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(54) Title: Adaptation of WAP to SMS in PDC networks

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"Adaptation of WAP to SMS in PDC Networks"

INTRODUCTION

Field of the Invention

The invention relates to provision of WAP functionality in PDC networks.

Prior Art Discussion

It is recognised that Short Message Service Centres (SMSCs) are suitable bearers for WAP content between WAP gateways and mobile handsets where the applications require low bandwidth or where interactive responses are not required. Short messaging is particularly attractive for "push" WAP applications because it offers an intuitive and inexpensive bearer for WAP data. Other advantages of using short messaging for WAP delivery are:

the existing infrastructure for legacy handsets is used,

it is a reliable high-performance bearer when radio conditions are poor,

it allows effective user authentication,

it is easily scaleable, and

it represents efficient use of network resources.

It is therefore an object of the invention to provide a system and method for effective use of SMS in PDC for WAP communication.

SUMMARY OF THE INVENTION

According to the invention, there is provided a method for communication of WAP content in a PDC mobile network, the method comprising the steps of:-

a WAP server using a short message entity interface to communicate WAP content in short messages to an SMSC, and

the SMSC communicating with a mobile handset over the PDC mobile network to transfer WAP content in short messages.

In one embodiment, signalling between the SMSC and the mobile handsets uses source port, destination port, and segmentation and reassembly fields.

In one embodiment, a teleservice identifier data element is used for submission and delivery of short messages, whereby different handset formats are catered for.

In one embodiment, concatenated messaging teleservice identifiers are used to provide concatenated messages which are fragments of WDP packet requiring reassembly.

In another embodiment, a message number is used to uniquely reference all the fragments in one larger segmented packet.

In a further embodiment, the message number parameter is a two-octet integer.

In a further embodiment, sequence number and maximum sequence number fields are used to indicate the sequential order of each fragments and the maximum number of fragments.

Preferably, originating and destination sub-addresses are present in submit and delivery Protocol Data Units (PDUs) to allow port level addressing.

In one embodiment, communication between the WAP server and the SMSC uses a tunnelling protocol based on the standard SMPP protocol.

In one embodiment, a multi-part message parameter in the format of a Tag-Length-Value parameter is used to specify a message number, a sequence number , and maximum sequence number for mapping to signalling between the SMSC and the mobile handsets.

In another embodiment, the tunnelling protocol between the WAP server and the SMSC maps sub-addresses of the handset-side communication for port level addressing on the server side.

In one embodiment, the SMSC incorporates a delay to reduce total latency when delivering multiple messages to a handset.

In a further embodiment, the SMSC uses express messaging functionality for transfer of WAP content to a mobile handset.

In one embodiment, the SMSC uses simple segmentation to deliver a plurality of messages in a single call attempt.

In one embodiment, the SMSC transmits overlength messages with a forward call indicator or a backward call indicator and the receiving entity sets a timer to receive the full set of messages.

Preferably, the SMSC processes mobile-originating express messages on a per-ATM (application interface module) basis.

In one embodiment, the SMSC recognizes sub-unit sub-addresses.

In a further embodiment, the SMSC uses a sub-address field passed as a key by a mobile handset for a destination WAP server IP address to avoid the need for encryption.

DETAILED DESCRIPTION OF THE INVENTION

Brief Description of the Drawings

The invention will be more easily understood from the following description of some embodiments thereof given by way of example only with reference to the accompanying drawings in which:

Fig. 1 is a schematic representation of the architecture for use of SMS for WAP in a PDC network; and

Figs. 2 to 4 are sample signalling sequences.

Description of the Embodiments

Referring to Fig. 1, there is illustrated an architecture for WAP communication between mobile handsets 1 and a WAP proxy server 20 via a Short Message Service Centre (SMSC) 10. The layered structure of the handset 1 comprises:

2: WAE (Wireless Application Entity),
3: WSP (Wireless Session Protocol),
4: WTP (Wireless Transaction Protocol),
5: WDP (Wireless Datagram Protocol) and Adaptation,

6: A Short Message Transfer Protocol (SMTP) interface developed for the system.

The SMSC 10 comprises a kernel 1 providing the core SMSC functionality. A MN-AIM (mobile network application interface module) 12 interfaces with the SMTP interface 6 of the mobile handsets 1.

An SMPP-AIM (Short Message Peer-to-Peer application interface module) 12 interfaces with the server 20 via a sub-network layer 14 which in this embodiment is TCP/IP, but could alternatively be a different protocol such as X.25.

