Title
Method and device for limiting call origination accompanied by executing application

International Patent Classification(s)
H04M 001/677
H04Q 007/38
H04M 011/00
G06F 015/00

Application No: 2002228369
Date of Filing: 2002.01.30

WIPO No: WO02/062044

Priority Data

Number (32) Date (33) Country
2001-24737 2001.01.31 JP

Publication Date: 2002.08.12
Publication Journal Date: 2003.02.20
Accepted Journal Date: 2004.08.12
Amended Journal Date: 2005.03.10

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Related Art
JP 6-164714
JP 2001-36636
JP 2000-332818
When an application originates a call to a certain communication node, an application manager refers to history of outgoing/incoming call data and/or telephone directory data to determine whether the call origination processing should be granted. If the telephone number of the communication node for which call origination is to be performed is included in the history of outgoing/incoming calls and/or the telephone directory data, then the call origination processing may be granted because the number may be considered a number with which communication was made in the past or may be recognized as a valid number to communicate with.
METHOD AND APPARATUS FOR LIMITING CALL ORIGINATION ACCOMPANIED BY EXECUTING APPLICATION

Technical Field
The present invention relates to a method and an apparatus for limiting call originations resulting from executing an application at a communication terminal.

Background Art
Advancement of portable telephones is accelerating. A portable telephone is able to access a server on the Internet to download a variety of contents and applications. Such applications that are downloaded from a network and used include, for example, an application called "Java Applet" written in the Java (registered trademark) programming language.

Open networks, including the Internet, generally have poor security, and hence, Java Applets distributed through such an open network are not necessarily reliable.

Accordingly, it is necessary to exclude access to networks established by an illegal Java Applet. To meet this demand, an access limiting technique called the "sandbox model" has been proposed. The sandbox model allows communication terminals, which act as clients, only to access a server from which a Java Applet is downloaded.

However, network resources will potentially be further integrated or distributed in the future. In such situations, the existing access limiting technique mentioned above may be inadequate.

Summary of The Invention
Accordingly, it is an object of the present invention to propose a new mechanism for limiting network accesses when executing
applications on a communication terminal.

According to a first aspect of the present invention there is provided a wireless communication terminal including:

- multiple communication functionalities including a voice communication functionality and a network browsing functionality;

  a network communication control that activates the network browsing functionality to access an external application source to thereby receive an application therefrom, wherein the application includes at least one application unit executable on the wireless communication terminal;

  an application platform that provides an execution environment for the received application in which the application platform executes each of the at least one application unit in the received application at a time, wherein before executing an application unit in the received application, the application platform determines if execution of the application unit will ensue an activation of the voice communication functionality to initiate a call to a telephone number and, if so determined, will suspend execution of the application unit until the telephone number is verified; and

  a telephone number manager that verifies the telephone number and allows the application platform to proceed to execute the application unit if the telephone number is verified, whereas otherwise disallowing the application platform to execute the application unit.

According to a second aspect of the present invention there is provided a method for disallowing an unverified call at a wireless communication terminal, including the steps of:

a) accessing an application source to receive an application therefrom, wherein the application includes at least one application unit executable on the wireless communication terminal;

b) providing an execution environment for the received application in which each of the at least one application unit in the received application is executed at a time;

c) before executing an application unit in the received application, determining if execution of the application unit will ensue an outgoing call to a telephone number;
d) if so determined, suspending execution of the application unit and verifying the telephone number; and

e) proceeding to execute the application unit if the telephone number is verified, whereas otherwise disallowing the call.

According to a third aspect of the present invention there is provided a wireless communication terminal including:

- multiple communication functionalities including a voice communication functionality and a network browsing functionality;
- a plurality of telephone number databases to which different security levels are attributed;
- a network communication control that activates the network browsing functionality to access an external application source to thereby receive an application executable on the wireless communication terminal;
- an application platform that executes the received application, wherein the received application is programmed to initiate, while running on the communication terminal, a call to a telephone number; and
- a telephone number manager that verifies the telephone number by searching one or more databases selected from the plurality of telephone number databases based on attributes of the received application, and allows the call to proceed to the telephone number if the telephone number is verified, whereas otherwise disallowing the call.

