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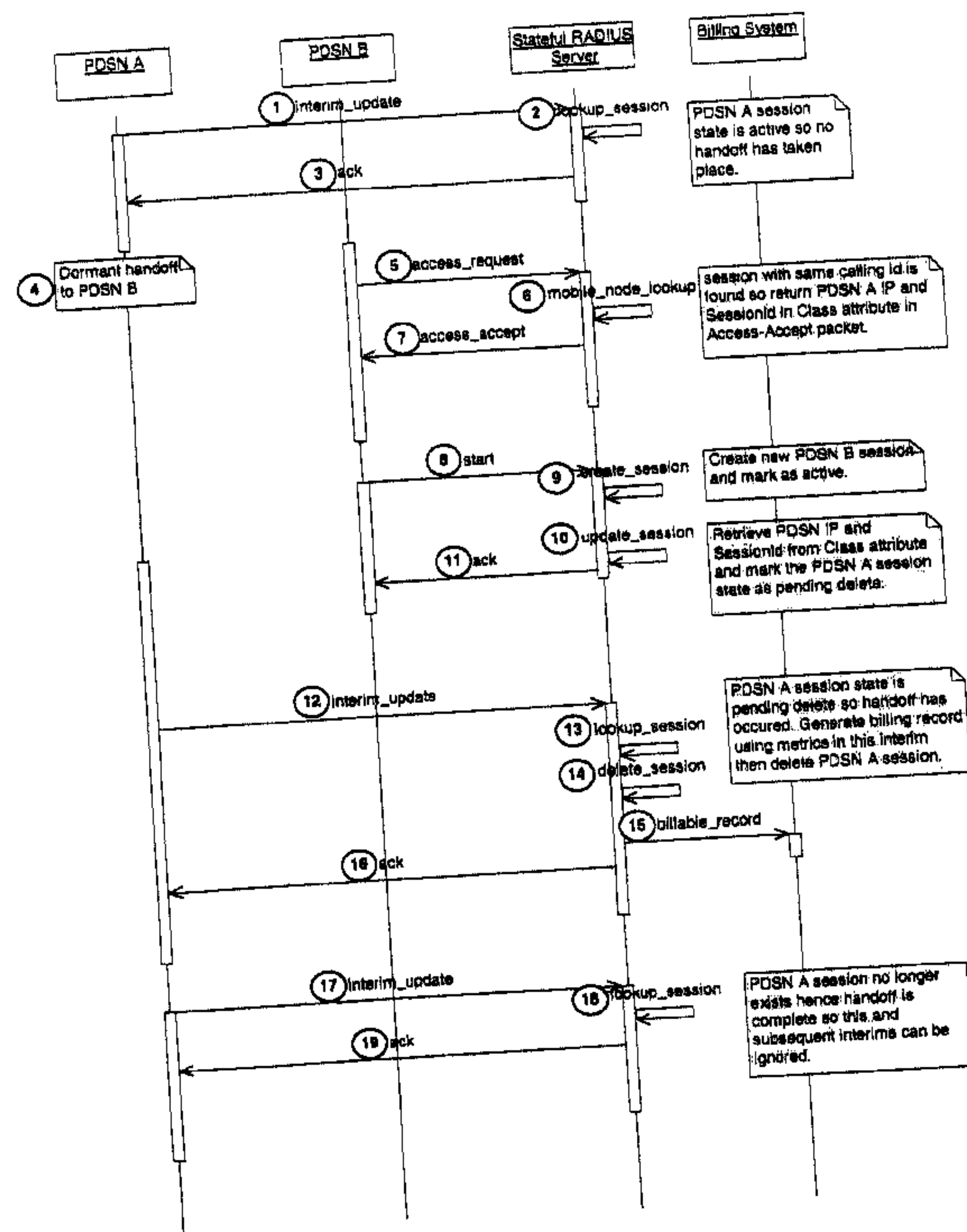
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(54) Titre : METHODE DE COMPTABILISATION DES SEANCES DANS LES RESEAUX DE TRANSMISSION DE DONNEES SANS FIL QUI UTILISE DES PROTOCOLES D'AUTHEMIFICATION, D'AUTORISATION ET DE COMPTABILISATION (COMME LE RAYON OU LE DIAMETRE IETF) QUAND IL N'Y A PAS DE MESSAGES DE TRANSFERT ENTRE LES ELEMENTS DE RESEAU

