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Description

Method, switching devices and programs for the switching of telecommunications connections

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The invention relates to a method for the switching of telecommunications connections, in which connections are switched between terminals in a switching device. During the process of switching a connection, connection data is stored in a memory unit.

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The connections are physical connections or virtual connections. Physical connections are produced by the interconnection of channels. A channel may be formed by an individual line. However, a number of channels are generally defined on one line, to which specific time periods are allocated in successive time frames. Another type of connection is a connection which is produced by means of data packets. The data packets associated with a connection have a common logical channel number. No physical resources need be provided for the entire connection duration in the switching device. These connections are therefore also referred to as virtual connections.

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In known switching methods, the connection data is generally used only for that connection during whose setting up it was stored. If data is required which is not stored in the connection data, then commands specified in standardized protocols must be used in order, for example, to check statuses in terminals.

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The document US 4,567,323 discloses a system for the switching of telecommunications connections. The connection data for the respective connection is used only for this connection in this known system. For each connection that is to be set up as new, connection data are determined as new for setting up that connection. An attempt is in this case made to set up a connection

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from the calling subscriber to the called subscriber even if no connection to the called subscriber is possible at that time.

- 5 One object of the invention is to specify improved methods for the switching of connections. A further aim is to specify

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switching devices and programs by means of which the methods according to the invention are carried out.

The object relating to the method is achieved by the
5 method steps specified in Patent Claim 1. Developments are specified in the dependent claims.

In the method according to the invention, the connection data for at least one connection is accessed
10 for the switching of at least one other connection. The use of connection data from other connections also makes it possible to draw conclusions relating to data which is required for setting up a specific connection. Even if the drawing of conclusions does not ensure 100%
15 reliable results, the results are nevertheless sufficiently reliable for many applications.

In the method according to the invention, the connection data for one or more other connections is
20 accessed alternatively or cumulatively before, during or after setting up the connection for a connection under consideration. If the connection data is accessed before setting up the connection, then, in some circumstances, it is possible, even before any attempt
25 is made to set up that connection, to determine whether there is a prospect of the process of setting up that connection being successful. If the connection data for other connections is accessed after the setting up of the connection, then, for example, it is possible to
30 draw conclusions as to whether the connection under consideration should be released once again.

Furthermore, in the method according to the invention, the connection data is used to determine the nature of
35 a terminal which is connected to the switching device. The utilization status of this terminal is determined alternatively or additionally. Fax machines and

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telephones whose utilization status is busy or free are used, by way of example, as terminals.

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The connection data which is evaluated in order to determine the nature of the terminal relates either to the same terminal or to some other terminal. Initially, the aim is to use connection data relating to the same
5 terminal. If such connection data is not available, then, however, conclusions about the terminal under consideration may also be drawn from the connection data for other terminals.

10 The nature of a terminal which is connected to a connection with a number of terminals, and its utilization status, can be determined by use of the method according to the invention in a simple way, since there is no need for standardized commands. This
15 also means that terminals which do not support the standardized commands may be used.

In one development, the connection data for a connection which has already been released are also
20 used. This measure considerably increases the amount of available data, since not only the data from existing connections but also the data from already released connections is used. This development makes it possible without any problems to read data directly and to draw
25 conclusions relating to the values of the data, which could not otherwise be accessed without further problems.

A second aspect of the invention relates to a method
30 having the method steps stated in Patent Claim 3. In this method, as in the development of the first aspect of the method just mentioned, connection data for an already released connection is used for the switching process. Either some of the data relating to
35 connections which have been released, or exclusively data such as this, is used. If the data from a released connection has no longer been considered

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up to this point in time after the releasing of the relevant connection, then the method according to the invention provides an information source which has so far remained unused. In addition to the use of the
5 second aspect of the method in conjunction with the first aspect of the method and the applications (mentioned below) for the "ring back" service feature, there are a large number of usage options for the second aspect of the method. The newly provided
10 information source can be used to improve the switching process in a large number of ways.

In one refinement, the method according to the invention is used instead of a check, which is
15 specified according to a Standard of a terminal by means of a message. For example, EN Standard 300 196 provides for the terminal to be checked by means of a FACILITY message for status checking. However, if the switching device has terminals connected to it which
20 cannot evaluate and respond to such a FACILITY message for status checking, then certain functions cannot be carried out. However, the method according to the invention means that the status of the terminal can be determined, even without checking the terminal, on the
25 basis of the data available in the switching device.