On the server 20 the layers are:

an application layer 21,
a WSP layer 22,
a WTP layer 23,
a WDP & adaptation layer 24
a WAP IGW (inter-working gateway) 25, and
a physical sub-network 26, in this embodiment TCP/IP.

The IGW 25 communicates with the SMPP-AIM 13 via the sub-network using SMPP over TCP.

The SMSC 10 communicates with the mobile handsets 1 using SMTP, supporting 128 octets of user data for short messages. The SMTP signalling uses Source Port, Destination Port, and Segmentation and Reassembly fields, as described below.

The Short Message Transfer Protocol defines a 'Telematic Identifier' data element to submit to and deliver short messages from the SMSC 10. This mechanism allows the format of handsets to differ through the addition or deletion of data elements.

Concatenated Messaging Telematic Identifiers are used to provide concatenated messages which are fragments of a larger WDP packets that requires reassembly. The Telematic Identifier is specified in a teleservice field. A Message Number parameter is used to uniquely reference all the fragments in one larger segmented packet. It is equivalent to a concatenated short message. The Message Number parameter in the SMTP is a two octet integer and all fragments use a two octet Message Number. Sequence Number and Maximum Sequence Number fields are used to indicate the sequence number of the fragment and the total number of fragments in the message respectively.

In this embodiment, there is a maximum of 255 fragments which can be reassembled together on the handset. As the userData field allows a maximum of 128 octets per short message, the maximum data payload when reassembled is 32,640 octets. The Short Message Transfer Protocol defines one octet for the Maximum Sequence Number field, so there are a maximum of 255 fragments allowed.

Regarding Port Level Addressing, origSubAddr and destSubAddr Short Message Transfer Protocol fields specify the originating sub-address and destination sub-address values for message delivery respectively. Both fields are present in both the MT-SUBMIT and MT-DELIVER PDUs (Protocol Data Units), allowing port level addressing to be specified for both Mobile Originated and Mobile Terminated messages. Both fields are two octets in length, for both MT_SUBMIT and MT-DELIVER PDUs.

"Short Message Entity-Interface (SME-IF)" protocol is a term used to describe the protocol between the SMSC 10 and an external entity submitting and receiving messages, in this embodiment the server 20. The SME-IF tunnelling protocol is based on the Short Message Peer to Peer protocol [SMPP™], available from Logica Aldiscon.

Segmentation and Reassembly in SMPP tunnelling protocol for PDC SMS

When sending segmented messages from the WAP Proxy/Server 20 across the SMSC 10, the segmentation and reassembly parameters are specified in the SMPP tunnelling protocol used between the WAP Proxy/Server and the SMSC. For Mobile Terminated messages, they are then mapped by the SMSC 10 from the SMPP tunnelling protocol to the Short Message Transfer Protocol, and then reassembled on the handset 1. For Mobile Originated messages, the WAP Proxy/Server 20 must reassemble the fragments before passing the WDP packet up the WAP stack. A PDC_MultiPartMessage optional parameter is defined to allow segmented messages to be specified. A PDC_MultiPartMessage parameter is in the format of a Tag-Length-Value parameter. The Value field in the PDC_MultiPartMessage parameter contains Message Number, Sequence Number and Maximum Sequence Number fields, which map to Short Message Transfer Protocol fields of the same name. The SMPP protocol will automatically map the SMPP PDC_MultiPartMessage parameters to and from the appropriate Short Message Transfer Protocol parameters.

Port level addressing in SMPP tunnelling protocol

The optional SMPP Subaddress Extended Facility defines Originator_SubAddr and Destination_SubAddr optional parameters. These parameters allow specification of port level addressing for PDC short messages. These parameters are available in both the submit_sm and deliver_sm PDUs, allowing specification of port level addressing for both Mobile Originated and Mobile Terminated messages across SMPP. The Originator_SubAddr and Destination_SubAddr parameters are in the format of Tag-Length-Value parameters. The first octet of the Value field specifies the SubAddress Type, which should be set to PDC Subaddress (0x01). There are then two following octets used to specify the port:

the WDP Source Port in the Originator_SubAddr, and

the WDP Destination Port in the Destination_SubAddr parameter.

The SMPP protocol automatically maps the SMPP Originator_SubAddr and Destination_SubAddr parameters to and from the Short Message Transfer Protocol parameters origSubAddr and destSubAddr respectively.