(54) Title: A METHOD FOR SESSION ACCOUNTING IN A WIRELESS DATA NETWORKS USING AUTHENTICATION, AUTHORIZATION AND ACCOUNTING (AAA) PROTOCOLS (SUCH AS IETF RADIUS OR DIAMETER) WHERE THERE IS NO SESSION HANDOFF COMMUNICATION BETWEEN THE NETWORK ELEMENTS



State session handling

Background of the Invention

In certain wireless data networks, the session handoff between fixed network elements is initiated by the mobile node rather than the network elements themselves and there is no communication between the network elements concerning the handoff. This is especially true where the mobile node enters a dormant state and then moves into an area covered by a new network element.

For example, a mobile node has a data session provided by network element X and enters a dormant state. The mobile node then moves to area where data coverage is provided by network element Y. The network element X may not be notified that a handoff has taken place thus leaving a stale session on network element X. The context for this stale session will typically remain on network element X until a pre-configured timeout period has elapsed.

In order to provide for 'always-on' services, the pre-configured timeout period mentioned in the previous example is frequently of the order of days rather than minutes. Aside from consuming resources unnecessarily on the network element holding the stale session, this situation significantly complicates the billing process where accounting records for data sessions that span many network elements must be correlated in order to produce a single record.

One possible solution to the billing problem is the use of interim accounting records. These records are sent at regular intervals following session setup and report usage metrics for the data session. Using these interim accounting records, a stateful Authentication, Authorization and Accounting (AAA) server could use the session setup event on the new network element to trigger the generation of a billable record based on the last interim accounting record received from the previous network element.

The disadvantage of this solution is that the sending of the interim accounting record will rarely coincide with the handoff event so the usage information that would appear in the next interim accounting record is effectively lost. This lost usage information translates to lost revenue for the network operator. The amount of usage lost can be minimized by sending interim accounting records at more frequent interval but storing and processing these additional accounting records increases the operational costs.

There is therefore a need for a method for session accounting in a wireless data networks using AAA protocols where there is no session handoff communication between the network elements.

Summary of the Invention

It is therefore an object of the invention to provide a novel method for session accounting in a wireless data networks using AAA protocols where there is no session handoff communication between the network elements which mitigates the disadvantages of the prior art.

One aspect of the invention is the use of a context attribute such as the RADIUS or Diameter Class attribute to store a session key which is subsequently used to trigger generation of the appropriate accounting records. Such context attributes are typically returned by the AAA server to the network element on successful authentication and authorization of the data session and are echoed by the network element back to the AAA server in subsequent accounting event messages for the data session.

An additional aspect of the invention is defined as the algorithm used by the AAA server to determine whether the incoming interim accounting record relates to a stale session and whether the usage information reported in the interim accounting record is relevant for billing purposes.

Brief Description of the Drawings

These and other features of the invention will become more apparent from the following description in which reference is made to the appended drawings in which:

Figure 1 presents a message sequence chart of the RADIUS messages exchanges during a session handoff between network elements in a CDMA2000 network.

Figure 2 presents a message sequence chart of the RADIUS messages exchanges during a session handoff between network elements in a CDMA2000 network where the PDSN support the unsolicited session termination request.

Detailed Description of the Preferred Embodiments of the Invention

A method which addresses the objects outlined above is presented as a message sequence diagram in Figure 1. This message sequence diagram presents an application of the method in a CDMA2000 network using RADIUS as the AAA protocol though the method is applicable to any wireless data network where the AAA protocol provides a context attribute for use by the AAA server.