If the connection data for a next refinement relates to a basic access in accordance with the ISDN Standard (Integrated Services Digital Network), then the
30 achieved effects are particularly major. This is because a basic access is connected not only to terminals of different types, such as fax machines, computers, telephones, but also to a large number of different appliances. Furthermore, the basic access has
35 two B channels. This results in a large number of access configurations and utilization statuses. If the terminals do not support direct checking, then the method

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according to the invention allows a plausible statement to be made about the configuration status of the basic access.

5 In one development, the method according to the invention is used to implement a service feature in which another terminal is intended to be rung back, depending on the status of a terminal which is connected to the switching device. This service feature
10 is, for example, the "ring back if busy" service feature or the "ring back if no answer" service feature. The stated service features operate correctly with previously used methods only if the terminals support the status check provided in the Standard.
15 However, there are a large number of terminals which do not support a status check. In the case of terminals such as these, the calling A subscriber has until now been informed whenever a B channel becomes free. Since this is done independently of the compatibility and the
20 utilization status of the terminals, the remote A subscriber will in some circumstances ring back unnecessarily. The disturbance to the A subscriber associated with this has placed a severe strain on the acceptance of ring back services in the past. The
25 method according to the invention allows the data required to implement the ring back services correctly to be determined in the switching device even without including the terminals. Unnecessary ring backs by the A subscriber can be avoided, since the status of a
30 terminal can be determined correctly with a high level of confidence.

The use of the development does not need to make use of any other less efficient methods in order to avoid
35 unnecessary ring backs. The refinement ensures that the ring back services are carried out correctly even if two terminals with different MS numbers (multiple subscriber numbers) are connected to the ISDN basic access, and the utilization sequence differs from the

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release sequence. Even in situations in which terminals for different transmission services are connected to the basic access and the utilization sequence differs from the release sequence, correct implementation of the ring back services is ensured. Furthermore, the ring back service, in which the method according to the invention or its developments is or are used, operates correctly even when one connection at the basic access is a long-term connection, which remains in existence over a number of hours. One example of such a long-term connection is a connection to the Internet. The long-term connection does not lead to any blocking of the ring back services for other terminals on the same basic access, either.

When the method according to the invention is used for a ring back service, ring back data is stored in the switching device, in one refinement. The connection data and the ring back data are used to determine whether a ring back should be initiated. The ring back is initiated only when there is a sufficiently good prospect of a connection successfully being set up. If, on the other hand, there is no such prospect, no ring back is initiated.

When checking whether a ring back should be initiated, a predetermined decision table is used for one refinement. The decision table allows the complex relationships which have to be taken into account in the check to be recorded, represented and stored in a clear manner. The decision table is predetermined, for example, as a function of customer requirements. Different decision tables can thus be stored in different switching devices.

The invention also relates to switching devices and programs for the switching of telecommunications connections.

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The switching devices according to the invention and the programs according to the invention are used for carrying out the methods according to the invention and their developments. The technical effects mentioned
5 above therefore also apply to the switching devices and to the programs.

Exemplary embodiments of the invention will be explained in the following text with reference to the
10 attached drawings, in which:

Figure 1 shows the subscriber signaling and signaling processes between switching centers in conjunction with the "ring back if busy" service feature according to
15 the prior art,

Figure 2 shows call data and ring back data in a destination switching center, and

20 Figure 3 shows a flowchart with method steps for determining the utilization status of a terminal.

Figure 1 shows the subscriber signaling and the signaling processes between switching centers 10, 12, and 14 when using the "ring back if busy" service feature according to the prior art. A telephone 15 of a calling subscriber Sub A is connected to the switching center 10, which is therefore also referred to as the source switching center 10, in the following text. A
25 telephone 16 and a fax machine 17 of a called subscriber Sub B are connected to an ISDN basic access (Integrated Services Digital Network) in the switching center 14. The switching center 14 is therefore also referred to as the destination switching center in the
30 following text. The switching center 12, which is also referred to as the transit switching center 12 in the following text, is located between the source switching center 10 and the destination switching center 14.