WAP applications make use of the concatenation feature of the Short Message Transfer Protocol, to allow amounts of data greater than 128 octets to be delivered to users. The SMSC 10 incorporates a delay feature in the Mobile Network AIM. The object of this delay is to avoid the scenario whereby when delivering more than one short message to a handset, the handset is busy when an attempt is made to deliver the second message. This feature reduces the total latency in delivering multiple messages to a handset, which is very important for interactive WAP applications, and avoids superfluous delivery attempts by the SMSC.

The SMSC Express Messaging functionality is suitable for interactive WAP applications. Express Messaging provides higher throughput of messages through an SMSC because it avoids the overhead of writing to a database and dealing with retry schemes. A single attempt is made to deliver the message. The WTP layer in a WAP stack is expected to provide the reliability required when running WAP applications over Express Messaging.

The Simple Segmentation procedure allows more than a single short message to be delivered in a single call attempt. This reduces the time taken to deliver multiple messages, as well as allowing operators to increase the maximum number of segments allowed in a concatenated message, thereby helping to address both latency and bandwidth concerns.

An IAM message is used to transport the SMTP mobile terminated and mobile originated messages between the SMSC and an MSC. A segmentation message (SGM) is used to convey an additional segment of an overlength IAM message as those which are longer than 272 octets but less than 544 octets. The 272 octet restriction is due to the MTP layer restrictions. The procedure can be summarised as follows:

If an IAM message length is greater than 272 octets and less than 544 octets then a segmentation message SGM will be sent. However the overlength message must contain either one of the following parameters:

- Optional Forward Call Indicators
- Optional Backward Call Indicators

The sending entity will set the Simple Segmentation Indicator in either the Optional Forward Call Indicators or Optional Backward Call Indicators parameter. The receiving entity upon receipt of an IAM message with the Simple Segmentation Indicator set to indicate additional information will set a timer T34 and wait to receive the SGM message. It may be possible to use a combination of IAM and SGM messages to allow for longer user data lengths.

The SMTP protocol allows for longer messages. The SMSC 10 supports longer message lengths in the SMPP AIM, in the kernel, and in the Mobile Network AIM. The SMSC Mobile Network AIM supports receiving of SGM messages. It also supports sending of SGM messages for overlength IAM messages. To allow segmentation the optional Forward Call Indicators or the optional Backward Call Indicators are included in the IAM message. The current ISUP specification for SMS between the MSC and SMSC defines these optional parameters for an outbound IAM.

The MSCs must support sending and receiving SGM messages as appropriated. For an Outbound IAM from the MSC to the SMSC the Optional Forward Call Indicators parameter is currently present. An ISUP IAM and SGM message combination will map to a single RCR air interface SETUP message. The MSC must support the optional Forward or Backward Call Indicators. The mobile handsets must support handling of extended user data message lengths.

Referring to Figs. 2 to 5 example signalling sequences are illustrated. The signals are as follows.

IAM:	Initial Access Message with phone numbers and SM data.
EACM:	Early Address Complete Message, in response to IAM.
REL:	Release, sent by handset for termination of call used to send the SM.
RLC:	Release confirm.

On the handset side:

Setup is the equivalent of an IAM message in the radio domain.

DISC: Disconnect, is the equivalent of Release.

Fig. 2 shows mobile-terminated calls. Fig. 3 shows a mobile-terminated call using an SGM message for messages longer than 270 bytes and requiring segmentation. Figs. 4 and 5 are equivalent to Figs. 2 and 3, for mobile-originated sessions.

The following is sample WAP content. Estimations of sizes of the content source, which is shown below, and compiled versions, which would be sent over the air, are included. They assume 8 bit characters are being used, using UTF-8 encoding. The size estimations do not take into account the overhead that would be added by the WAP stack.

The size of the WML source shown below is approximately 600 bytes. The estimated size of the binary version that would get sent over the air is approximately 318 bytes.

```
<?XML VERSION="1.0"?>
<!DOCTYPE WML PUBLIC "-//WAPFORUM//DTD WML 1.0//EN">
<WML>
<CARD NAME="TdpHomePage" TITLE="TDP Home Page">
Tokyo Digital Phone provides mobile phone services to over 1 million
people in Tokyo. Services includes Skyweb & Skywalker.
<DO TYPE="ACCEPT" LABEL="Contact Us">
<GO URL="#ContactTdp">
</GO>
</DO>
</CARD>
<CARD NAME="ContactTdp" TITLE="Contacting TDP">
To contact TDP please:<BR/>
Call +81-3-5360-2000<BR/>
Or Email marketing@skyproject.com
</CARD>
</WML>
```

The following is a sample email notification application. The size of the WML source shown below is approximately 340 bytes. The estimated size of the binary version that would get sent over the air is approximately 150 bytes. The source below assumes the following:

- A WTA server is available in the network.