An example of such a context attribute is the RADIUS Class attribute (id:25). According to RFC2865, this attribute "is available to be sent by the server to the client in an Access-Accept and SHOULD be sent unmodified by the client to the accounting server as part of the Accounting-Request packet if accounting is supported". RADIUS servers typically use this attribute to store session tracking information such as the resources allocated to the session so that the resources can be de-allocated on receipt of the accounting record confirming the session has terminated. The invention employs the RADIUS Class attribute to identify the stale data sessions in a mobile network where the network elements do not support handoff.

Two types of data session handoff exist in a CDMA200 network; those between Packet Control Function (PCF) network elements and those between Packet Data Serving Node (PDSN) network elements. The CDMA2000 specifications (TIA/EIA/IS-835) define the communication that must take place between Packet Control Function (PCF) in the event of a handoff so the stale session scenario that this invention addresses does not occur. However, the same specifications fail to define the communication that must take place between Packet Data Serving Nodes (PDSN) in the event of a handoff so stale sessions do occur on these network elements.

In Figure 1, it is assumed that a wireless data session has previously been established between the mobile node and the PDSN A and that IP traffic has been exchanged between the two.

At the pre-configured interim interval, PDSN A generates a RADIUS interim update message (step 1). This message contains the Acct-Session-Id attribute which in conjunction with the IP address of the PDSN serves to uniquely identify the data session network-wide. On receipt of the interim update message, the stateful RADIUS server extracts the Acct-Session-Id and looks up the session in its cache (step 2). Since the session is found to be modeled as active, the RADIUS server determines that is an interim update from an active session and an acknowledgement is returned to PDSN A (step 3).

The mobile node then ceases to exchange IP traffic with PDSN A and some time later moves into a dormant state (step 4). While in this dormant state, the mobile node moves outside the area covered by PDSN A into the area covered by PDSN B and the mobile node re-initiates a data session.

The PDSN B sends a RADIUS access request message to the stateful RADIUS server requesting authorization to setup the data session for the mobile node (step 5). On receipt of the access request message, the stateful RADIUS server performs the usual authentication and authorization process then checks for the existence of a pre-existing data session from the same mobile node (identified by the calling number) (step 6). The stateful RADIUS server locates the data session on PDSN A in its cache and constructs a Class attribute containing the IP address of PDSN A and the Acct-Session-Id of the data session on PDSN A. This Class attribute is appended to the access request message returned to PDSN B (step 7).

Once PDSN B successfully sets up the new data session, it sends an accounting start message to the Stateful RADIUS server (step 8). At this point, the handoff to PDSN B has successfully taken place and the data session on PDSN A is now stale. In accordance with the RADIUS protocol, the Class attribute received by PDSN B in the access accept is returned unmodified to the stateful RADIUS server in this accounting start message. On receipt of the accounting start message, the stateful RADIUS server creates a new session in its cache to track the data session on PDSN B (step 9). It then extracts the IP address and Acct-Session-Id from the Class attribute and updates the state of this stale session in its cache to be that of pending deletion (step 10) before acknowledging the accounting message (step 11).

At the pre-configured interim interval, PDSN A generates the next RADIUS interim update message which contains the metrics for the usage between the last interim update and the handoff to PDSN B (step 12). On receipt of the interim update message, the stateful RADIUS server extracts the Acct-Session-Id and looks up the session in its cache (step 13). The session is found to be marked as pending deletion indicating a handoff has occurred. The stateful RADIUS server deletes the session from its cache (step 14) and generates an accounting record marking it as the final record resulting from the data session on PDSN A (step 15). An acknowledgement for the interim update message is returned to PDSN A.

On receipt of subsequent interim update messages from PDSN A (step 17), the RADIUS server extracts the Acct-Session-Id and looks up the session in its cache (step 18). Since the session is no longer modeled found to be modeled, the RADIUS server determines that is an interim update from a stale session and ignores it.

A further method which addresses the objects outlined above is presented as a message sequence diagram in Figure 2. This message sequence diagram presents an application of the method in a CDMA2000 network using RADIUS as the AAA protocol where the PDSN supports a session termination request from the AAA server. Again the method is applicable to any wireless data network where the AAA protocol provides a context attribute for use by the AAA server and session termination by the AAA server is supported.

