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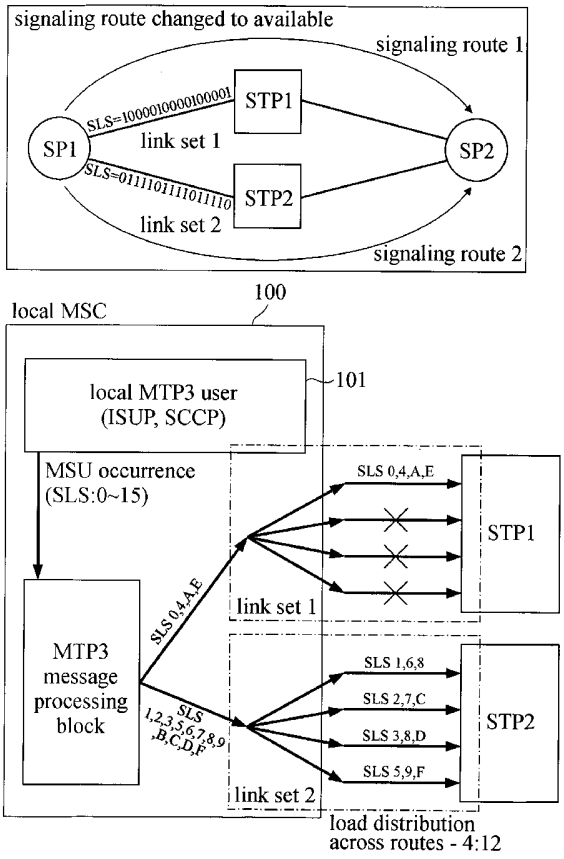
(54) Title: METHOD OF DISTRIBUTING NETWORK TRAFFIC IN A MOBILE COMMUNICATION SYSTEM



(57) Abstract: In the prior art, a switching center distributes network traffic based on the traffic of signaling routes including a plurality of signaling links. Considering that the conventional way of distributing network traffic does not consider the state of individual signaling links in a signaling route and that the network traffic actually occupies signaling links, it can be appreciated that a signaling route can suffer from heavy traffic. This may cause message loss in case the signaling route contains one or more failed signaling links. However, since the switching center of the present invention distributes network traffic based on the number of available signaling links, it is expected that the above problem can be eliminated.

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METHOD OF DISTRIBUTING NETWORK TRAFFIC IN A MOBILE COMMUNICATION SYSTEM

TECHNICAL FIELD

The present invention relates to a method of managing a network when the state of a No. 7 network changes in a mobile communication switching center. More particularly, the present invention, which is related to a method of managing a network when the state of a No. 7 network changes in a mobile communication switching center, enables the network to be stabilized by adjusting network traffic between signaling links according to changes in the network state when signaling links are switched and restored, or when a control-rerouting operation changes.

BACKGROUND ART

In the No. 7 protocol of a conventional mobile communication switching center, each signaling route to a specific signaling point has 16/N (N is the number of the signaling routes) Signaling Link Selection (SLS) bits. This is irrespective of the number of signaling links within a signaling link set of a signaling route. Since a network is designed based on the network traffic in a stable state and the network traffic varies widely by each of the signaling links during the time of a change in the network state (e.g., when a signaling link switching/restoration or a control-rerouting occurs), it is hard to design a network in consideration of the above.

Upon restoration of a signaling link in a link set during a restart process for an adjacent signaling point, all of the traffic assigned to the corresponding link set should be transferred using the single restored signaling link. When switching a signaling link occurs in series of a normal state, the traffic assigned to a link set should be transferred using a small number of signaling links. If the signaling links cannot sustain such traffic, then additional signaling link switching or congestion may occur at the time the network state changes (e.g., a signaling link switching/restoration or a control-rerouting in the No. 7 protocol).

Accordingly, the present invention is directed to resolving the above problems associated with the prior art. The object of the present invention is to provide a method for managing a network, which prevents congestion by ensuring that the network traffic does not vary greatly between each of the signaling links by adjusting SLS bits assigned to each signaling routes. The SLS bits are assigned according to the number of signaling links in each link set at the time of control-rerouting, thereby minimizing message loss.

Further, another object of the present invention is to provide a method for managing a network when the state of a No. 7 network changes in a mobile communication switching center, which improves stability during network state changes. Stability is improved by mitigating load differences between signaling links by adjusting SLS bits between signaling routes according to the number of signaling links in each of the link sets. Stability can be also improved by distributing the SLS bits in each of the link sets during signaling link switching or restoration.

DISCLOSURE OF THE INVENTION

In order to achieve the above objects, a method of distributing traffic uniformly at the time of control-rerouting in a mobile communication switching center including a Message Transfer Part 3 (MTP3) message processing block is provided. The method comprises the steps of:

at the MTP3 message processing block within the switching center, receiving a signal with information that the state of a first signaling link within a link set has changed to available;

at the MTP3 message processing block within the switching center, selecting a signaling route from the link set;

at the MTP3 message processing block within the switching center, calculating the number of signaling links within the link set, wherein said link set comprises signaling routes;

at the MTP3 message processing block within the switching center, determining whether or not signaling links within each of the signaling routes are well-distributed;

if the signal links within each of the signaling routes are not well-distributed, at the MTP3 message processing block within the switching center, assigning to each of the signaling routes Signaling Link Selection (SLS) bits in accordance with the number of signaling links within each of the signaling routes;

at the MTP3 message processing block within the switching center, determining whether the step of distributing the SLS bits has been performed for all signaling routes within the link set; and

if the step of assigning SLS bits has not been performed for all signaling routes, returning to the step of selecting a signaling route from a link set, and otherwise, at the MTP3 message processing block within the switching center, continuing a restart process for an adjacent signaling point or a corresponding

signaling point.