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The signaling processes which are required for a telephone call from the A subscriber Sub A to the subscriber Sub B are explained in the following text. It is assumed that the subscriber Sub A has dialed a busy subscriber Sub B, that is to say the subscriber Sub B is making a telephone call to some other subscriber using his telephone 16. The subscriber Sub A would like to be rung back when the subscriber Sub B has ended the connection to the other subscriber.

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In this sequence, time lines 17 to 24 relate to signaling processes relating to the subscriber Sub A, to the source switching center 10, to the transit switching center 12, to the destination switching center 14 and to the subscriber Sub B. Identical times on the time lines 17 to 24 are situated on a line which runs parallel to the longitudinal sides of the page.

The signaling to and from the subscribers Sub A and Sub B is carried out in accordance with the subscriber signaling protocols E-DSS1 (Euro Digital Signaling System One). The signaling between the switching centers 10 to 14 is carried out in accordance with the international signaling protocol no. 7, which has been specified by the ITU-T (International Telecommunication Union - Telecommunication) and its predecessor organization the CCITT (Comité Consultatif International Télégraphique et Téléphonique). Details of the signaling commands illustrated in Figure 1 can be found in these Standards.

The subscriber Sub A lifts his telephone 15 off hook and thus initiates the production of a connection setting up message SETUP to the source switching center 10. The subscriber Sub A then dials the telephone number of the subscriber Sub B. The telephone number is transmitted to the source switching center 10, which is not illustrated. The source switching center 10 then transmits an

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initial address message IAM to the transit switching center 12 in order to initiate the setting up of a connection in the direction of the subscriber Sub B. Furthermore, the source switching center 10 sends a
5 CALL PROCEEDING message to the subscriber Sub A in order to signal to his telephone 15 that the process of setting up the call is being continued and that no further dialing information is required. Channels for the call to the subscriber Sub B are also reserved in
10 the source switching center 10.

After receiving the initial address message IAM, the transit switching center 12 likewise reserves channels for the connection to the subscriber Sub B.
15 Furthermore, the transit switching center 12 itself sends an initial address message IAM to the destination switching center 14.

During the processing of the initial address message
20 IAM which is received by the switching center 12, channels are reserved for the connection to the subscriber Sub B in the destination switching center 14. A connection setting up message SETUP is sent to the telephone 16 and to the fax machine 17 of the
25 subscriber Sub B, in order to signal to them the desire for a connection by the subscriber Sub A. However, the telephone 16 and the fax machine 17 of the subscriber Sub B are busy, so that these appliances each send a release confirmation message RELEASE COMPLETE to the
30 destination switching center 14. The release reason in the release confirmation messages RELEASE COMPLETE is in each case stated as being that the telephone 16 or the fax machine 17 of the subscriber Sub B is busy.

35 The release confirmation messages RELEASE COMPLETE are processed in the destination switching center 14, and confirmation is obtained that ring back is available for the subscriber Sub B. The release confirmation

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message RELEASE COMPLETE results in the channels which
have been kept available in the switching

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- center 14 for the connection between the subscriber Sub A and the subscriber Sub B being released once again. Furthermore, a release message REL is sent to the transit switching center 12. This message contains
- 5 parameters which indicate that the subscriber Sub B is busy and that, in addition, a ring back can be initiated as soon as the telephone 16 of the subscriber Sub B is free once again.
- 10 After receiving the release message REL in the transit switching center 12, the channels kept available there are also released once again. The transit switching center 12 sends to the source switching center 10 a release message REL whose contents are the same as the
- 15 release message REL which it has itself received. The transit switching center 12 also sends a release confirmation message RLC (Release Complete) to the destination switching center 14.
- 20 After receiving the release message REL, the resources which have been kept available in the source switching center 10 are released. Furthermore, a disconnection message DISCONNECT is sent to the subscriber Sub A. This message contains as a parameter the statement that
- 25 the subscriber Sub B is busy, and that a ring back is possible. In accordance with the protocol, the telephone 15 of the subscriber Sub A releases the B channel being used, by means of a subscriber release message RELEASE. The source switching center 10
- 30 processes the subscriber release message RELEASE and sends to the transit switching center 12 a release confirmation message RLC (Release Complete) which acknowledges the release message REL received by the transit switching center 12. The source switching
- 35 center 10 furthermore sends a release confirmation message RELEASE COMPLETE to the telephone 15.