According to preferred embodiments of the present invention, when a call origination of a predetermined communication node is accompanied
by executing an application, whether the call origination should be
granted or not is determined by checking whether the telephone number of
the communication node is one of the telephone numbers that have been
granted in advance. This permits improved security to be achieved.

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Brief Description of the Drawings

Fig. 1 is a block diagram showing an entire system configuration in
accordance with an embodiment of the present invention.

Fig. 2 is a block diagram showing a hardware configuration of a
portable telephone in the embodiment.

Fig. 3 is a diagram showing an example of a history of
outgoing/incoming calls stored in the portable telephone in the
embodiment.

Fig. 4 is a diagram showing an example of telephone directory data
stored in the portable telephone in the embodiment.

Fig. 5 is a schematic diagram showing a software configuration of
the portable telephone in the embodiment.

Fig. 6 is a flowchart showing a processing operation performed
when a Java virtual machine of the portable telephone in the embodiment
executes a downloaded Java application.

Preferred Embodiments

Referring to the drawings, an embodiment will be described in
accordance with the present invention as follows:

In this embodiment, a portable telephone for radio data
communication executes an application written in Java (registered
trademark) programming language (hereinafter referred to as "Java
application"). The present invention, however, may be implemented with
various modifications within the scope of the technological spirit thereof,
A: Configuration

(1) Configuration of the entire system

Fig. 1 is a block diagram showing the configuration of the entire system according to the embodiment of the present invention. As shown in the drawing, the system is constructed of portable telephones 10a and 10b, a mobile data communication network 20, a server 25, the Internet 30, and a download server 40.

The portable telephones 10a and 10b are owned by users to receive call services of a mobile telephone network, which is not shown, and to perform radio communication with a base station 21 of the mobile data communication network 20 in order to receive the data communication service of the mobile data communication network 20. The portable telephones 10a and 10b incorporate a browser for browsing various pages on the Internet 30 and a Java virtual machine for supporting Java (registered trademark), which allows various Java applications to be executed.

The portable telephones 10a and 10b share the same configuration and operation, so they shall be generically referred to as a portable telephone 10 hereinafter, unless it is necessary to distinguish them.

The mobile data communication network 20 comprises base station 21, switching office, which is not shown, and communication lines for connecting them. Multiple base stations 21 are deployed at predetermined intervals in a communication service area of the mobile data communication network 20 to effect radio communication with the portable telephones 10 movably located in respective radio cells. The mobile data communication network 20 is connected to the Internet 30 through a gateway, which is not shown, so that two-way data transfer is possible between the networks.
The download server 40 has data in an HTML (Hypertext Markup Language) format that can be accessed by using the browser of the portable telephone 10, and various types of Java applications. The download server 40 provides the Java applications to the portable telephone 10 through the intermediary of the Internet 30 and the mobile data communication network 20.

Java applications in the download server 40 include, for example, software for providing PIM (Personal Information Management) to a user of the portable telephone 10 and game software for the user of the portable telephone 10 to play an adversarial game with another user. When these Java applications are downloaded from the download server 40 to the portable telephone 10 and executed by the portable telephone 10, a predetermined communication node is called, and processing is carried out by communicating with the communication node. There is also a Java application in which, when a user specifies a call destination communication node, a so-called "PhoneTo" function is implemented to call the communication node to effect voice communication.

In this case, server 25, portable telephones 10 other than the portable telephone 10 that executes an application, and fixed telephones, which are not shown may be, for example, the call destination communication node.