Further, in order to achieve the above objects, a method of distributing traffic uniformly at the time of signaling link switching or restoration in a mobile communication switching center including a Message Transfer Part 3 (MTP3) message processing block is provided. The method comprises the steps of:

at the MTP3 message processing block within the switching center, receiving a signal with information that the state of a first signaling link within a link set has been switched or restored;

at the MTP3 message processing block within the switching center, selecting a signaling route from the link set;

at the MTP3 message processing block within the switching center, calculating the number of signaling links within the link set, wherein said link set comprises signaling routes;

at the MTP3 message processing block within the switching center, determining whether or not signaling links within each of the signaling routes are well-distributed;

if the signal links within each of the signaling routes are not well-distributed, at the MTP3 message processing block within the switching center, assigning to each of the signaling routes Signaling Link Selection (SLS) bits in accordance with the number of signaling links within each of the signaling routes;

at the MTP3 message processing block within the switching center, determining whether the step of assigning the SLS bits has been performed for all signaling routes within the link set; and

if the step of assigning the SLS bits has not been performed for all signaling routes, returning to the step of selecting a signaling route from a link set, and otherwise, at the MTP3 message processing block within the switching center, continuing control-rerouting and a switching/restoring operation for signaling links in the remaining link sets.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a schematic diagram that illustrates a load state of signaling routes and signaling links between STPs in a normal state according to a method for managing a network when the state of a No. 7 network changes in a mobile communication switching center.

Fig. 2 is a schematic diagram that illustrates a load distribution across signaling routes when a link set changes to unavailable or available according to a

conventional method for managing a network.

Fig. 3 is a schematic diagram that illustrates load differences across signaling links within a link set in the case of a load distribution in Fig. 2.

Fig. 4 is a schematic diagram that illustrates a load distribution after a control-rerouting improvement is applied according to a method for managing a network when the state of a No. 7 network changes in a mobile communication switching center in accordance with an embodiment of the present invention.

Fig. 5 is a schematic diagram that illustrates a state after loads are distributed in accordance with the number of signaling links after a control-rerouting improvement is applied in Fig. 4.

Fig. 6 is a flow chart that illustrates a control-rerouting in a method for managing a network when the state of a No. 7 network changes in a mobile communication switching center in accordance with an embodiment of the present invention.

Fig. 7 is a schematic diagram that illustrates switching and restoring of signaling links within a link set according to a method for managing a network when the state of a No. 7 network changes in a mobile communication switching center in accordance with an embodiment of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

In accordance with one embodiment of the present invention, a method of distributing network traffic in a switching center when the state of a No. 7 network changes will now be described in detail with reference to the accompanying drawings.

Fig. 1 is a schematic diagram that illustrates a load state of signaling routes and signaling links between STPs in a normal state according to a method for managing a network when the state of a No. 7 network changes in a mobile communication switching center.

In Fig. 1, load distribution across signaling routes and signaling links is shown when the network is in a normal state and there is no change in a network state. It is assumed that each signaling link set has four signaling links. In the upper figure of Fig. 1, there are two signaling routes from a signaling point SP1 to a signaling point SP2, and eight SLS bits are assigned to each signaling routes. The lower figure of Fig 1 illustrates a load distribution across signaling links within a link set, which comprises signaling routes, and two SLS bits are assigned to each signaling link.

Fig. 2 is a schematic diagram that illustrates a load distribution across signaling routes when a link set changes to unavailable or available according to a conventional method for managing a network. Fig. 3 is a schematic diagram that illustrates a load difference across signaling links within a link set when loads are distributed according to Fig. 2.

First, Fig. 2 illustrates that SLS bits are assigned to each signaling routes when a link set to an adjacent signaling point (STP1) is changed to unavailable and then changed back to available. Looking at the traffic between the signaling routes, the SLS bits pour into one signaling route when the link set is changed to unavailable. Then, the traffic is distributed equally to both signaling routes after the link set is changed back to available.

If the traffic assigned to each of the signaling routes is evenly distributed and only one signaling link is available in the link set, the traffic may be distributed to each of signaling links as shown in the lower figure of Fig. 3. While the traffic to STP 2 is evenly distributed with 2 bits per signaling link, the traffic distributed to a signaling link within the link set to STP 1, having only one available signaling link, amounts to 4 times the traffic distributed to the signaling link within the link set to STP2. The difference will be greater if there is a larger number of signaling links in each of the signaling routes.

Fig. 4 is a schematic diagram that illustrates a load distribution after a control-rerouting improvement is applied according to a method for managing a network when the state of a No. 7 network changes in a mobile communication switching center in accordance with an embodiment of the present invention. While the traffic for signaling routes has become unbalanced, the traffic for each signaling link has become more equivalent with each other. Therefore, if the network is designed to prepare against unstable signaling links, the signaling links will not be changed to unavailable again or congested with traffic.

Fig. 5 is a schematic diagram that illustrates a state after loads are distributed in accordance with the number of signaling links after a control-rerouting improvement is applied in Fig. 4. In Fig.5, signal links within a link set of a route, which is changed to available, are restored and unbalances between signal links are minimized by flexibly controlling SLS bits assigned to each signaling route whenever signaling links are restored.

Now, a method for managing a network when the state of a No. 7 network changes in a mobile communication switching center will be described.

Fig. 6 is a flow chart that illustrates a control-rerouting according to a

method for managing a network when the state of a No. 7 network changes in a mobile communication switching center in accordance with an embodiment of the present invention. First, MTP3 message processing block 102 within switching center 100 receives a signal with information that the state of a first signaling link within a link set has changed to available (S1). Next, MTP3 message processing block 102 within switching center 100 selects a signaling route from the link set (S2). MTP3 message processing block 102 within switching center 100 calculates the number of signaling links within the link set, wherein said link set comprises signaling routes (S3). MTP3 message processing block 102 within switching center 100 determines whether or not signaling links within each of the signaling routes are well-distributed (S4).

If the signal links within each of the signaling routes are not well-distributed, MTP3 message processing block 102 within switching center 100 assigns to each of the signaling routes Signaling Link Selection (SLS) bits in accordance with the number of signaling links within each of the signaling routes (S5). MTP3 message processing block 102 within switching center 100 determines whether the step of distributing the SLS bits has been performed for all signaling routes within link sets (S6). If the step of distributing the SLS bits has not been performed for all signaling routes, the step of selecting a signaling route within a link set is performed (S7). If signaling links within each of the signaling routes are well-distributed, MTP3 message processing block 102 within switching center 100 assigns SLS bits of the normal state to each of the signaling routes. Otherwise, it continues a restart process for an adjacent signaling point or a corresponding signaling point (S8).