It is assumed that a wireless data session has previously been established between the mobile node and the Packet Data Serving Node (PDSN) A and that IP traffic has been exchanged between the two.

At the pre-configured interim interval, PDSN A generates a RADIUS interim update message (step 1). This message contains the Acct-Session-Id attribute which in conjunction with the IP address of the PDSN serves to uniquely identify the data session network-wide. On receipt of the interim update message, the stateful RADIUS server extracts the Acct-Session-Id and looks up the session in its cache (step 2). Since the session is found to be modeled as active, the RADIUS server determines that is an interim update from an active session and an acknowledgement is returned to PDSN A (step 3).

The mobile node then ceases to exchange IP traffic with PDSN A and some time later moves into a dormant state (step 4). While in this dormant state, the mobile node moves outside the area covered by PDSN A into the area covered by PDSN B and the mobile node initiates a data session.

The PDSN B sends a RADIUS access request message to the stateful RADIUS server requesting authorization to setup the data session for the mobile node (step 5). On receipt of the access request message, the stateful RADIUS server performs the usual authentication and authorization process then checks for the existence of a pre-existing data session from the same mobile node (identified by the calling number) (step 6). The stateful RADIUS server locates the data session on PDSN A in its cache and constructs a Class attribute containing the IP address of PDSN A and the Acct-Session-Id of the data session on PDSN A. This Class attribute is appended to the access request message returned to PDSN B (step 7).

Once PDSN B successfully sets up the new data session, it sends an accounting start message to the Stateful RADIUS server (step 8). At this point, the handoff to PDSN B has successfully taken place and the data session on PDSN A is now stale. In accordance with the RADIUS protocol, the Class attribute received by PDSN B in the access accept is returned unmodified to the stateful RADIUS server in this accounting start message. On receipt of the accounting start message, the stateful RADIUS server creates a new session in its cache to track the data session on PDSN B (step 9). It then extracts the IP address and Acct-Session-Id from the Class attribute and sends a session termination request to PDSN A requesting that the stale session be terminated (step 10). On acknowledgement of the session termination (step 11), the AAA server updates the state of this stale session in its cache to be that of pending deletion (step 12) before acknowledging the accounting message (step 13).

Once the stale session is terminated, PDSN A generates a RADIUS stop message which contains the metrics for the usage between the last interim update and the handoff to PDSN B (step 14). On receipt of this stop message, the stateful RADIUS server extracts the Acct-Session-Id and looks up the session in its cache (step 15). The session is found to be marked as pending deletion indicating a handoff has occurred. The stateful RADIUS server generates an accounting record marking it as the final record resulting from the data session on PDSN A (step 16) and deletes the session from its cache (step 17). An acknowledgement for the stop message is then returned to PDSN A (step 18).

While the above applications assume RADIUS as the AAA protocol, the Diameter protocol can also be used with the same effect. Since Diameter was intended to be backwards compatible with RADIUS, the message sequences in the above diagrams remain unchanged but the names of some of the Diameter messages are different. The RADIUS Access-Request message is renamed as AA-Request message in Diameter and the Access-Request message is renamed as AA-Accept in Diameter. For the accounting messages, the Accounting-Request message is unchanged but the Accounting-Response message is renamed as Accounting-Answer in Diameter. The same accounting events (start, interim and stop) are also supported in Diameter. While RADIUS does not have any IETF sanctioned method for session termination, Diameter does provide an Abort-Session-Request message for this purpose. The RADIUS Class attribute is key to the above applications and Diameter also provides a Class AVP with the same specification and behavior. (Ref: Base protocol and NASREQ application)

What is claimed is:-

1. A method of employing the RADIUS Class attribute (or equivalent in other AAA protocols) to identify stale data sessions in mobile networks where the network elements do not support handoff.
2. A method of generating accurate usage metrics for data sessions in mobile networks where the network elements do not support handoff.
3. A method of terminating stale data sessions in mobile networks where the network elements do not support handoff.
4. A method of determining whether an incoming accounting record relates to a stale session.
5. A method of determining whether an incoming accounting record is relevant to a stale session.
6. A method of wireless management in which administrative data is stored in a context attribute field.
7. A method of wireless management incorporating a stateful Radius server.
8. A method of wireless management comprising the step of searching for a pre-existing data session.
9. A packet data serving node for executing the method claims of any one of claims 1 through 8.
10. A system for implementing the method of any one of claims 1 through 8.
11. An apparatus for executing the method of any one of claims 1 through 8.
12. A memory medium storing code executable to perform the method of any one of claims 1 through 8.