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The subscriber Sub A uses the released connection to identify the fact that the subscriber Sub B is busy. The subscriber Sub A then initiates the "ring back if busy" service feature, for example by pressing a specific key on his terminal, and places the telephone on hook. The calling of the service feature is reported to the telecommunications network by means of a FACILITY RING BACK service message to the source switching center 10.

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After receiving the FAC RING BACK service message, a direct signaling connection to the destination switching center 14 is set up in the source switching center 10, cf. the dialogue start message TC-BEGIN. The control of the "ring back if busy" service feature is based on the interchange of signaling data using a TCAP-dialogue (Transaction Capability Application Part), which is part of the abovementioned protocol no. 7. The transit switching center 12 is not included in this dialogue.

After receiving the dialogue start message TC-BEGIN, the destination switching center 14 now checks whether the subscriber Sub B is free. This is done using the FACILITY-STATUS-REQUEST service messages. The telephone 16 of the subscriber Sub B has to process the FACILITY-STATUS service messages and has to signal its status, likewise using service messages to the destination switching center 14. It is assumed that the appliances 16, 17 are still busy, "BUSY" status. The telephone 16 therefore sends a FACILITY-COMPATIBLE(+)-BUSY service message. The fax machine 17 sends a FACILITY-COMPATIBLE(-)-BUSY service message. The ring back request from the subscriber Sub A is placed in a queue in the destination switching center 14 at a time 26. In the course of the dialogue, the destination switching center 14 signals directly to the source switching center 10 that the ring back request from the subscriber Sub A has been

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entered in the queue, see the dialogue message TC-CONT
(Continue).

The source switching center 10 uses a FACILITY-RING-
5 BACK-ACCEPTED service message to report to the
telephone 15 of the subscriber Sub A that the ring back
request has been entered in the queue. Figure 1 also
shows the next service message, FACILITY-STATUS-REQUEST
which is sent by the destination switching center 14 in
10 response to the check of the status of the telephone 16
and of the fax machine 17 of the subscriber Sub B after
a B channel has been released. Further checks which are
sent while releasing a B channel are indicated by dots
28.

15
Service messages 30 to 34 in Figure 1 are interchanged
in the sequence explained above only if the appliances
16, 17 of the subscriber Sub B support the "ring back
if busy" service feature and, in particular, the check
20 of their status. The method according to the invention
is used if the appliances 16, 17 of the subscriber Sub
B do not support the status check. This means that the
messages 30 to 34 cannot be interchanged. Instead of
this, the destination switching center 14 carries out a
25 method using which the status of the appliances 16, 17
of the subscriber Sub B can be determined without
having to interchange messages with these appliances
16, 17. This process will be explained in the following
text with reference to Figures 2 and 3.

30
Figure 2 shows data records 50 and 52 as well as ring
back data records 54 and 56, which are stored in a
memory of the destination switching center 14. The call
data record 50 relates to the call which has just been
35 released to the fax machine 17, which is connected to
the basic access of the subscriber Sub B. Figure 2
shows six data fields 66 to 70 in the call data record
50, which contain the following data, in this sequence:

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- the telephone number of the calling subscriber, in this case the telephone number "34",
- the telephone number of the called subscriber, that is to say of the subscriber Sub B, in this case the
5 telephone number "12",
- the service being switched, in this case a fax connection,
- the connection direction, in this case an incoming call,
- 10 - the status of the connection, in this case "connected" and
- the release reason, in this case the value "16".

The call data 52 relates to a call in existence at that
15 time to the subscriber Sub B. Figure 2 shows six data fields 80 to 90 in the call data record 52. The meaning of the data in the data fields 80 to 90 corresponds in this sequence to the meaning of the data fields 60 to 70. The data field 80 contains the telephone number
20 "33" of the calling subscriber, who is not the subscriber Sub A. The data field 82 contains the telephone number "12" of the subscriber Sub B. A telephone call TEL is entered as the service in the data field 84. The fact that this is an incoming call,
25 that is to say the fact that the subscriber Sub B has been called, has been entered in the data field 86. The entry in the data field 88 for the current status of the connection is that the "connected" state has been reached. The data field 90 is not filled with a valid
30 value since there is not yet any release reason for the connection entered in the call data record 52.