Fig. 7 is a schematic diagram that illustrates switching and restoring of signaling links within a link set according to a method for managing a network when the state of a No. 7 network changes in a mobile communication switching center in accordance with an embodiment of the present invention. First, MTP3 message processing block 102 within switching center 100 receives a signal with information that the state of a first signaling link within a link set has been switched or restored (S11). Next, MTP3 message processing block 102 within switching center 100 selects a signaling route from the link set (S12). MTP3 message processing block 102 within switching center 100 calculates the number of signaling links within the link set, wherein said link set comprises signaling routes (S13). MTP3 message processing block 102 within switching center 100 determines whether or not signaling links within each of the signaling routes are well-distributed (S14).

If the signal links within each of the signaling routes are not well-distributed,

MTP3 message processing block 102 within switching center 100 assigns to each of the signaling routes Signaling Link Selection (SLS) bits in accordance with the number of signaling links within each of the signaling routes (S15). MTP3 message processing block 102 within switching center 100 determines whether the step of assigning the SLS bits has been performed for all signaling routes within link sets (S16). If the step of assigning the SLS bits has not been performed for all signaling routes, the step of selecting a signaling route within a link set is performed (S17). If signaling links within each of the signaling routes are well-distributed, MTP3 message processing block 102 within switching center 100 assigns SLS bits of the normal state to each of the signaling routes. Otherwise, it continues control-rerouting and a switching/restoring operation for signaling links in the remaining links sets (S18).

INDUSTRIAL APPLICABILITY

As described above, according to a method of the present invention for managing a network when the state of a No. 7 network changes in a mobile communication switching center, it is possible to stabilize a network by adjusting network traffic between signaling links according to changes in the network state when signaling links are switched and restored, or when a control-rerouting operation changes. Accordingly, removing load difference across signaling links, which can be caused from equal load distribution across signaling routes, can increase stability when network state changes, and a link set can change quickly to available without congestion or unavailability. This minimizes message loss.

CLAIMS

1. A method of distributing network traffic at a switching center including a Message Transfer Part 3 (MTP3) message processing block, said method comprising the steps of:

receiving a signal with information that the state of a first signaling link within a link set has changed to available;

selecting a signaling route from the link set;

calculating the number of signaling links within the link set, wherein said link set comprises signaling routes;

determining whether or not signaling links within each of the signaling routes are well-distributed; and

if the signal links within each of the signaling routes are not well-distributed, assigning to each of the signaling routes Signaling Link Selection (SLS) bits in accordance with the number of signaling links within each of the signaling routes.

2. The method as defined in claim 1, further comprising assigning SLS bits of the normal state to each of the signaling routes if signaling links within each of the signaling routes are well-distributed.

3. A method of distributing network traffic at a switching center including a Message Transfer Part 3 (MTP3) message processing block, said method comprising the steps of:

receiving a signal with information that the state of a first signaling link within a link set has been switched or restored;

selecting a signaling route from the link set;

calculating the number of signaling links within the link set, wherein said link set comprises signaling routes;

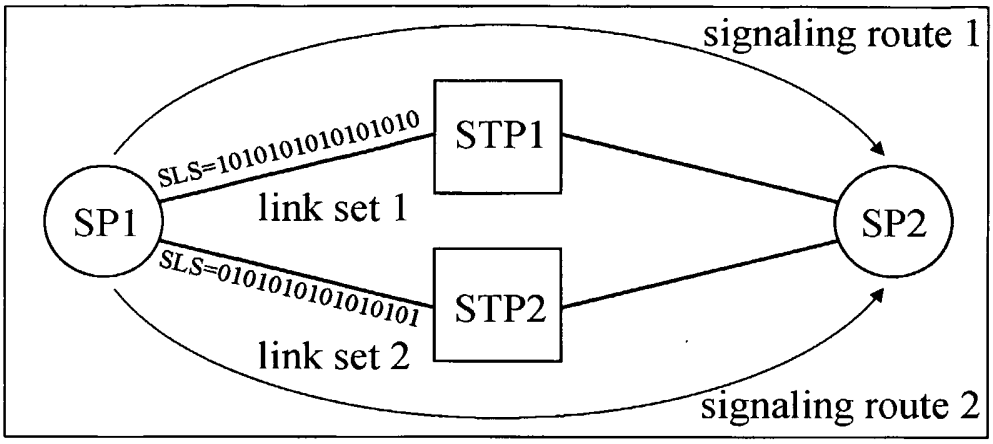
determining whether or not signaling links within each of the signaling routes are well-distributed; and

if the signal links within each of the signaling routes are not well-distributed, assigning to each of the signaling routes Signaling Link Selection (SLS) bits in accordance with the number of signaling links within each of the signaling routes.

4. The method as defined in claim 3, further comprising assigning SLS bits of the normal state to each of the signaling routes if signaling links within each of the

signaling routes are well-distributed.

Fig. 1


signaling route 1
SLS=1010101010101010
STP1
SP1
link set 1
SP2
SLS=0101010101010101
STP2
link set 2
signaling route 2