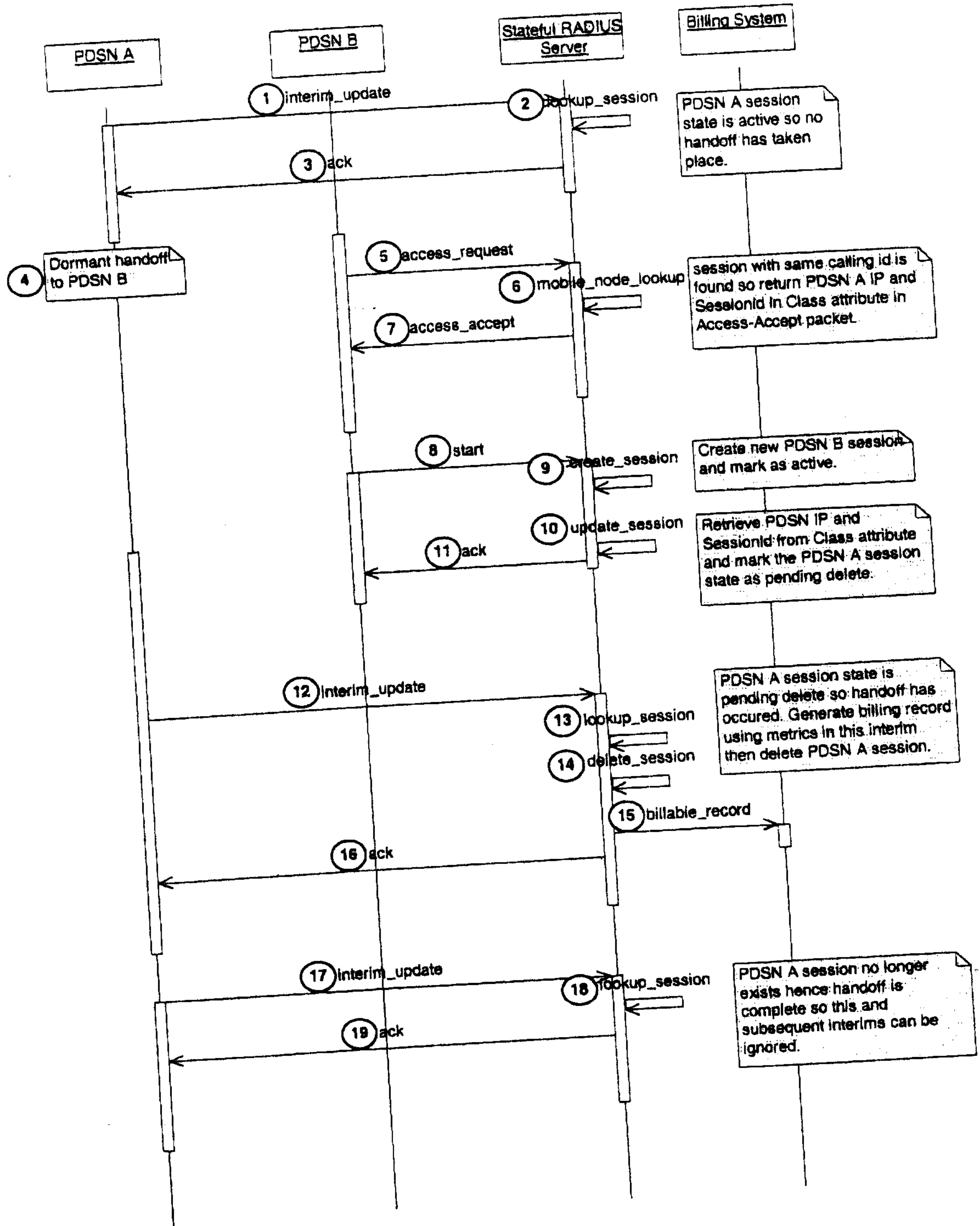


Figure 1:Stale session handling

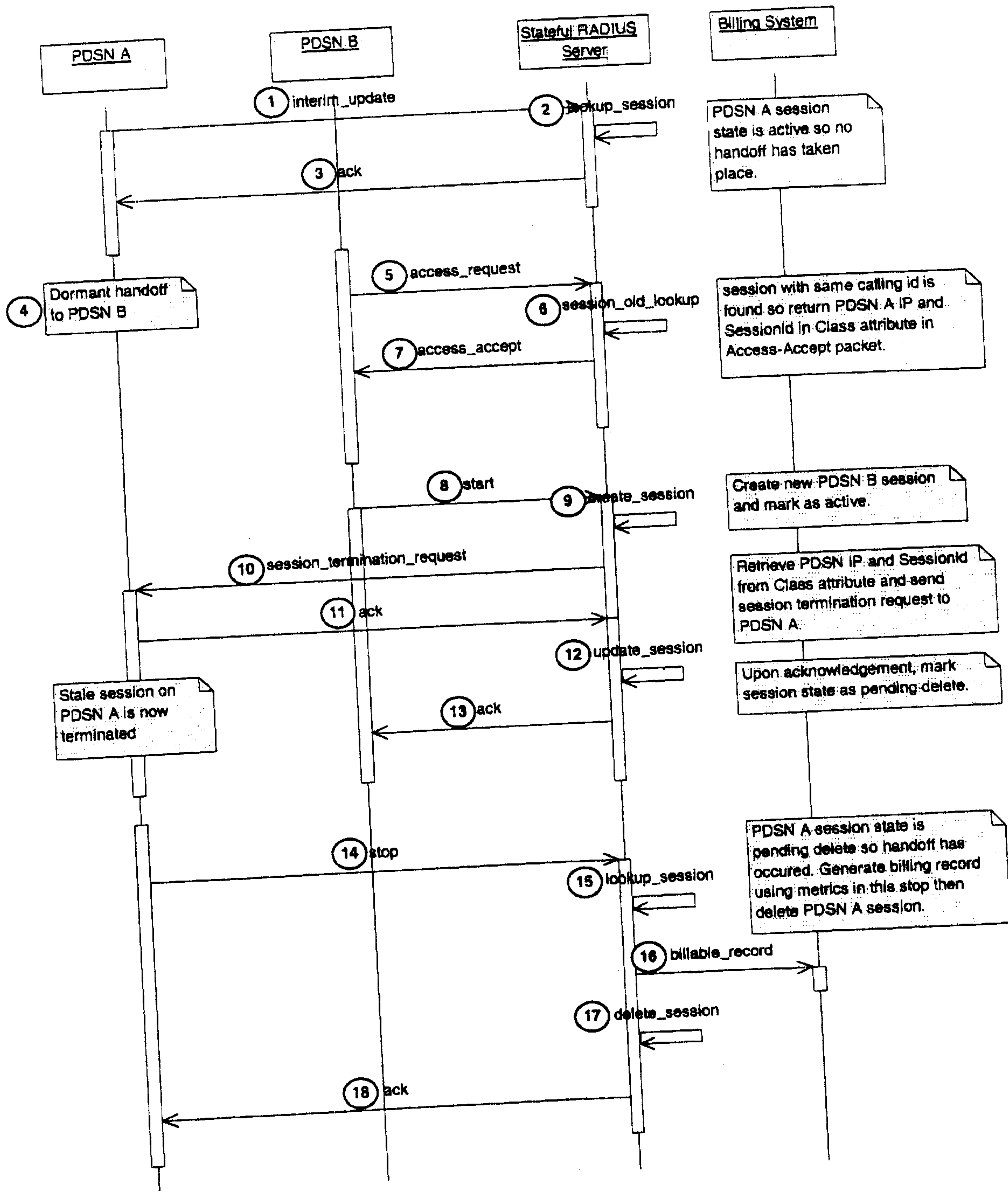