- The WTA server incorporates a table mapping the source email address to telephone numbers, where possible, to allow the browser to prompt the user to call the originator of the email message.

```
<?XML VERSION="1.0"?>
<!DOCTYPE WML PUBLIC "-//WAPFORUM//DTD WML 1.0//EN">
<WML>
<CARD NAME="EmailHeaders" TITLE="New Email">
FR: Gerard Keena<BR/>
SU: Meeting rescheduled<BR/>
MSG: Robert, the meeting has been moved to 9am on Wed&lt;more..&gt;
<DO TYPE="ACCEPT" LABEL="Get more">
<GO URL="WTANetText.send("5555","Get_Mail_1_for_user_81353602999">

</GO>
</DO>
<DO TYPE="ACCEPT" LABEL="Call sender">
<GO URL="wtai://wp/mc;81353602111">
</GO>
</DO>
</CARD>
</WML>
```

The following describes aspects of the use of the invention in more detail.

Datagram/Express Messaging

The SMSC 10 provides one-shot message delivery. When the transmitter AIM 6 or 12 receives the message it is forwarded to the kernel 11, which makes an immediate delivery attempt. The message will not be stored in the database or a file and the

kernel 11 will not check the SME state before making a delivery attempt. Only one delivery attempt is made – a forward only functionality. Express messaging is ideally suited for some WAP applications which require a faster response to the user than can be offered using a "store and forward" mechanism.

Express messaging mode also supports a transaction capability which enables a delivery receipt to be returned, thus confirming that the message was received at the destination mobile handset. The SMSC 10 also supports "store and forward" message mode (premium messaging) for use in WAP applications which require secure delivery.

The PDC MN-AIM 12 supports MO express messaging on a per-AIM basis, set in a configurable entities file. A command > force_sub_express_swt::Y: will force messaging mode to "Express" for MO submission.

A per-SMSC system-wide default messaging mode may be specified by setting the value of the configurable parameter:

- smsc_messaging_mode_str = express[classic], which means that the default messaging mode is "express," while the "classic" mode (in brackets) is also allowed.

For interworking on the server 20 side the deliver_sm and submit_sm PDUs, set the parameter:

> messaging_mode = 1 (express messaging/datagram).

There is a transaction type operation that every PDU is acknowledged with a response PDU. Because WDP does not require reliable transport, responses to deliver/submit PDUs may be optionally omitted to save bandwidth. The optional

acknowledgement should be able to be specified at the bind/session level and at per deliver/submit message level.

WDP/UDP Application Port Addressing

Regarding WDP/UDP Application Port Addressing, WDP port is similar to that of UDP which is used to specify higher layer protocols, services, and applications.

The SMTP/ISUP link supports 2 octet origSubAddr and destSubAddr mandatory parameters which can be used for application port addressing:

> origSubAddr, M, 2 octet integer, 0..65535, end-to-end
> destSubAddr, M, 2 octet integer, 0..65535, end-to-end

These two parameters are mapped to the access transport field in the ISUP IAM message.

The kernel 11 supports explicit originating and destination port number parameters. The interworking data field for passing through optional network specific parameters can also be used to communicate port addresses.

Sub-unit Addressing

Subunit addressing is used to indicate where a message originated or is destined in the mobiel entity (ME), for example a smart card or an external device (ED) connected to the handset.

For the SMTP/ISUP and MN-AIM link,in the MT-DELIVER and MT-SUBMIT PDUs, the destAddr and origAddr of the MTAddress format may be used:

> MTAddress, mandatory, fixed 12 octet
> octet 0, length
> octet 1, bits 0-3 TON = 9 (extended MSN)
> octet 1, bits 4-7 NPI = 0 (unknown)
> octets 2-11, extended MSN with the last nibble =
> 0: MS
> 1..8: ED
> 9: RDD

The kernel 11 can handle the source and destination subaddress parameters. Fir the SMPPv4 and IW-AIM link in the deliver_sm and submit_sm PDUs, the source and destination addresses can take the extended MSN format:

(TON/NPI = 9/0, default in PDC networks).
> addr_ton = 9 (extended MSN)
> addr_npi = 0 (unknown)
> src/dst addr, mandatory, 0-64 octets, extended MSN with the last nibble =
> 0: MS
> 1..8: ED
> 9: RDD

SMPP and IW-AIM

In the deliver_sm, submit_sm, submit_multi and data_sm PDUs, the following conditional parameters may be used:

> dest_addr_subunit, optional TLV, 1 octet integer, 0..255
> source_addr_subunit, optional TLV, 1 octet integer, 0..255
> 0: unknown (default)
> 1: MS display

> 2: mobile equipment

> 3: smart card 1 (expected to be SIM if a SIM exists in the MS)

> 4: external unit 1

➢ 5 to 255 = reserved

WAP end-to-end security

The SMSC 10 includes functionality for WAP end-to-end security requirements, through use of a subaddress field which is passed as a key by the handset for the destination WAP proxy server IP address. This eliminates the need for encryption of addresses end-to-end which would probably not be possible with intermediate bearers which require the addresses for routing.

SMTP/ISUP and MN-AIM Link

In the MT-DELIVER and MT-SUBMIT PDUs the following conditional parameter may be used:

> MTPrivacy, conditional, 3 octets in 4-4-16 bit format, end-to-end

> octet 0, bits 7-4 security code = 1000: private security scheme (TBD)

> octet 0, bits 3-0 privacy level = 1..4 (do not use)

> octets 1-2, 2 octets of transparent authentication data

Although the 2 octet data in the MTPrivacy parameter may be used for end for end-to-end security sub-addressing, there is a problem to convert up to 22 octet sub-addresses. The range of sub-addresses that can be used by WAP applications is restricted by the SMTP/ISUP interface.

Kernel 11

The kernel 11 can handle the source and destination sub-address parameters. In the deliver_sm, submit_sm, submit_multi and data_sm PDUs, the following parameters are used:

> source_subaddress, optional TLV, V22COS
> dest_subaddress, optional TLV, V22COS
The format of sub-addresses is X.213/NSAP or user specified, contains authority and format identifier.

Segmentation and Reassembly (SAR)

The WAP framework allows segmentation and reassembly of packets to be done in the WAP infrastructure, in an SMSC or both. The SMSC 10 supports SAR in ESME (External Short Message Entities) and supports SAR in either SMSC or ESME (but not both).

SMTP/ISUP and MN-AIM

In the MT-DELIVER and MT-SUBMIT PDUs the following parameters are used:

> MTTeleServID, mandatory, 1 octet integer, 4 = concatenated messaging
> message number, conditional, 2 octet integer
> sequence number, conditional, 1 octet integer, 1..255
> max sequence number, conditional, 1 octet integer, 2..255

This will allow at most 255 * 128 = 32640 octets of concatenated user data. Long messages may be segmented up to 12 (1500/128) SMS. In PDC networks, an SMSC delay (about 3 seconds) is required between concatenated messages.

Kernel 11

The kernel 11 passes through the SAR information in the inter-working data field for PDC networks and supports explicit SAR parameters in general.

SMPP and IW-AIM

The SMPP deliver_sm and submit_sm PDUs theoretically allow up to 4096 octets of short_message data. The maximum user data length is limited by the SMTP protocol (128 octets). In the deliver_sm and submit_sm PDUs, the following optional parameter (PDC network facilities) is used:

> PDC_MultiPartMessage, optional TLV (tag = 0x1105)
> with 4 octets of data:
> message number, 2 octet integer
> sequence number, 1 octet integer, 1..255
- max sequence number, 1 octet integer, 2..255

This is the same as described above for SMTP/ISUP. To use this optional parameter, an ESME should negotiate for the PDC network facilities in the bind PDU using the following parameter:

- facilities_mask = NF_PDC (0x00010000)

End-to-End Message ID by WAP Proxy

SMTP/ISUP and MN-AIM

In the MT-DELIVER and MT-SUBMIT PDUs, the following parameter is used:

- MTMsgRef, mandatory, 2 octet integer, end-to-end.

Kernel 11

The kernel 11 can handle the end-to-end message ID.

SMPP and IW-AIM

In the deliver_sm and submit_sm PDUs, the following parameter is used:

- message_reference, mandatory, variable 1..9 COS

Message-Type (WDP/WCMP), Support WCMP Generated by MS

The kernel 11 can handle the message-type parameter.