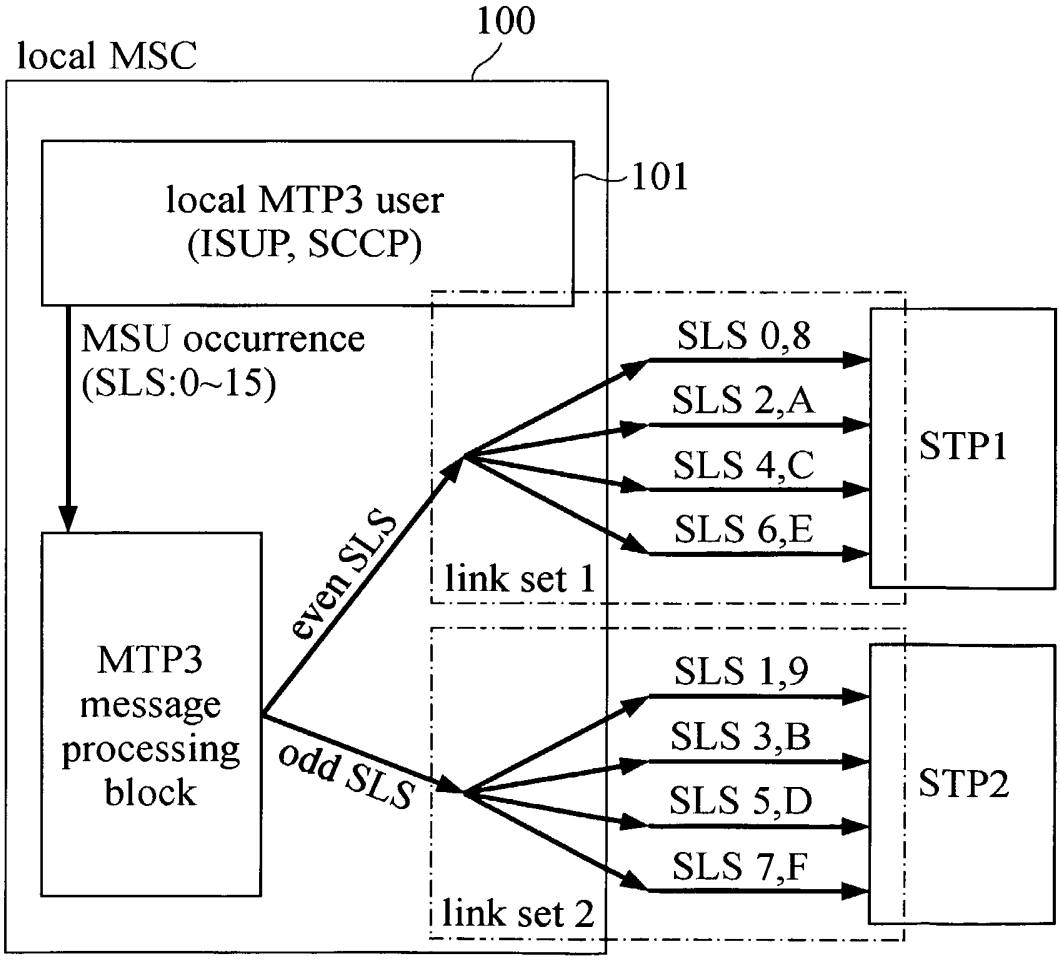

100
local MSC
local MTP3 user
(ISUP, SCCP)
101
MSU occurrence
(SLS:0~15)
MTP3
message
processing
block
even SLS
odd SLS
SLS 0,8
SLS 2,A
SLS 4,C
SLS 6,E
link set 1
STP1
SLS 1,9
SLS 3,B
SLS 5,D
SLS 7,F
link set 2
STP2

Fig. 2

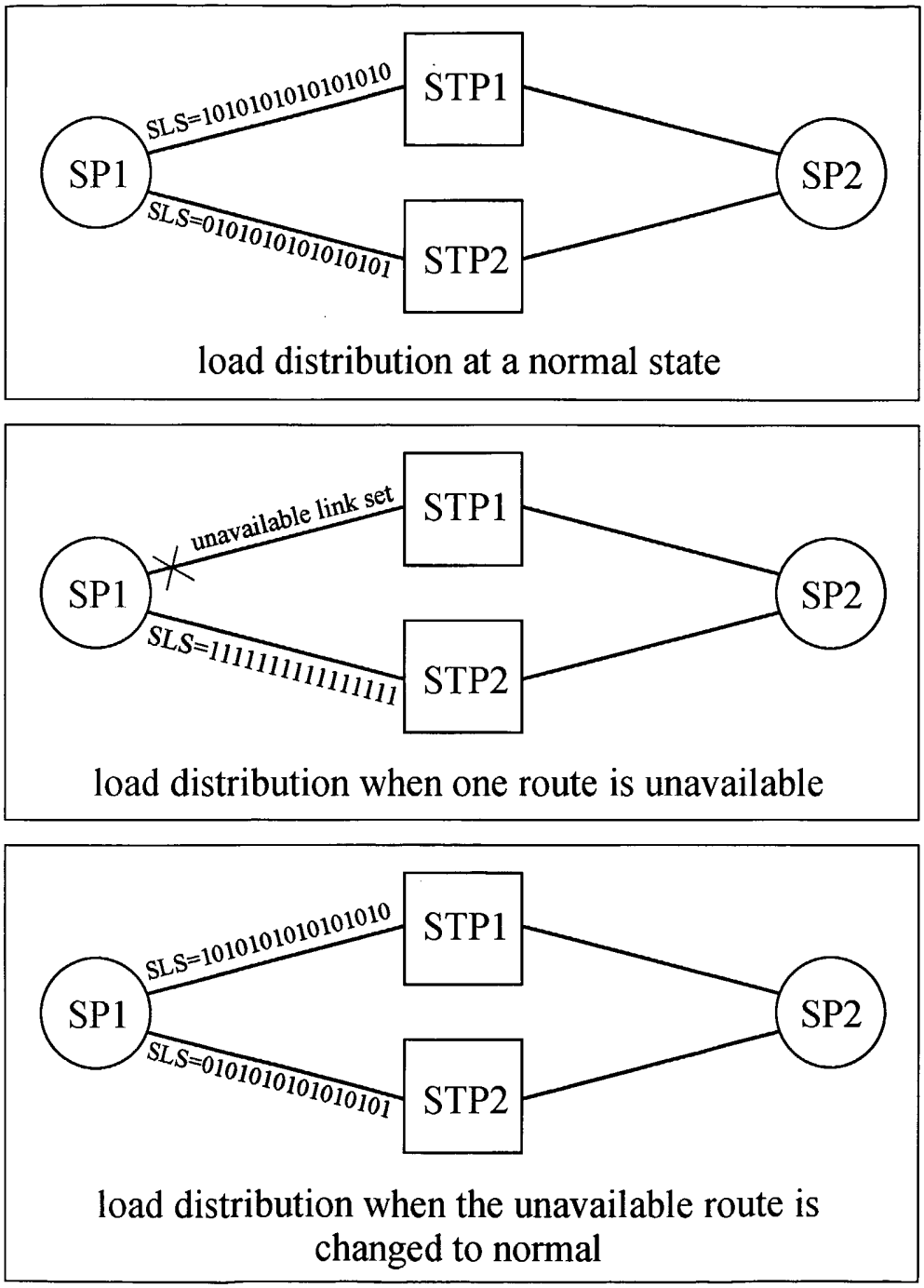

SLS=1010101010101010
SLS=0101010101010101
SP1
STP1
STP2
SP2
load distribution at a normal state
unavailable link set
SLS=1111111111111111
load distribution when one route is unavailable
load distribution when the unavailable route is changed to normal

