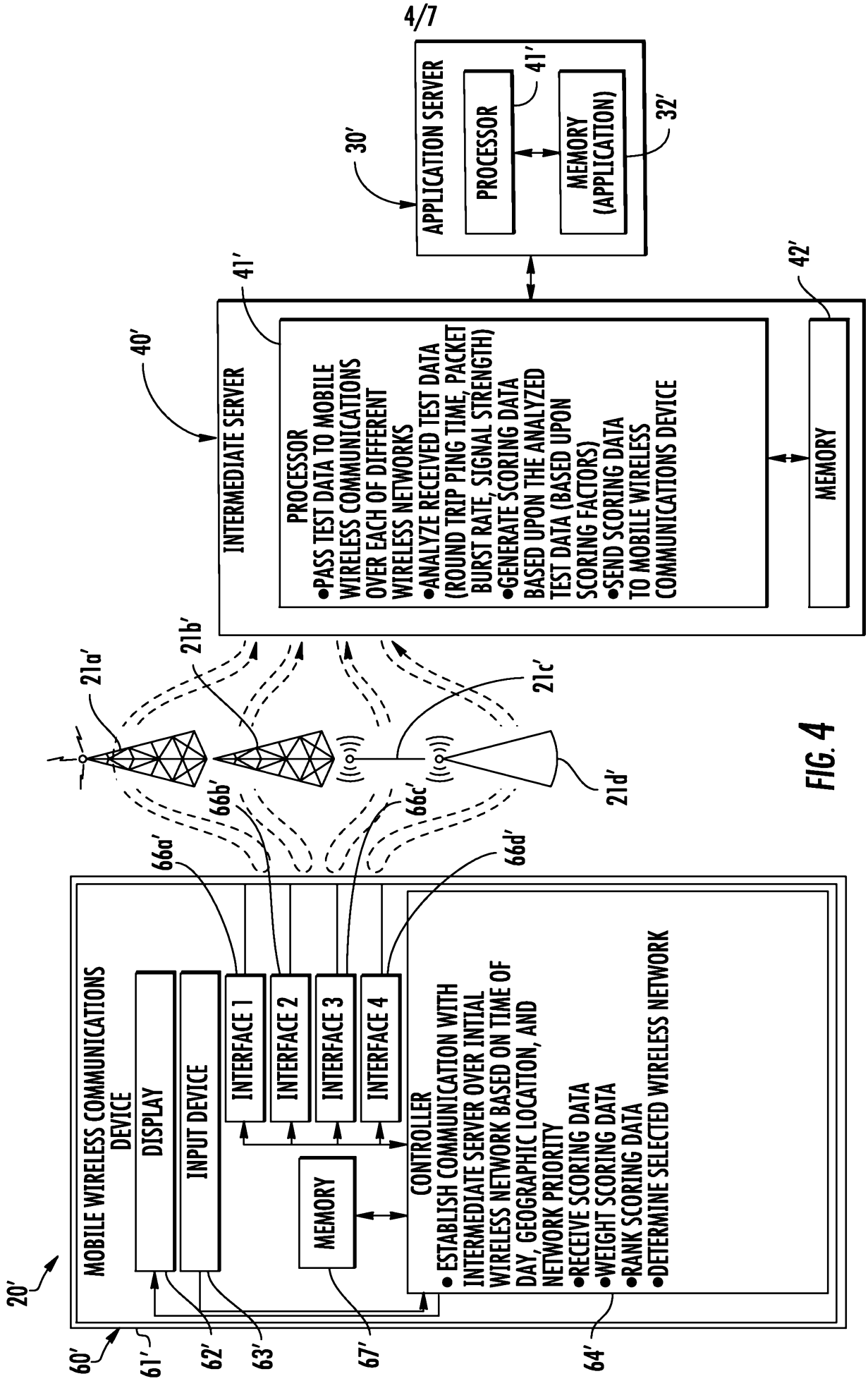
APPLICATION SERVER
PROCESSOR
MEMORY (APPLICATION)
30'
41'
32'
42'
INTERMEDIATE SERVER
40'
PROCESSOR
•PASS TEST DATA TO MOBILE WIRELESS COMMUNICATIONS OVER EACH OF DIFFERENT WIRELESS NETWORKS
•ANALYZE RECEIVED TEST DATA (ROUND TRIP PING TIME, PACKET BURST RATE, SIGNAL STRENGTH)
•GENERATE SCORING DATA BASED UPON THE ANALYZED TEST DATA (BASED UPON SCORING FACTORS)
•SEND SCORING DATA TO MOBILE WIRELESS COMMUNICATIONS DEVICE
MEMORY
21a'
21b'
21c'
21d'
66a'
66b'
66c'
66d'
MOBILE WIRELESS COMMUNICATIONS DEVICE
DISPLAY
INPUT DEVICE
INTERFACE 1
INTERFACE 2
INTERFACE 3
INTERFACE 4
MEMORY
CONTROLLER
• ESTABLISH COMMUNICATION WITH INTERMEDIATE SERVER OVER INTIAL WIRELESS NETWORK BASED ON TIME OF DAY, GEOGRAPHIC LOCATION, AND NETWORK PRIORITY
•RECEIVE SCORING DATA
•WEIGHT SCORING DATA
•RANK SCORING DATA