The server 25 may provide a user with the PIM service. More specifically, the server 25 has a memory area for storing schedules, note pads, etc. of each user, and may update such data in response to requests received from the portable telephone 10 of each user. In this case, the Java application downloaded into the portable telephone 10 is executed to control the portable telephone 10 to call the server 25 and interact with the server 25 to receive the PIM service.

If the Java application downloaded into the portable telephone 10
is an adversarial game to play with another portable telephone 10, then the portable telephone 10a, for example, may call the portable telephone 10b. Thereafter, communication is carried out between the portable telephones 10a and 10b to execute the Java application.

Thus, a Java application is executed on the portable telephone 10 so as to connect a line by calling a predetermined communication node and to execute processing (including voice communication processing) by communicating with the communication node.

However, when an illegal application mentioned above is present, it is not desirable to allow, without limitation, a call origination processing in accordance with an instruction from Java applications.

For this reason, the embodiment imposes a certain limitation on call origination processing resulting from executing a Java application.

(2) Hardware configuration of portable telephone 10

Referring now to the block diagram shown in Fig. 2, the hardware configuration of the portable telephone 10 will be described.

As shown in Fig. 2, the portable telephone 10 is constructed of a transmitting/receiving unit 11, a control unit 12, a user interface unit 13, and a bus 14 interconnecting them.

The transmitting/receiving unit 11 comprises an antenna and a communication control circuit, which are not shown, and performs radio communication with the base stations 21 of the mobile data communication network 20.

The user interface unit 13 comprises a liquid crystal display for displaying various types of information, a key pad for a user to perform various types of input operations, and a microphone with a speaker for telephone calls of the user.

The control unit 12 controls each part of the portable telephone 10, and comprises a CPU 121, a ROM 122, and an SRAM 123.
Various control programs or the like are stored in the ROM 122, and the CPU 121 reads the control programs to execute various types of control processing. Control programs in the ROM 122 include an operating system in the portable telephone 10, a browser, and various types of software, which are discussed below.

The SRAM 123 is used as a work area of the CPU 121. The SRAM 123 also stores Java applications downloaded from the download server 40, the history of outgoing/incoming calls of the portable telephone 10, and telephone directory data entered by a user.

Fig. 3 is a diagram showing an example of the history of outgoing/incoming calls stored in the SRAM 123. Fig. 4 is a diagram showing exemplary telephone directory data stored in the SRAM 123.

As shown in Fig. 3, the history of outgoing calls is stored. The history of outgoing calls includes the date and time when the portable telephone 10 made each call, along with the corresponding outgoing telephone number of the communication node from which the telephone call was made (the originating telephone number). Similarly, the history of incoming calls is stored. The history of incoming calls include the date and time when the portable telephone 10 received each call, along with the corresponding incoming telephone number of the communication node from which the telephone call, corresponding to the received call, was made (the incoming telephone number).

Furthermore, the telephone directory data is stored with corresponding names and telephone numbers, as shown in Fig. 4.

Storing of histories of outgoing and incoming calls as known in the art shall be applied and the explanation thereof is omitted.

(3) Software configuration of portable telephone

Fig. 5 is a schematic diagram showing the software configuration of the portable telephone 10. As shown in Fig. 5, the software of the
portable telephone 10 comprises, in order from a lowermost layer to an uppermost layer, an operating system OS, a Java application manager JAM, a Java K virtual machine KVM and a Java application AP.

The operating system OS comprises well-known software installed in a portable telephone to support basic processing of the portable telephone 10.

The Java application manager JAM is software primarily to control and check security on the Java K virtual machine KVM. More specifically, the Java application manager JAM accesses the aforesaid histories of outgoing/incoming calls and the telephone directory data. The Java application manager JAM determines whether to execute the call origination processing by checking whether the telephone number of the above communication node is included in the histories of outgoing/incoming calls when, during execution of Java application AP, a call origination is processed to a predetermined communication node. The determination is based on an idea: call origination processing may be granted in such cases that the node communication telephone number of the call origination is included in the histories of outgoing/incoming calls or the telephone directory data, because the portable telephone 10 communicated with the communication node in the past or the user recognized it as a communication partner.