Fig. 3

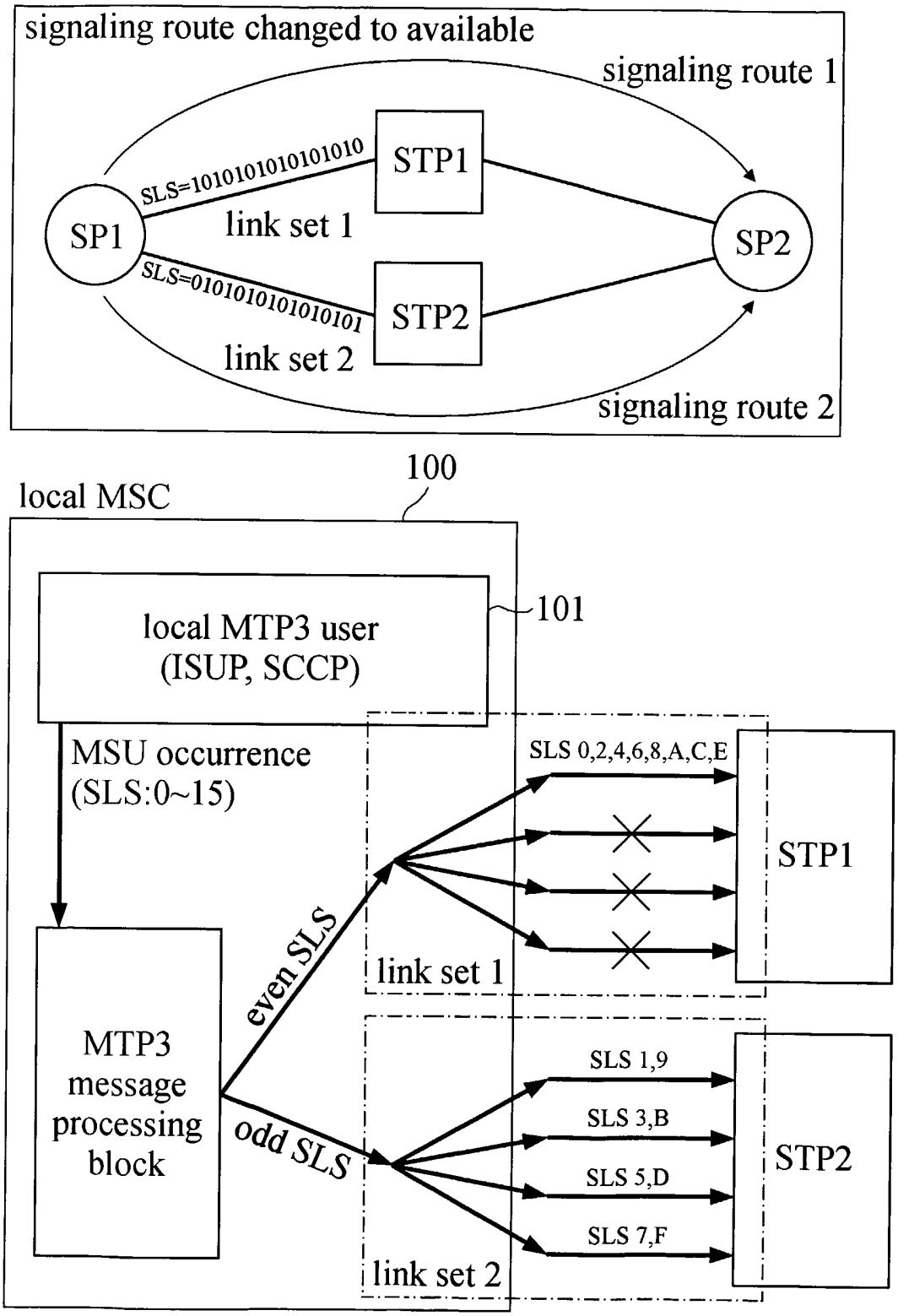
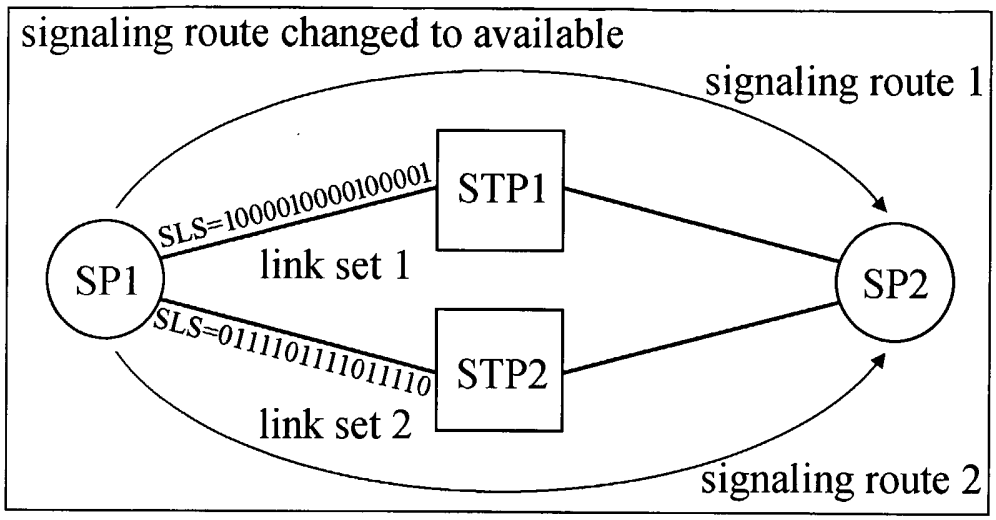
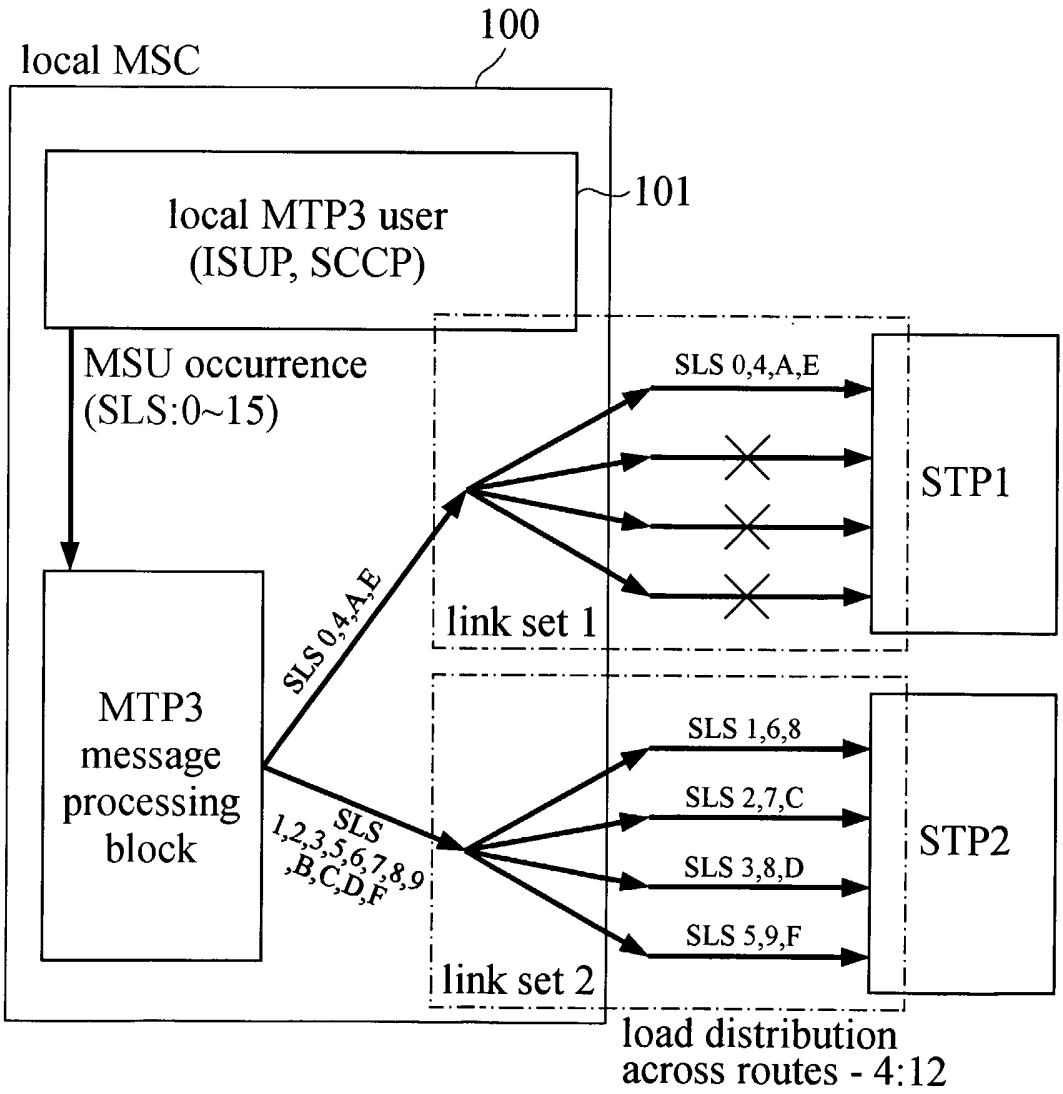