SMPP and IW-AIM

In the deliver_sm, submit_sm, submit_multi and data_sm PDUs, the following parameter is used:

- payload_type, optional, 1 octet integer, 0: default/WDP, 1: WCMP

SMSC Generated WCMP Messages

The SMSC 10 does not return WCMP error messages. The ESME analyses SMPP error messages and sends WCMP messages to the WAP proxy gateway.

Data Coding <need further investigation

The SMSC 10 and SMPP data coding scheme (DCS) parameter defines encoding scheme of the short message user data.

(

SMPP and IW-AIM

In the deliver_sm and submit_sm PDUs, the following parameter is used:

> data_coding, mandatory, 1 octet integer

Generic_nack (SMPP)

The WAP proxy/server should be informed if it has submitted a message that is too big. In this case (ESME_RINVMSGLEN), the generic_nack PDU needs an optional parameter to indicate maximum allowed message user data length. The ESME or WAP proxy can do SAR properly according to this information.

MS Not Reachable to WAP Proxy (set_dpf)

In the data_sm PDU, an optional parameter may be used to request the setting of a delivery pending flag (DPF) for certain delivery failure scenarios, such as MS unavailable (as indicated by HLR).

> se_dpf, optional TLV, 1 octet integer,
> 0: setting of DPF for delivery failure to MS not requested
> 1: setting of DPF for delivery failure requested (default)
If the DPF is set, the SMSC will send an alert_notification PDU when it detects that the destination MS has become available.

Alert_notification to WAP proxy

The alert_notification PDU defined in SMPP is used by SMSC to inform ESME when it detects that the destination MS has become available.

The following are some of the advantages of the invention

1. Applications can take advantage of the store and forward capabilities of an SMSC. This feature is not available in other WAP bearers.

2. The invention provides a relatively inexpensive bearer to use for small amounts of data, in comparison to circuit switched data calls.

3. SMS based applications are already widely available, and it should be feasible to port these to a WAP framework.

4. MS in general is evolving to be more suitable for interactive applications. Examples of this are the implementation of the More-Messages-to-Send feature in GSM and the Express Messaging feature in the SMSC 10.

The invention is not limited to the embodiments described, but may be varied in construction and detail within the scope of the claims.

Claims

1. A method for communication of WAP content in a PDC mobile network, the method comprising the steps of:-

a WAP server using a short message entity interface to communicate WAP content in short messages to an SMSC, and

the SMSC communicating with a mobile handset over the PDC mobile network to transfer WAP content in short messages.

2. A method as claimed in claim 1, wherein signalling between the SMSC and the mobile handsets uses source port, destination port, and segmentation and reassembly fields, and wherein a teleservice identifier data element is used for submission and delivery of short messages, whereby different handset formats are catered for, and wherein concatenated messaging teleservice identifiers are used to provide concatenated messages which are fragments of WDP packet requiring reassembly, and wherein a message number is used to uniquely reference all the fragments in one larger segmented packet, and wherein the message number parameter is a two-octet integer.

3. A method as claimed in any preceding claim, wherein communication between the WAP server and the SMSC uses a tunnelling protocol based on the standard SMPP protocol, and wherein a multi-part message parameter in the format of a Tag-Length-Value parameter is used to specify a message number, a sequence number, and maximum sequence number for mapping to signalling between the SMSC and the mobile handsets, and wherein the tunnelling protocol between the WAP server and the SMSC maps sub-addresses of the handset-side communication for port level addressing on the server side, and wherein the SMSC incorporates a delay to reduce total

latency when delivering multiple messages to a handset, and wherein the SMSC uses express messaging functionality for transfer of WAP content to a mobile handset, and wherein the SMSC uses simple segmentation to deliver a plurality of messages in a single call attempt.

4. A method as claimed in any preceding claim, wherein the SMSC transmits overlength messages with a forward call indicator or a backward call indicator and the receiving entity sets a timer to receive the full set of messages.

5. A short message service centre comprising a kernel, a PDC mobile network application interface module, and a WAP server application interface module, and wherein the kernel comprises means for using source port, destination port, and segmentation and reassembly fields for communication of WAP content using short messages between a WAP server and a mobile handset.