The Java K virtual machine KVM executes the Java application under the control of the Java application manager JAM. The Java virtual machine KVM and the Java application manager JAM are incorporated into the operating system OS in advance, all of which are stored in the ROM 122.

The Java application AP is the software written in the Java (registered trademark) programming language as mentioned above. The Java application AP is downloaded into the portable telephone 10 from the
download server 40, and then written to and stored in the SRAM 123.

B: Operation

The operation of the embodiment with the above configurations will now be explained.

Fig. 6 is a flowchart showing the processing when executing the Java application AP by the portable telephone 10.

When an instruction is issued to begin a requested Java application AP by user's operation, the Java application AP is begun on the Java K virtual machine KVM shown in Fig. 3 in response to the instruction. The processing of the Java application AP is executed unit by unit, with an executed unit being called a "class" (step S1).

Then, it is determined whether the class to be executed during processing requires call origination to a communication node (step S2).

If the class does not require call origination processing (NO in step S2), then the Java K virtual machine KVM repeats the processing of step S1, and executes the processing corresponding to the class.

If the class requires call origination processing (YES in step S2), then the Java application manager JAM refers to the telephone number of the communication node, for which the call origination processing is to be implemented, the histories of outgoing/incoming calls and the telephone directory data, and compares them in response to a request from the Java K virtual machine KVM (step S3).

If the comparison indicates that the telephone number of the communication node for which the call origination processing is to be implemented is in the histories of outgoing/incoming calls or the telephone directory data (YES in step S4), then the Java application manager JAM grants the call origination processing and instructs the Java K virtual machine KVM to execute the call origination processing (step S5).
If the telephone number of the communication node for which the call origination processing is to be carried out is not found in the histories of outgoing/incoming calls and the telephone directory data (NO in step S4), then the call origination processing is not granted. The Java application manager JAM instructs the Java K virtual machine KVM to display a message on a liquid crystal display, indicating that the call origination processing cannot be granted, together with another message indicating that user instruction is necessary to perform call origination (step S6).

The display in this case may be a message, for example, "You need to call oo-xxxx-AAAA to continue the processing. Are you making the call? Press key 1 for YES or press key 2 for NO."

If the user issues an instruction to make the call (YES in step S7), then the processing transfers to step S5 wherein the Java K virtual machine KVM executes the call origination processing. Then, the processing returns to step S1 wherein the processing for executing the Java application AP is continued.

In this case, call origination is made in the step S5 processing so that the telephone number used for making the call is stored in the history of outgoing calls. Hence, the call origination processing will be granted thereafter for this telephone number when comparing the telephone number with the history of outgoing calls step S4.

If an instruction is issued by the user not to make the call (NO in step S7), then the Java application manager JAM forcibly terminates the Java application AP in response to the instruction (step S8).

In this way, a call origination is granted only if the result indicates conformity after the comparison of the communication node telephone number to be implemented for the call origination with the histories of outgoing/incoming calls and the telephone directory data.
In this embodiment, call originations are limited to the communication nodes called before or the communication nodes registered in the telephone directory by the user in order to ensure the security.

C: Modification examples

As previously mentioned, the present invention is not limited to the embodiment described above, and may be implemented in various modifications as shown below.

(1) Form of each communication node

In the embodiment described above, the portable telephone 10 is the device executing applications. The device executing applications, however, is not limited thereto; it may be a fixed telephone, or a personal computer connected to a portable telephone or a fixed telephone.

A communication node to be called is not limited to the server 25 or the portable telephone 10; the communication node may be a personal computer or the like connected to a fixed network and placed at a home or in an office.

Thus, the devices executing the applications and the objects to be called are not limited to those disclosed. Devices executing the applications or the objects to be called may be any communication nodes to which lines are connected by using telephone numbers to perform data communication or voice communication.