•DETERMINE SELECTED WIRELESS NETWORK
20'
60'
61'
62'
63'
67'
64'

FIG. 4

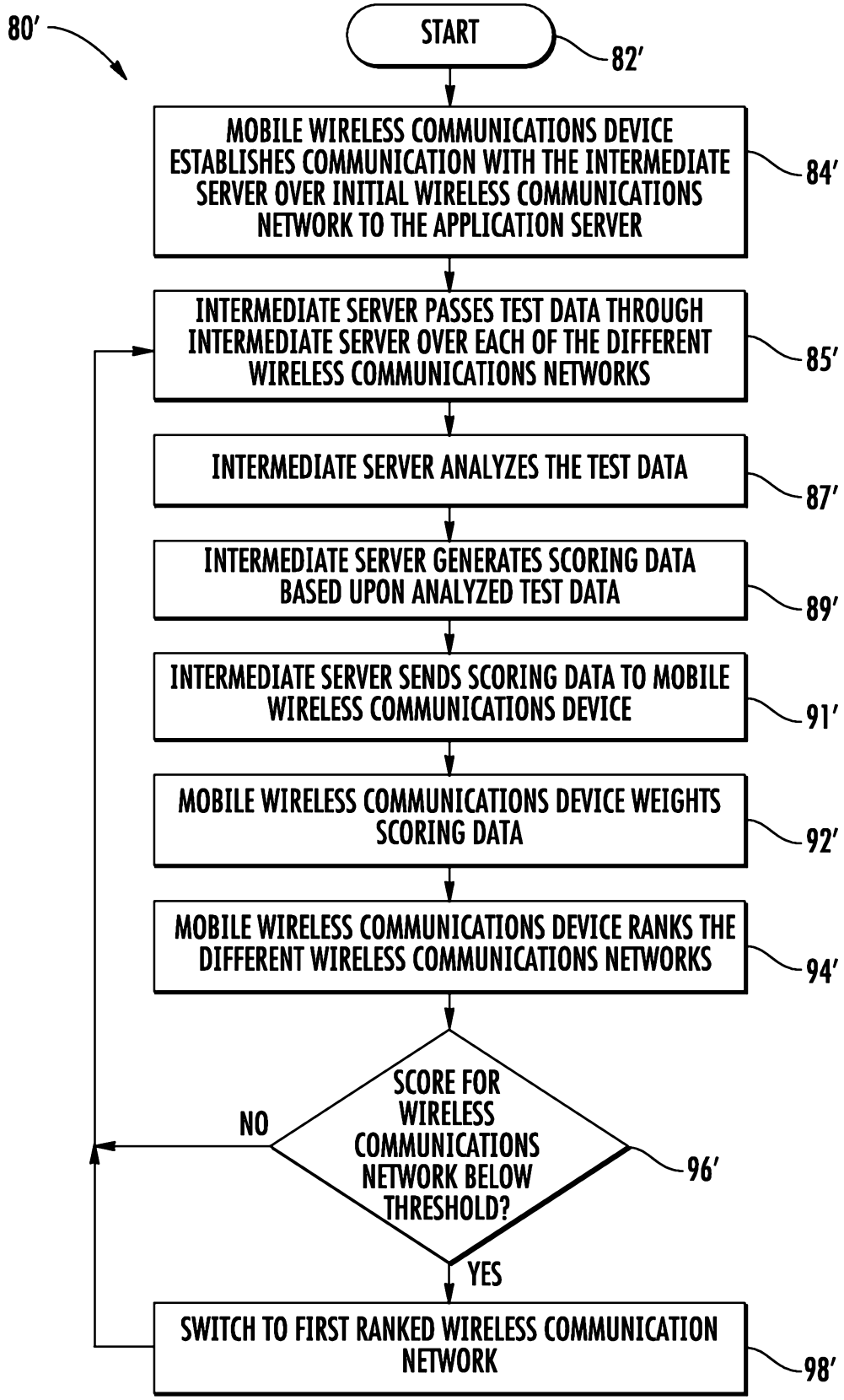
80′
START
82′
MOBILE WIRELESS COMMUNICATIONS DEVICE ESTABLISHES COMMUNICATION WITH THE INTERMEDIATE SERVER OVER INITIAL WIRELESS COMMUNICATIONS NETWORK TO THE APPLICATION SERVER
84′
INTERMEDIATE SERVER PASSES TEST DATA THROUGH INTERMEDIATE SERVER OVER EACH OF THE DIFFERENT WIRELESS COMMUNICATIONS NETWORKS
85′
INTERMEDIATE SERVER ANALYZES THE TEST DATA
87′
INTERMEDIATE SERVER GENERATES SCORING DATA BASED UPON ANALYZED TEST DATA
89′
INTERMEDIATE SERVER SENDS SCORING DATA TO MOBILE WIRELESS COMMUNICATIONS DEVICE
91′
MOBILE WIRELESS COMMUNICATIONS DEVICE WEIGHTS SCORING DATA
92′
MOBILE WIRELESS COMMUNICATIONS DEVICE RANKS THE DIFFERENT WIRELESS COMMUNICATIONS NETWORKS
94′
SCORE FOR WIRELESS COMMUNICATIONS NETWORK BELOW THRESHOLD?
96′
NO
YES