The ring back data records 54 and 56 are stored in a queue. The ring back data record 54 is the first
35 element in the queue, and the ring back data record 56 is the second element. Other ring back data records in the queue are indicated by dots 100.

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Figure 2 shows two data fields 110 and 112 in the ring
back data record 54. The telephone number "12" of the
subscriber to be called is entered in the data field
110, that is to say in this case the telephone number
5 of the

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subscriber Sub B. The requested service, in this case a telephone call TEL, is entered in the data field 112. Further data fields in the ring back data record 54 are indicated by dots 114. These data fields contain data
5 using which the destination switching center 14 can associate the source switching center, for example the source switching center 10, with the ring back data 54.

The ring back data record 56 contains two data fields
10 120 and 122, whose meanings correspond to those of the data fields 110 and 112. The telephone number "12" of the subscriber Sub B is stored in the data field 120. The transmission of a fax is entered as the requested service in the data field 122. Dots 124 indicate
15 further data fields the ring back data record 56.

The switching center 14 contains decision logic 130 which uses a circuit or uses a program to make decisions on the basis of the data stored in the call
20 data records 50, 52 and the ring back data records 54, 56, cf. arrows 132 and 134. One example of such a decision will be explained in the following text with reference to Figure 3.

25 Figure 3 shows a flowchart with method steps for determining the status of a terminal which is connected to the switching center 14. The method is carried out only when the queue contains at least one ring back data record. The method illustrated in Figure 3 starts
30 in a method step 200, when a B channel to a basic access of the destination switching center 14 becomes free. In a following method step 202, the next element to be processed is read from the queue, for example the ring back data record 54.

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In the method step 204, the data in the ring back data record, which has been read in the method step 202,

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and the data in the call data records 50 and 52 for the basic access under consideration are used to make a statement about the nature of the appliance on the basic access under consideration and about its utilization status. The decision logic 130 is used for this purpose, see also Figure 2. During the processing of the first element in the queue, that is to say during the processing of the ring back data record 54, the basic access is related to the telephone number "12", see the data field 110. The ring back data record 54 relates to a telephone call, see the data field 112. It can be seen from the call data record 50 that a fax connection has just become free, see the data fields 64 and 70. It can be seen from the call data record 52 that a telephone with the telephone number "12" on the basic access is still busy, as before. A ring back for the ring back noted with the aid of the ring back data record 54 has no real chances of success, since there is no possibility of concluding that a further telephone exists with the same telephone number.

The method step 204 confirms as the decision result of the fact that although a compatible appliance, in this case a telephone and namely the telephone 16, is connected to the basic access with the telephone number "12", this appliance is, however, busy. In consequence, immediately after carrying out the method step 204, the method is continued, without any further actions, in a method step 212 which will be explained in the following text.

Two other decisions can also be made in the method step 204. If it is found that the terminal for the required ring back is "compatible and free", then the method step 204 is followed immediately by a method step 208, in which a ring back is initiated. A wait for a short time period, for example 10 seconds, is introduced for this purpose. The method step 204 is then repeated. If

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the terminal affected by the ring back is still "free",
then a dialogue message

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TC-CONT "REMOTE USER FREE" is sent to the relevant source switching center, noting the fact that the terminal is "compatible and free". The method is then ended in a method step 214. If, on the other hand, it is found in the method step 204 that there is no suitable terminal available for the ring back on the relevant basic access, then the element being processed at that time is removed from the queue, see method step 210.

The method step 204 in the case of a "compatible and busy" response and the method step 210 are each followed directly by the method step 212. A check is carried out in the method step 212 to determine whether there are any further ring back data records in the queue to be processed. If this is the case, then the method is continued in the method step 202. The method thus follows a loop comprising the method steps 202 to 212.

In the second run, the ring back data record 56 is read from the queue in the method step 202. In the method step 204 during the second run, it is found from the call data record 50 for the released call that a free FAX machine is now available for the second ring back order in the queue, namely the fax machine 17. This means that it has been possible to find a "compatible and free" terminal. In consequence, the method step 204 is followed immediately by a ring back being initiated in the method step 208, and a corresponding dialogue message TC-CONT is sent to the relevant source switching center.