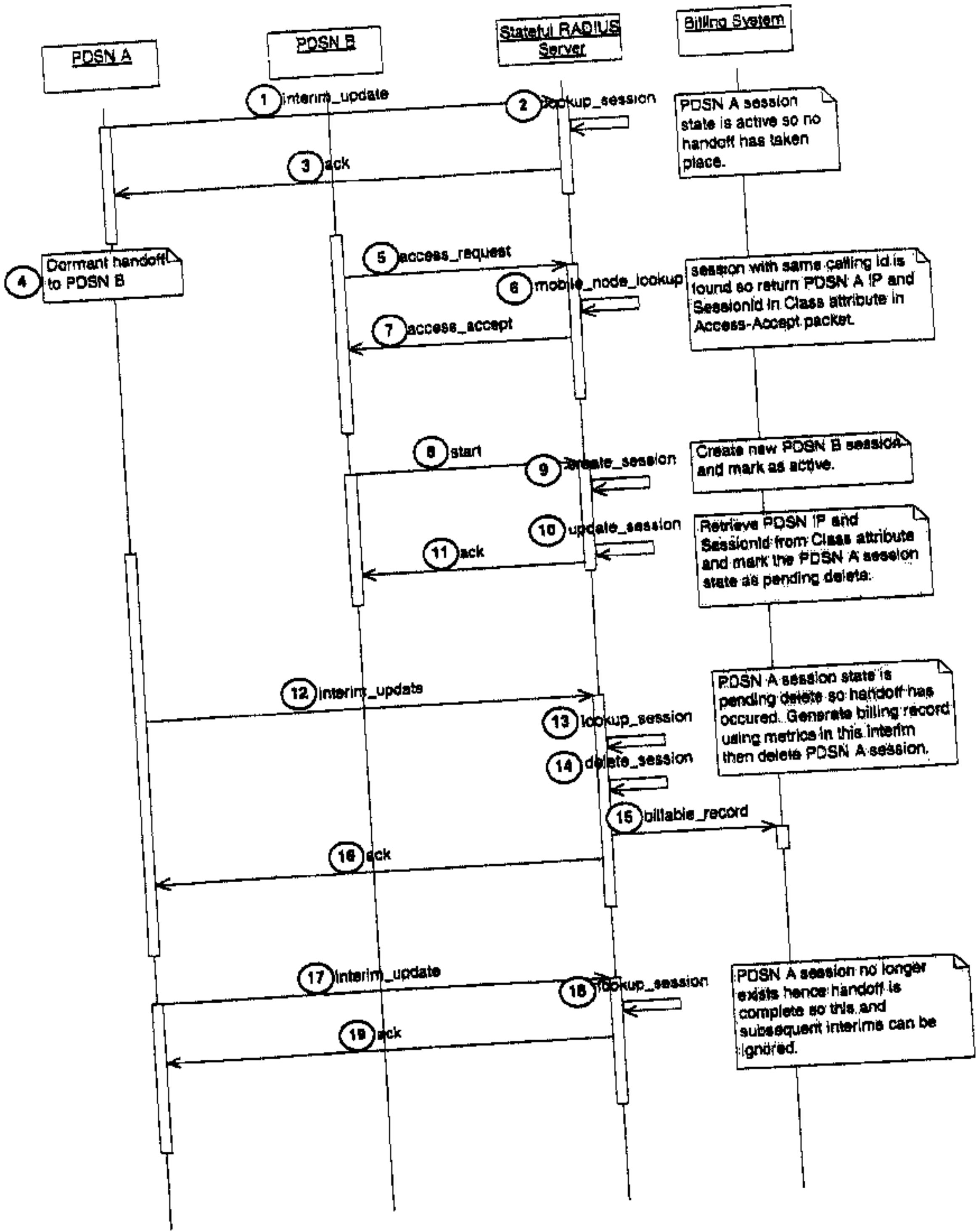


Figure 2: Stale session handling including termination

Application number/ Numéro de demande : 2358083

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Stale session handling