SWITCH TO FIRST RANKED WIRELESS COMMUNICATION NETWORK
98′

FIG. 5

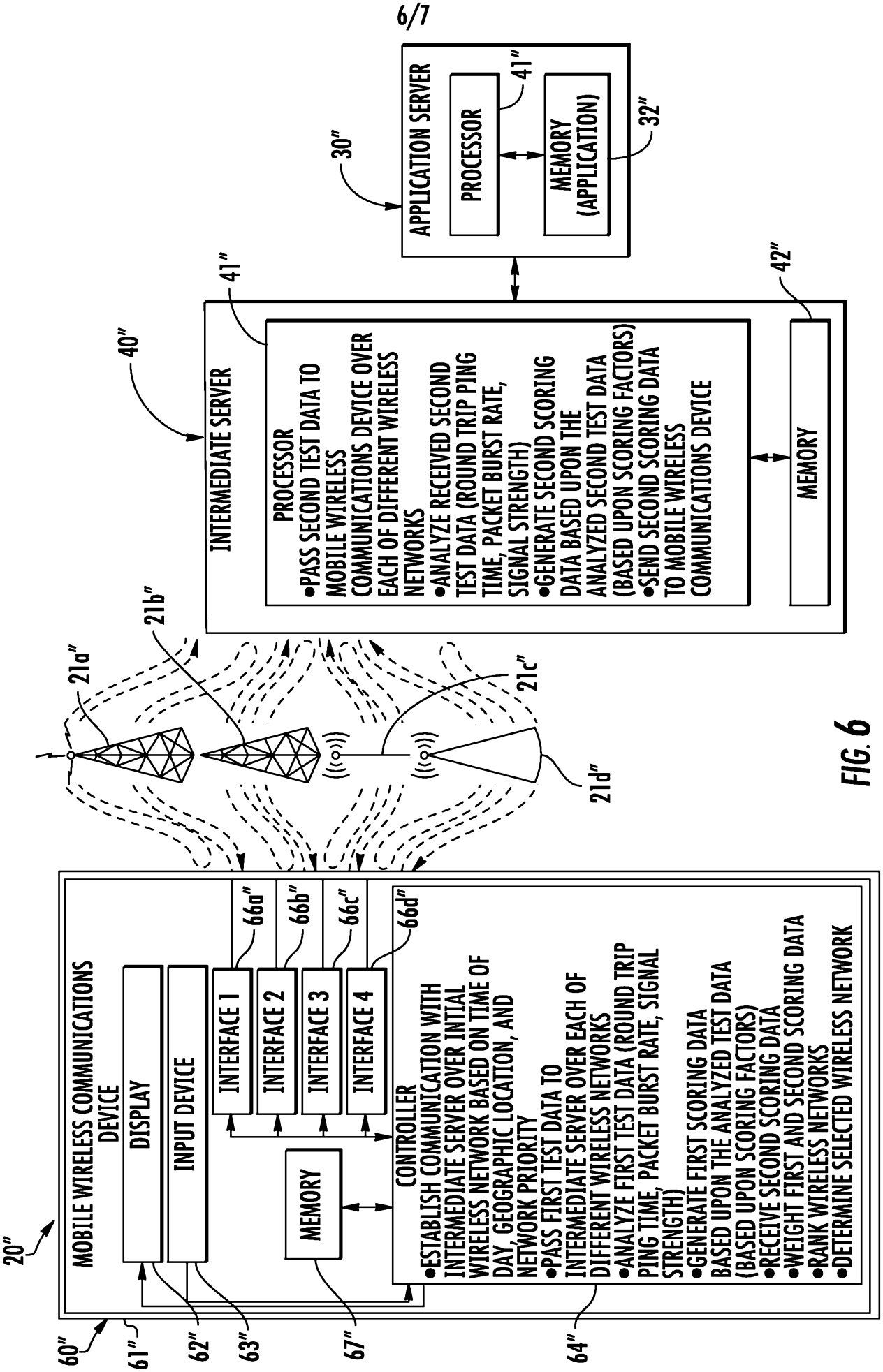
APPLICATION SERVER
PROCESSOR
MEMORY (APPLICATION)
30"
41"
32"
INTERMEDIATE SERVER
PROCESSOR
•PASS SECOND TEST DATA TO MOBILE WIRELESS COMMUNICATIONS DEVICE OVER EACH OF DIFFERENT WIRELESS NETWORKS
•ANALYZE RECEIVED SECOND TEST DATA (ROUND TRIP PING TIME, PACKET BURST RATE, SIGNAL STRENGTH)
•GENERATE SECOND SCORING DATA BASED UPON THE ANALYZED SECOND TEST DATA (BASED UPON SCORING FACTORS)
•SEND SECOND SCORING DATA TO MOBILE WIRELESS COMMUNICATIONS DEVICE
MEMORY
40"
41"
42"
21a"
21b"
21c"
21d"
MOBILE WIRELESS COMMUNICATIONS DEVICE
DISPLAY
INPUT DEVICE
INTERFACE 1
INTERFACE 2
INTERFACE 3
INTERFACE 4
66a"
66b"
66c"
66d"
MEMORY
CONTROLLER
•ESTABLISH COMMUNICATION WITH INTERMEDIATE SERVER OVER INTIAL WIRELESS NETWORK BASED ON TIME OF DAY, GEOGRAPHIC LOCATION, AND NETWORK PRIORITY