(2) The use of the histories of outgoing/incoming calls and telephone directory data

In the embodiment, both the histories of outgoing/incoming calls and the telephone directory data are used to determine whether to grant the call origination processing; however, the present invention is not limited thereto. Alternatively, whether to grant call origination
processing may be determined by using only the history of outgoing calls, only the history of incoming calls, or only the telephone directory data, or by using at least two of them.

(3) Processing for different applications

In the embodiment, when a plurality of Java applications AP have been installed in the portable telephone 10, whether to implement call origination is determined by referring to all of the histories of outgoing/incoming calls and the telephone directory data without distinguishing the applications.; however, the present invention is not limited thereto. Alternatively, a database to be referred to when the determination is based may vary, depending upon what application AP is being executed.

For instance, for a first Java application, only the telephone directory data may be used to determine whether to implement call origination. For a second Java application, both histories of outgoing/incoming calls and telephone directory data may be used for the determination. And, for a third Java application, without making any determination, calls to all communication nodes may be granted.

A user may choose, every time a call is to be initiated, which data shall be used to determine whether to implement call origination. Or, the Java application manager JAM may determine whether to implement call origination according to attributes of a Java application AP.

Java applications AP are not necessarily limited to those downloaded from a network. For example, some Java applications AP are stored in the ROM 122 in advance. Such Java Applications AP are considered to be high security and no limitation may be put on the call originations. Furthermore, Java applications AP that are downloaded from a download server 40 that has been authenticated by a predetermined certificate authority, may be expected to provide sufficient security.
Hence, both the histories of outgoing/incoming calls and the telephone directory data may be used to determine whether to ease the restrictions on call origination. Sufficient security may not be expected for Java applications AP downloaded from a download server 40 that is not authenticated by any predetermined certificate authority. Hence, only a telephone directory data history may be used as the basis of the determinations, thereby enhancing restrictions on call origination.

(4) Programming language

In the embodiment, the Java (registered trademark) has been used; the present invention, however, is not limited thereto. Other programming languages may be used.

Comprises/comprising and grammatical variations thereof when used in this specification are to be taken to specify the presence of stated features, integers, steps or components or groups thereof, but do not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A wireless communication terminal including:
   multiple communication functionalities including a voice communication functionality and a network browsing functionality;
   a network communication control that activates the network browsing functionality to access an external application source to thereby receive an application therefrom, wherein the application includes at least one application unit executable on the wireless communication terminal;
   an application platform that provides an execution environment for the received application in which the application platform executes each of the at least one application unit in the received application at a time, wherein before executing an application unit in the received application, the application platform determines if execution of the application unit will ensue an activation of the voice communication functionality to initiate a call to a telephone number and, if so determined, will suspend execution of the application unit until the telephone number is verified; and
   a telephone number manager that verifies the telephone number and allows the application platform to proceed to execute the application unit if the telephone number is verified, whereas otherwise disallowing the application platform to execute the application unit.

2. The wireless communication terminal according to claim 1, wherein the application is a JAVA Applet.

3. The wireless communication terminal according to claim 1 or 2, wherein the application platform is a JAVA virtual machine.

4. The wireless communication terminal according to any one of the preceding claims, further including at least one telephone number database, wherein the telephone number manager, in verifying the telephone number, searches one or more of the at least one telephone number database for the telephone number.
5. The wireless communication terminal according to claim 4, wherein the at least one telephone number database includes any of: a first database that stores telephone numbers to which calls were originated from the wireless communication terminal; a second database that stores telephone numbers from which calls were received by the wireless communication terminal; and a telephone directory stored in the wireless communication terminal.

6. The wireless communication terminal according to claim 4 or 5, wherein the telephone number is verified when the telephone number is found in any of the one or more databases searched among the at least one telephone number database.

7. The wireless communication terminal according to claim 4 or 5, wherein the telephone number is verified when the telephone number is found in a particular database selected from the at least one telephone number database.