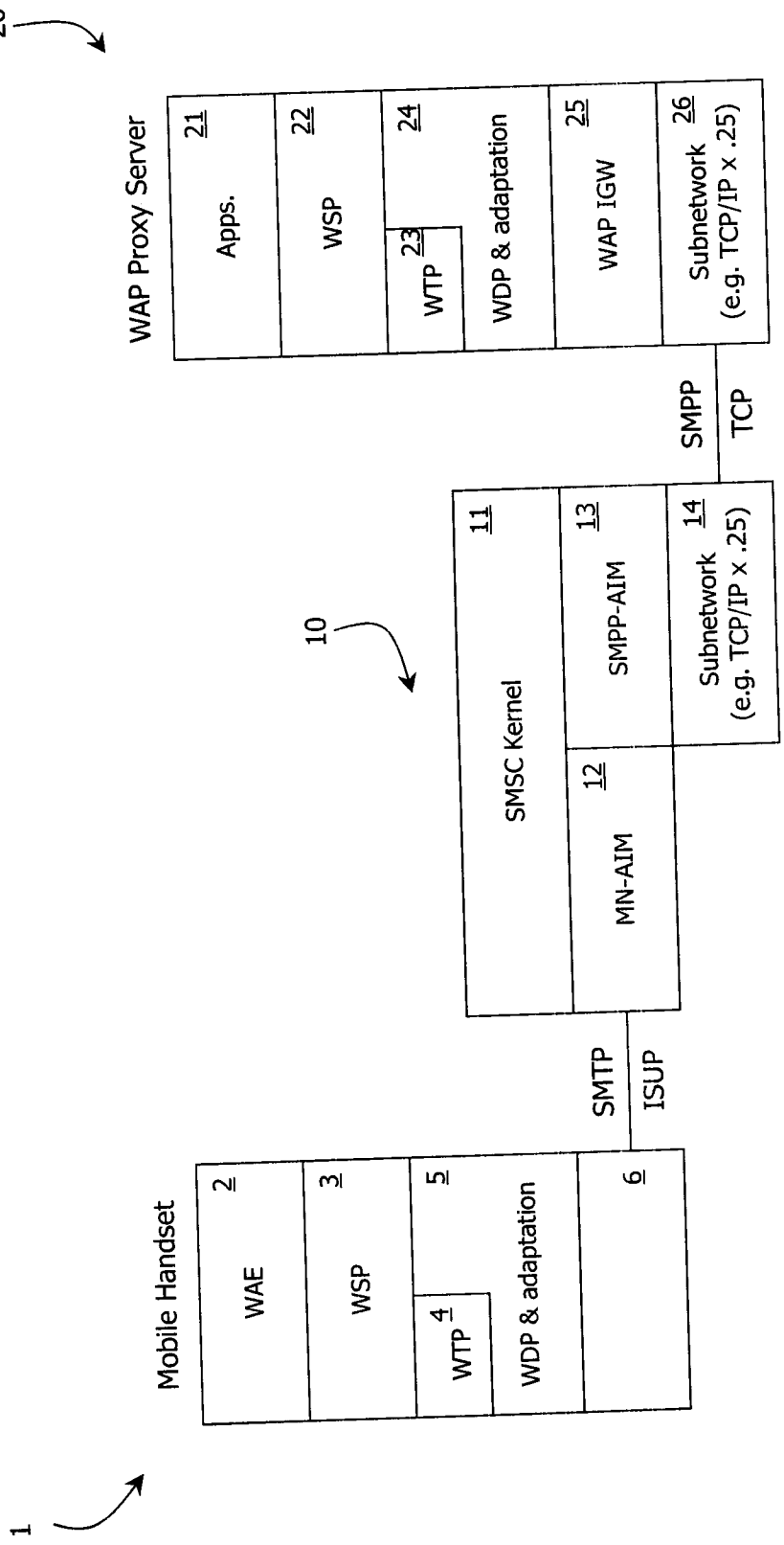
1
Mobile Handset
2
WAE
3
WSP
4
WTP
5
WDP & adaptation
6
SMTP
ISUP
10
SMSC Kernel
11
MN-AIM
12
SMPP-AIM
13
Subnetwork
(e.g. TCP/IP x .25)
14
SMPP
TCP
20
WAP Proxy Server
21
Apps.
22
WSP
23
WTP
24
WDP & adaptation
25
WAP IGW
26
Subnetwork
(e.g. TCP/IP x .25)