•PASS FIRST TEST DATA TO INTERMEDIATE SERVER OVER EACH OF DIFFERENT WIRELESS NETWORKS
•ANALYZE FIRST TEST DATA (ROUND TRIP PING TIME, PACKET BURST RATE, SIGNAL STRENGTH)
•GENERATE FIRST SCORING DATA BASED UPON THE ANALYZED TEST DATA (BASED UPON SCORING FACTORS)
•RECEIVE SECOND SCORING DATA
•WEIGHT FIRST AND SECOND SCORING DATA
•RANK WIRELESS NETWORKS
•DETERMINE SELECTED WIRELESS NETWORK
20"
60"
61"
62"
63"
67"
64"

FIG. 6

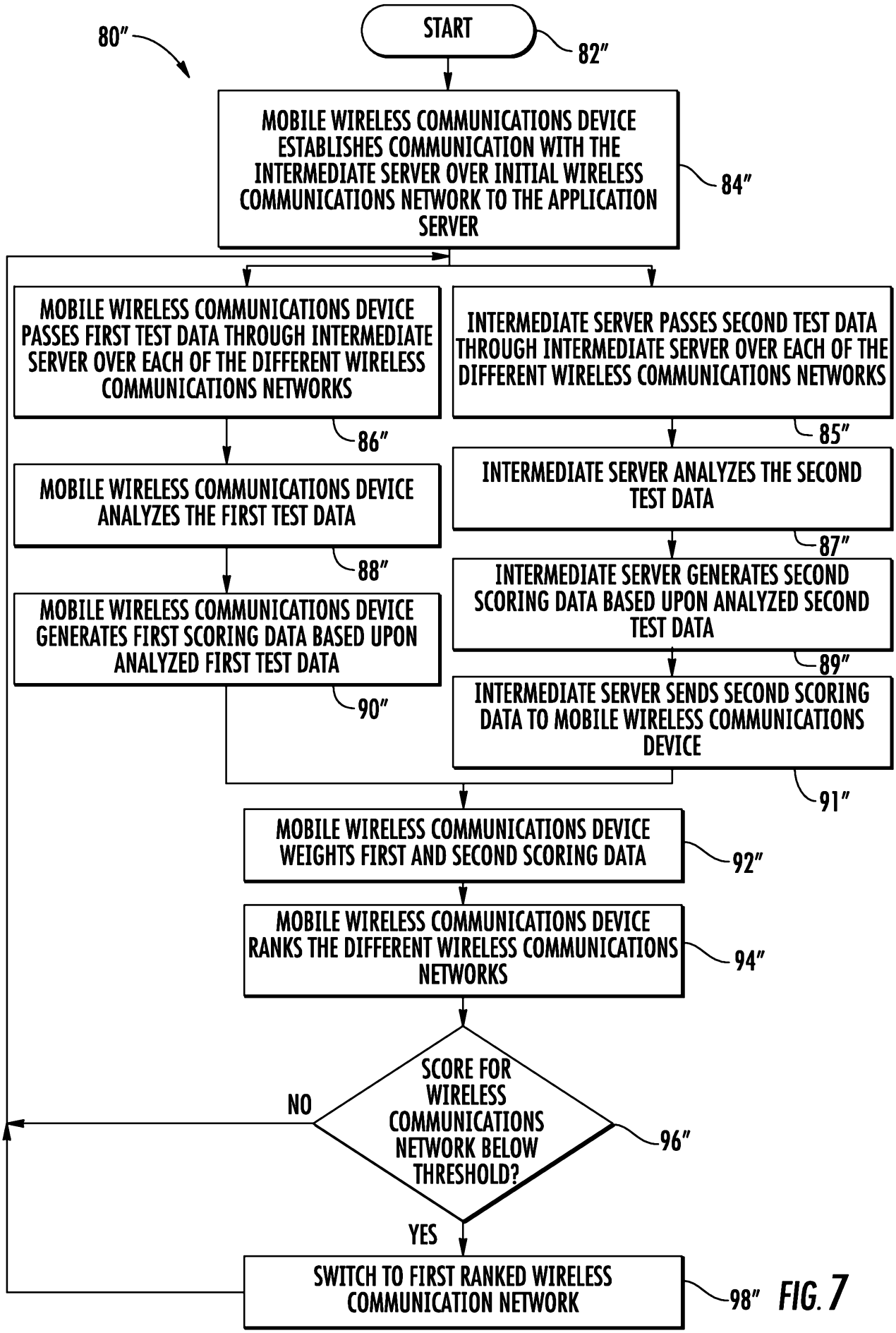
80″
START
82″
MOBILE WIRELESS COMMUNICATIONS DEVICE ESTABLISHES COMMUNICATION WITH THE INTERMEDIATE SERVER OVER INITIAL WIRELESS COMMUNICATIONS NETWORK TO THE APPLICATION SERVER
84″
MOBILE WIRELESS COMMUNICATIONS DEVICE PASSES FIRST TEST DATA THROUGH INTERMEDIATE SERVER OVER EACH OF THE DIFFERENT WIRELESS COMMUNICATIONS NETWORKS
86″