8. The wireless communication terminal according to claim 4 or 5, wherein the telephone number is verified when the telephone number is found commonly in more than one of the at least one telephone number database.

9. The wireless communication terminal according to any one of the preceding claims, wherein the telephone number manager selectively performs a different verification method for a different application.

10. The wireless communication terminal according to claim 9, wherein the verification method varies according to attributes of the application.

11. The wireless communication terminal according to claim 10, wherein one of the attributes is an application source from which the application is received.

12. The wireless communication terminal according to claim 11, wherein the verification method varies depending upon how trustworthy the application source is.
13. The wireless communication terminal according to claim 12 when appended to claim 5, wherein a telephone number, which came with an application whose source is trustworthy, is verified when the telephone number is found in any one of the first and second databases and the telephone directory.

14. The wireless communication terminal according to claim 13 or 12 when appended to claim 5, wherein a telephone number, which came with an application whose source is doubted in its trustworthiness, is verified when the telephone number is found in the telephone directory.

15. The wireless communication terminal according to any one of the preceding claims, wherein execution of the received application is terminated when the telephone number is not verified.

16. The wireless communication terminal according to any one of claims 1 to 14, wherein if the telephone number manager fails to verify the telephone number, a user of the communication terminal will be asked if it is permissible to allow the call to proceed to the telephone number.

17. The wireless communication terminal according to claim 16, further including a display, wherein the user is asked through a visual message displayed on the display.

18. The wireless communication terminal according to claim 16 or 17, wherein execution of the application is terminated when permission is not obtained from the user.

19. A method for disallowing an unverified call at a wireless communication terminal, including the steps of:
   a) accessing an application source to receive an application therefrom, wherein the application includes at least one application unit executable on the wireless communication terminal;
b) providing an execution environment for the received application in which each of the at least one application unit in the received application is executed at a time;

c) before executing an application unit in the received application, determining if execution of the application unit will ensue an outgoing call to a telephone number;

d) if so determined, suspending execution of the application unit and verifying the telephone number; and

e) proceeding to execute the application unit if the telephone number is verified, whereas otherwise disallowing the call.

20. The method according to claim 19, further including providing at least one telephone number database, wherein verifying the telephone number includes searching one or more of the at least one telephone number database for the telephone number.

21. The method according to claim 20, wherein the at least one telephone number database includes any of: a first database that stores telephone numbers to which calls were originated from the communication terminal; a second database that stores telephone numbers from which calls were received by the communication terminal; and a telephone directory stored in the communication terminal.

22. The method according to claim 20 or 21, wherein the telephone number is verified when the telephone number is found in any of the one or more databases searched among the at least one telephone number database.

23. The method according to claim 20 or 21, wherein the telephone number is verified when the telephone number is found in a particular database selected from the at least one telephone number database.
24. The method according to claim 20 or 21, wherein the telephone number is verified when the telephone number is found commonly in more than one of the at least one telephone number database.

25. The method according to any one of claims 19 to 24, wherein verifying the telephone number includes selectively performing a different verification method for a different application.

26. The method according to claim 25, wherein the verification method varies according to attributes of the application.

27. The method according to claim 26, wherein one of the attributes is an application source from which the application is received.

28. The method according to claim 27, wherein the verification method varies depending upon how trustworthy the application source is.

29. The method according to claim 28 when appended to claim 21, wherein a telephone number, which came with an application whose source is trustworthy, is verified when the telephone number is found in any one of the first and second databases and the telephone directory.

30. The method according to claim 29 or 28 when appended to claim 21, wherein a telephone number, which came with an application whose source is doubted in its trustworthiness, is verified when the telephone number is found in the telephone directory.

31. The method according to any one of claims 19 to 30, wherein disallowing the call includes terminating execution of the application.