Fig. 1

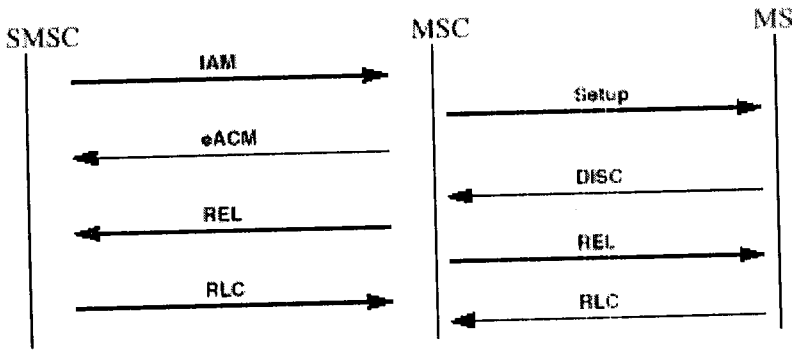
SMSC
MSC
MS
IAM
Setup
eACM
DISC
REL
REL
RLC
RLC

Fig. 2

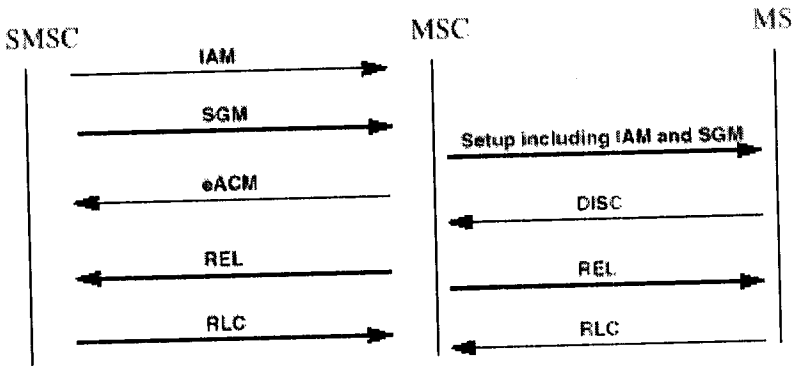
SMSC
MSC
MS
IAM
SGM
Setup including IAM and SGM
eACM
DISC
REL
REL
RLC
RLC

Fig. 3

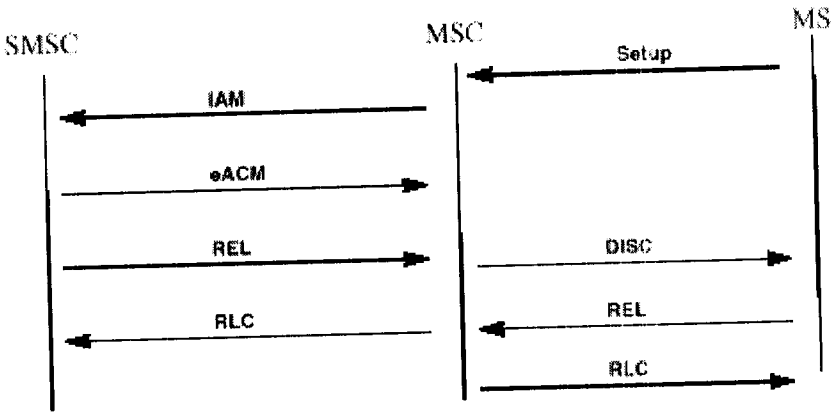
SMSC
MSC
MS
Setup
IAM
eACM
REL
DISC
RLC
REL
RLC

Fig. 4

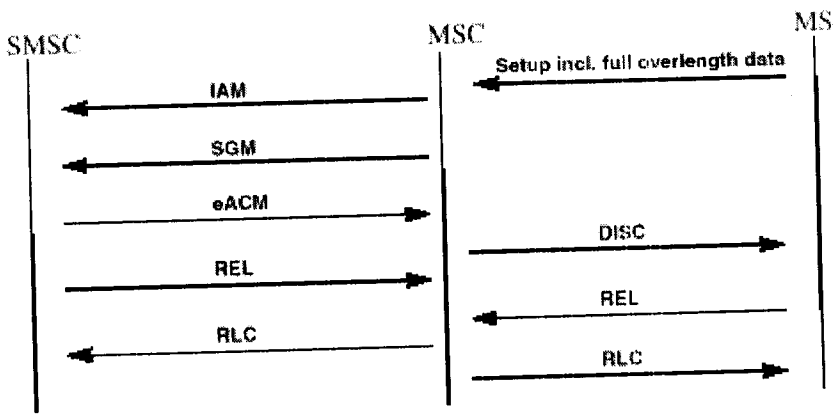
SMSC
MSC
MS
Setup incl. full overlength data
IAM
SGM
eACM
DISC
REL
REL
RLC
RLC

Fig. 5