The loop comprising the method steps 202, 204, 210 and 212 is left in the method step 212 only if all the elements in the queue have been processed. If all the elements have been processed, then the method step 212 is followed immediately by a method step 214, in which the method is ended.

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The method illustrated in Figure 3 is repeated when a B channel becomes free. If the B channel which is being used by the telephone 16 becomes free, then the method step 204 is followed immediately by the initiation of the ring back in the method step 208, with a message TC-CONT "REMOTE USER FREE" being sent to the source switching center 10. Steps specified in accordance with the Standard are then carried out in the source switching center 10, in order to inform the subscriber

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10 Sub A.

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Patent Claims

1. A method for the switching of telecommunications connections,
5 in which connections between terminals (15, 16, 17) are switched in a switching device (14),
and in which during the switching of a connection for a connection with a number of terminals (16, 17),
connection data (50, 52) is stored in a memory unit in
10 the switching device (14),
characterized in that
the connection data (50, 52) for at least one connection is accessed for the switching of another connection,
15 and in that the nature of a terminal (16, 17) which is connected to the switching device (14) and/or its utilization status is determined from the connection data (50, 52).
- 20 2. The method as claimed in claim 1, characterized in that some of the connection data (50) relates to a connection which has already been released.
3. A method for the switching of telecommunications
25 connections,
in which connections between terminals (15, 16, 17) are switched in a switching device (14),
and in which during the switching of a connection for a connection with a number of terminals (16, 17),
30 connection data (50, 52) is stored in a memory unit in the switching device (14),
characterized in that
the connection data (50, 52) for at least one connection is accessed for the switching of another
35 connection,

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and in that at least some of the connection data (50) relates to a connection which has already been released.

5 4. The method as claimed in claim 1, 2 or 3, characterized in that said method is used instead of a check, as specified in accordance with a Standard of a terminal (16) by means of a message, in particular by means of a status message (FACILITY-STATUS-REQUEST).

10 5. The method as claimed in one of claims 1 to 4, characterized in that the connection data (50, 52) relates to a basic access in accordance with ISDN Standard.

15 6. The method as claimed in one of claims 1 to 5, characterized in that said method is used for a service function in which a terminal (14) is intended to be rung back.

20 7. The method as claimed in claim 6, characterized in that ring back data (54, 56) is stored in the switching device (14), and the connection data (50, 52) as well as the ring back data (54, 56) are used to determine
25 whether a ring back should be initiated.

8. The method as claimed in claim 7, characterized in that a predetermined decision table (130) is included in the determination process.

30 9. A switching device (14) for the switching of telecommunications connections,

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having a memory unit for storing connection data (50, 52) which is produced while switching connections for a connection with a number of terminals (16, 17), and having a control unit, characterized in that the control unit switches connections as a function of the connection data (50, 52) and accesses the connection data (50, 52) for at least one connection for the switching of at least one other connection, and in that the control unit uses the connection data (50, 52) to determine the nature of a terminal (16, 17) which is connected to the switching device, and/or to determine its utilization status.

10. A switching device (14) for the switching of telecommunications connections, having a memory unit for storing connection data (50, 52) which is produced while switching connections between terminals (16, 17), and having a control unit, characterized in that the control unit switches connections as a function of the connection data (50, 52) and accesses the connection data (50, 52) for at least one connection for the switching of at least one other connection, and in that at least some of the connection data (50) relates to a connection which has already been released.

11. A program for the switching of telecommunications connections, having a command sequence which can be executed by the processor for a switching device (14) and during whose execution the switching device (14) is caused to switch connections for a connection with a number of terminals (16, 17),

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during the switching of a connection, to store
connection data (50, 52) in a memory unit,
characterized in that
the connection data of at least one connection is
5 accessed for the switching of at least one other
connection, and
in that the connection data (50, 52) is used to
determine the nature of a terminal (16, 17) which is
connected to the switching device, and/or to determine
10 its utilization status.

12. A program for the switching of telecommunications
connections, having a command sequence, which can be
executed by the processor for a switching device (14)
15 and during whose execution the switching device (14) is
caused
to switch connections between terminals (16),
during the switching of a connection, to store
connection data (50, 52) in a memory unit,
20 characterized in that
the connection data for at least one connection for the
switching of at least one other connection is accessed, and
in that at least some of the connection data (50)
relates to a connection which has already been
25 released.