signaling route changed to available
signaling route 1
SLS=1010101010101010
STP1
SP1
link set 1
SP2
SLS=0101010101010101
STP2
link set 2
signaling route 2
100
local MSC
local MTP3 user
(ISUP, SCCP)
101
MSU occurrence
(SLS:0~15)
SLS 0,2,4,6,8,A,C,E
STP1
even SLS
link set 1
MTP3
message
processing
block
odd SLS
SLS 1,9
SLS 3,B
SLS 5,D
SLS 7,F
STP2
link set 2

Fig. 4


signaling route changed to available
signaling route 1
SLS=1000010000100001
STP1
SP1
link set 1
SP2
SLS=0111101111011110
STP2
link set 2
signaling route 2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local MTP3 user
(ISUP, SCCP)
101
MSU occurrence
(SLS:0~15)
SLS 0,4,A,E
STP1
link set 1
MTP3
message
processing
block
SLS 0,4,A,E
SLS
1,2,3,5,6,7,8,9
,B,C,D,F
SLS 1,6,8
SLS 2,7,C
SLS 3,8,D
SLS 5,9,F
STP2
link set 2
load distribution
across routes - 4:12

Fig. 5

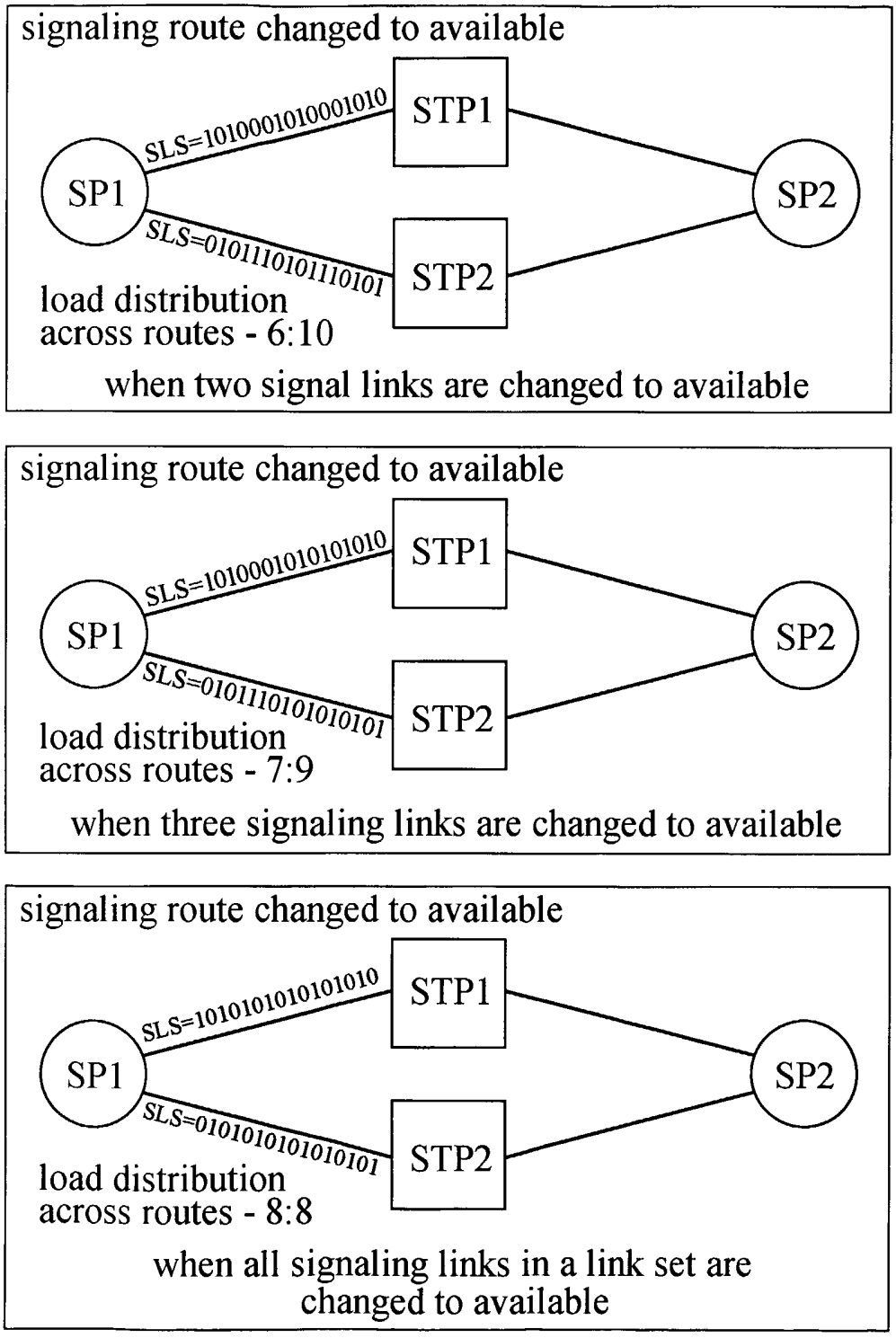

signaling route changed to available
SLS=1010001010001010
SLS=0101110101110101
STP1
STP2
SP1
SP2
load distribution
across routes - 6:10
when two signal links are changed to available
signaling route changed to available
SLS=1010001010101010
SLS=0101110101010101
STP1
STP2
SP1
SP2
load distribution
across routes - 7:9
when three signaling links are changed to available
signaling route changed to available
SLS=1010101010101010
SLS=0101010101010101
STP1
STP2
SP1
SP2
load distribution
across routes - 8:8
when all signaling links in a link set are
changed to available

Fig. 6

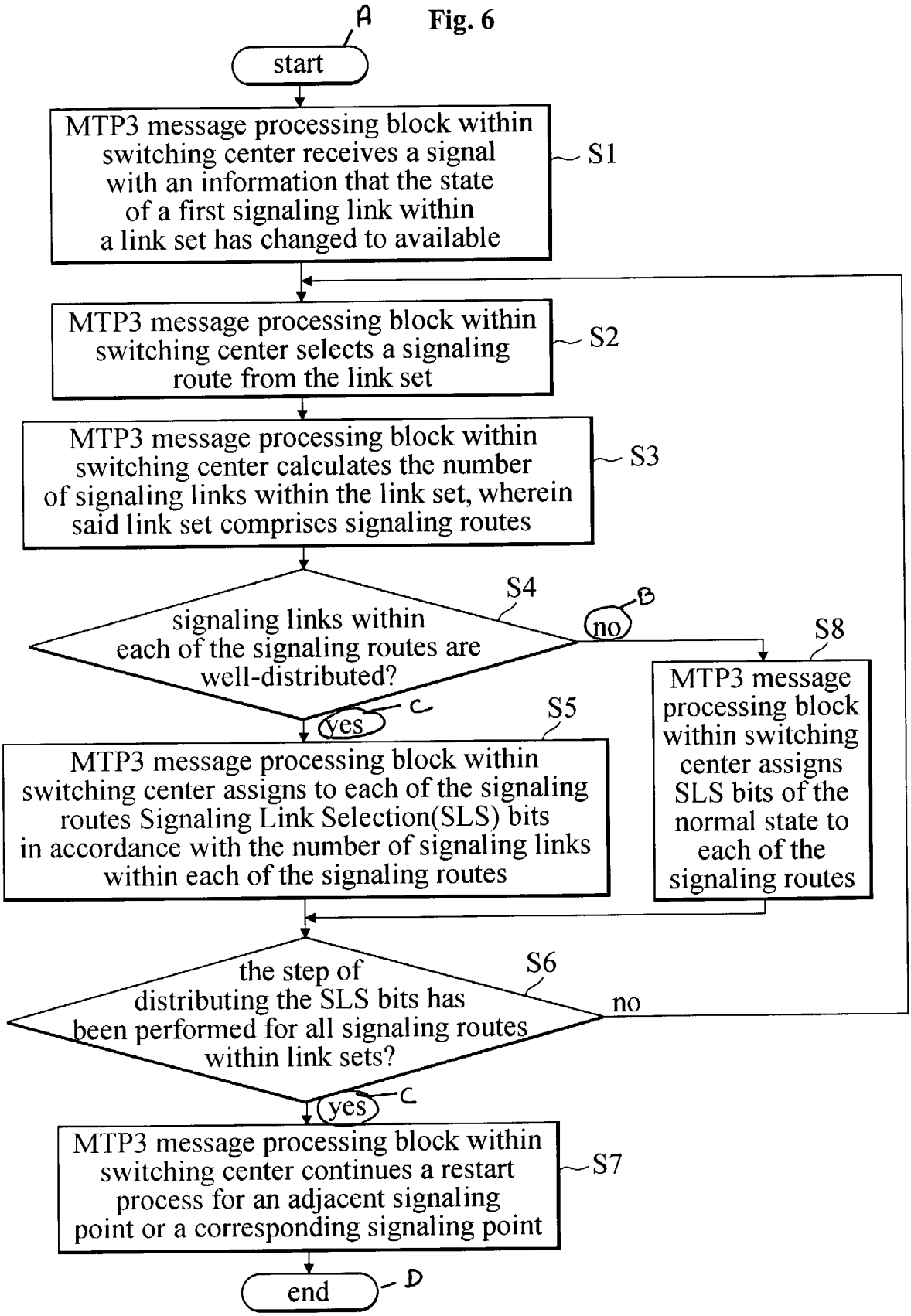
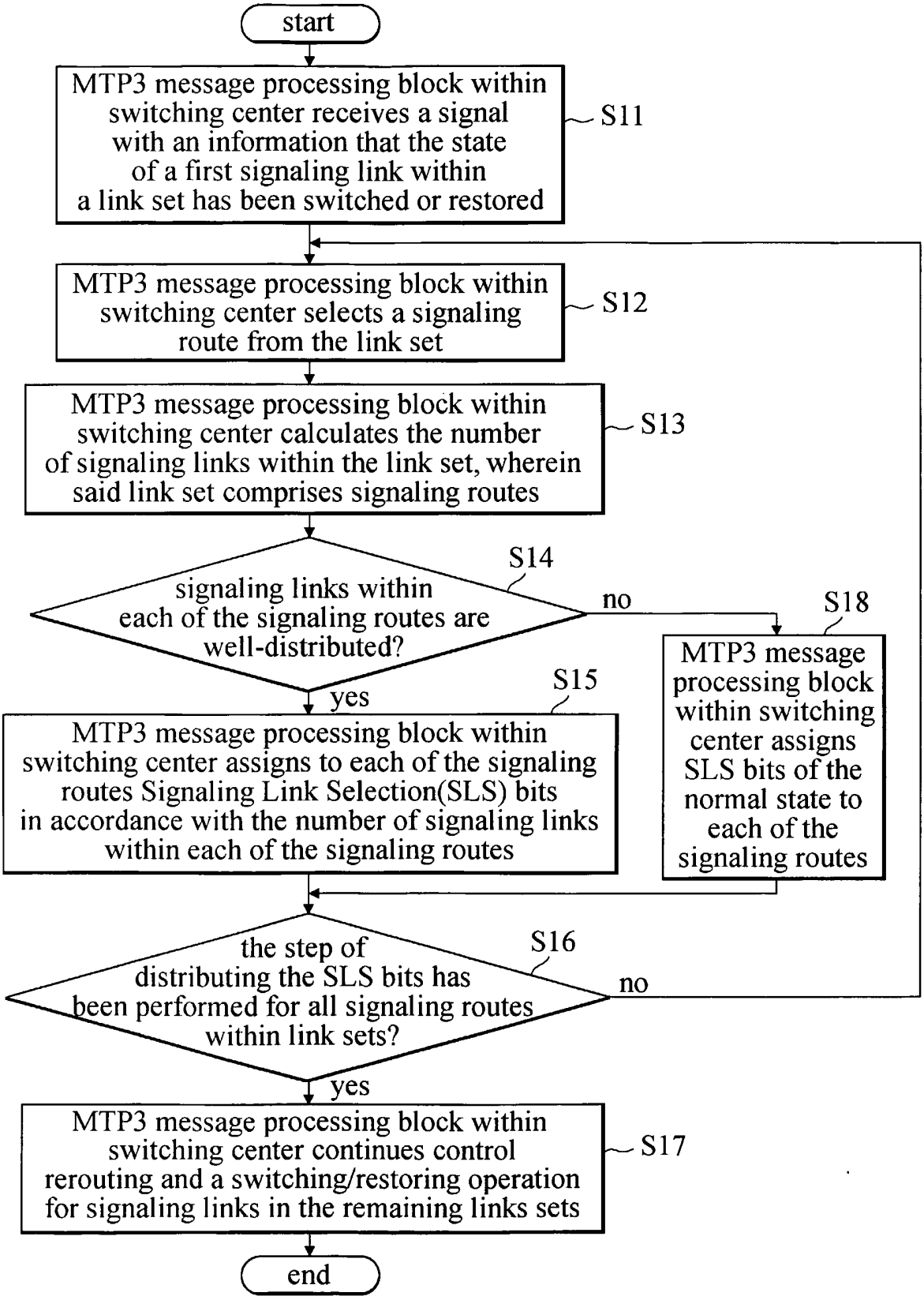