32. The method according to any one of claims 19 to 30, wherein verifying the telephone number includes asking a user if it is permissible for the call to proceed to the telephone number.
33. The method according to claim 32, wherein disallowing the call includes terminating execution of the application when permission is not obtained from the user.

34. A wireless communication terminal including:
   multiple communication functionalities including a voice communication functionality and a network browsing functionality;
   a plurality of telephone number databases to which different security levels are attributed;
   a network communication control that activates the network browsing functionality to access an external application source to thereby receive an application executable on the wireless communication terminal;
   an application platform that executes the received application, wherein the received application is programmed to initiate, while running on the communication terminal, a call to a telephone number; and
   a telephone number manager that verifies the telephone number by searching one or more databases selected from the plurality of telephone number databases based on attributes of the received application, and allows the call to proceed to the telephone number if the telephone number is verified, whereas otherwise disallowing the call.

35. The wireless communication terminal according to claim 34, wherein the plurality of telephone number databases includes any of: a first database that stores telephone numbers to which calls were originated from the communication terminal; a second database that stores telephone numbers from which calls were received by the communication terminal; and a telephone directory stored in the communication terminal.

36. The wireless communication terminal according to claim 35, wherein the telephone number is verified when the telephone number is found in any of the one or more databases selectively searched among the plurality of telephone number databases.
37. The wireless communication terminal according to claim 35, wherein the telephone number is verified when the telephone number is found in a particular database selected among the plurality of telephone number databases.

38. The wireless communication terminal according to claim 35, wherein the telephone number is verified when the telephone number is found commonly in more than one of the plurality of telephone number databases.

39. The wireless communication terminal according to any one of claims 34 to 38, wherein one of the attributes is an application source from which the application is received.

40. The wireless communication terminal according to claim 39, wherein one or more databases are selectively searched among the plurality of telephone number databases depending upon how trustworthy the application source is.

41. The wireless communication terminal according to any one of claims 34 to 40, wherein execution of the application is terminated when the telephone number is not verified.

42. The wireless communication terminal according to any one of claims 34 to 40, wherein if the telephone number manager fails to verify the telephone number, a user of the wireless communication terminal will be asked if it is permissible to allow the call to proceed to the telephone number.

DATED this 15th day of September 2004

NTT DOCOMO, INC

WATERMARK PATENT & TRADE MARK ATTORNEYS
290 BURWOOD ROAD
HAWTHORN VICTORIA 3122
AUSTRALIA
### FIG. 3

<table>
<thead>
<tr>
<th>HISTORY OF OUTGOING CALLS</th>
<th>HISTORY OF INCOMING CALLS</th>
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<td>OUTGOING DATE/TIME</td>
<td>OUTGOING TELEPHONE NUMBER</td>
</tr>
<tr>
<td>2000.9.20. 8:00</td>
<td>090-1111-1111</td>
</tr>
<tr>
<td>2000.9.21.15:23</td>
<td>090-2222-2222</td>
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### FIG. 4

**TELEPHONE DIRECTORY**

<table>
<thead>
<tr>
<th>NAME</th>
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### FIG. 5

**JAVA APPLICATION**
- AP
- KVM
- JAM
- OS

**JAVA K VIRTUAL MACHINE**

**JAVA APPLICATION MANAGER**

**OPERATING SYSTEM**
FIG. 6

START

EXECUTE JAVA APPLICATION

S1

IS CALL ORIGINATION PROCESSING NECESSARY?

S2

YES

REFER TO HISTORY OF OUTGOING/INCOMING CALLS AND TELEPHONE DIRECTORY DATA

S3

S4

HAS TEL NO. FOR THE CALL ORIGINATION FOUND?

NO

INQUIRE INSTRUCTION FOR CALL ORIGINATION

S6

S7

HAS USER INSTRUCTED CALL ORIGINATION?

NO

YES

PERFORM CALL ORIGINATION

S5

FORCIBLY TERMINATE JAVA APPLICATION

S8

END