MOBILE WIRELESS COMMUNICATIONS DEVICE ANALYZES THE FIRST TEST DATA
88″
MOBILE WIRELESS COMMUNICATIONS DEVICE GENERATES FIRST SCORING DATA BASED UPON ANALYZED FIRST TEST DATA
90″
INTERMEDIATE SERVER PASSES SECOND TEST DATA THROUGH INTERMEDIATE SERVER OVER EACH OF THE DIFFERENT WIRELESS COMMUNICATIONS NETWORKS
85″
INTERMEDIATE SERVER ANALYZES THE SECOND TEST DATA
87″
INTERMEDIATE SERVER GENERATES SECOND SCORING DATA BASED UPON ANALYZED SECOND TEST DATA
89″
INTERMEDIATE SERVER SENDS SECOND SCORING DATA TO MOBILE WIRELESS COMMUNICATIONS DEVICE
91″
MOBILE WIRELESS COMMUNICATIONS DEVICE WEIGHTS FIRST AND SECOND SCORING DATA
92″
MOBILE WIRELESS COMMUNICATIONS DEVICE RANKS THE DIFFERENT WIRELESS COMMUNICATIONS NETWORKS
94″
SCORE FOR WIRELESS COMMUNICATIONS NETWORK BELOW THRESHOLD?
96″
NO
YES
SWITCH TO FIRST RANKED WIRELESS COMMUNICATION NETWORK
98″

FIG. 7