A
start
MTP3 message processing block within switching center receives a signal with an information that the state of a first signaling link within a link set has changed to available
S1
MTP3 message processing block within switching center selects a signaling route from the link set
S2
MTP3 message processing block within switching center calculates the number of signaling links within the link set, wherein said link set comprises signaling routes
S3
S4
signaling links within each of the signaling routes are well-distributed?
B
no
S8
MTP3 message processing block within switching center assigns SLS bits of the normal state to each of the signaling routes
C
yes
S5
MTP3 message processing block within switching center assigns to each of the signaling routes Signaling Link Selection(SLS) bits in accordance with the number of signaling links within each of the signaling routes
S6
the step of distributing the SLS bits has been performed for all signaling routes within link sets?
no
C
yes
MTP3 message processing block within switching center continues a restart process for an adjacent signaling point or a corresponding signaling point
S7
end
D

Fig. 7


start
MTP3 message processing block within switching center receives a signal with an information that the state of a first signaling link within a link set has been switched or restored
S11
MTP3 message processing block within switching center selects a signaling route from the link set
S12
MTP3 message processing block within switching center calculates the number of signaling links within the link set, wherein said link set comprises signaling routes
S13
S14
signaling links within each of the signaling routes are well-distributed?
no
S18
MTP3 message processing block within switching center assigns SLS bits of the normal state to each of the signaling routes
yes
S15
MTP3 message processing block within switching center assigns to each of the signaling routes Signaling Link Selection(SLS) bits in accordance with the number of signaling links within each of the signaling routes
S16
the step of distributing the SLS bits has been performed for all signaling routes within link sets?
no
yes
MTP3 message processing block within switching center continues control rerouting and a switching/restoring operation for signaling links in the remaining links sets
S17
end

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2004/001310

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H04Q 3/42

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC7 H04Q 3/42

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Patents and applications for inventions since1975
Korean Utility models and applications for Utility models since1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)
eKIPASS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR2002-0000653A (LG INFORMATION TELECOMMUNICATION CO.,LTD.)05.JAN.2002 see the whole document.	1-4
Y	KR2001-0028091 A(LG INFORMATION TELECOMMUNICATION CO.,LTD)06.APR.2001 see the whole document.	1-4
A	US6515985 B2(AIRSLIDE SYSTEMS LTD.)04.FEB.2003 see the whole document	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 SEPTEMBER 2004 (17.09.2004)	**17 SEPTEMBER 2004 (17.09.2004)**

Name and mailing address of the ISA/KR
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Information on patent family members

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