M3UA Implementor’s Guide
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Abstract

This document contains a compilation of all defects found up until October 2002 for M3UA [RFC3332]. These defects may be of an editorial or technical nature. This document may be thought of as a companion document to be used in the implementation of M3UA to clarify errors in the original M3UA document. This document updates RFC3332 and text within this document supersedes the text found in RFC3332.
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1. Introduction

This document contains a compilation of all defects found up until March 2002 for the MTP3 User Adaptation Layer (M3UA) [RFC3332]. These defects may be of an editorial or technical nature. This document may be thought of as a companion document to be used in the implementation of M3UA to clarify errors in the original M3UA document. This document updates RFC3332 and text within this document, where noted, supersedes the text found in RFC3332. Each error will be detailed within this document in the form of:

- The problem description,
- The text quoted from RFC3332,
- The replacement text,
- A description of the solution.

1.1 Abbreviations

SPC    Signalling Point Code

2. Conventions

The keywords MUST, MUST NOT, REQUIRED, SHALL, SHALL NOT, SHOULD, SHOULD NOT, RECOMMENDED, NOT RECOMMENDED, MAY, and OPTIONAL, when they appear in this document, are to be interpreted as described in [RFC2119].

3. Corrections to RFC-M3UA

3.1 Parameter Containing Subparameters with Padding Bytes

3.1.1 Description of the problem

If a parameter contains subparameters with padding bytes, should the parameter length include the subparameter padding bytes or not.

3.1.2 Text changes to the document

--------
Old text: (Section 3.2)
--------
Parameter Length: 16 bits (unsigned integer)

The Parameter Length field contains the size of the parameter in bytes, including the Parameter Tag, Parameter Length, and Parameter Value fields. Thus, a parameter with a zero-length Parameter Value field would have a Length field of 4. The Parameter Length does not include any padding bytes.
Parameter Length: 16 bits (unsigned integer)

The Parameter Length field contains the size of the parameter in bytes, including the Parameter Tag, Parameter Length, and Parameter Value fields. Thus, a parameter with a zero-length Parameter Value field would have a Length field of 4. The Parameter Length does not include any padding bytes. If the parameter contains subparameters, the Parameter Length field will include all the bytes of each subparameter including subparameter padding bytes (if any).

3.1.3 Solution description

When calculating the length of a parameter that contains subparameters, include the padding bytes of the subparameters.

3.2 Dynamic Registration Not Supported

3.2.1 Description of the problem

There is a need to be able to correlate a Dynamic Registration not supported error to a Registration Request.

3.2.2 Text changes to the document

Old text: (Section 4.4.1)

If the SGP does not support the registration procedure, the SGP returns an Error message to the ASP, with an error code of "Unsupported Message Type".

New text: (Section 4.4.1)

If the SGP does not support the registration procedure, the SGP returns an Error message to the ASP, with an error code of "Unsupported Message Class".
The "Unsupported Message Class" error is sent if a message with an unexpected or unsupported Message Class is received.

The "Unsupported Message Type" error is sent if a message with an unexpected or unsupported Message Type is received.

The "Unsupported Message Class" error is sent if a message with an unexpected or unsupported Message Class is received. For this error, the Diagnostic Information parameter MUST be included with the first 40 bytes of the offending message.

The "Unsupported Message Type" error is sent if a message with an unexpected or unsupported Message Type is received. For this error, the Diagnostic Information parameter MUST be included with the first 40 bytes of the offending message.

The Error message contains the following parameters:

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Mandatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routing Context</td>
<td>Mandatory*</td>
</tr>
<tr>
<td>Network Appearance</td>
<td>Mandatory*</td>
</tr>
<tr>
<td>Affected Point Code</td>
<td>Mandatory*</td>
</tr>
<tr>
<td>Diagnostic Information</td>
<td>Optional</td>
</tr>
</tbody>
</table>

(*) Only mandatory for specific Error Codes
(*) Only mandatory for specific Error Codes

3.2.3 Solution description

A SGP that does not support registration must return an Error (Unsupported Message Class) message with the first 40 bytes of the offending message (i.e. any Routing Key Management message sent by the ASP) so that the ASP can correlate this error to the Registration Request message.

Note that the changes to the "Unsupported Message Class" and "Unsupported Message Type" text make this a general solution that allows the ASP or SG side to correlate these error responses with the offending message.

3.3 Contents of User Protocol Data

3.3.1 Description of the problem

There is a need to add a reference that contains the different SS7 message label types to ensure implementations take into account the differences among these labels.

3.3.2 Text changes to the document

-------
Old text: (Section 3.3.1)
-------

Protocol Data: (variable)

The Protocol Data field contains a byte string of MTP-User information from the original SS7 message starting with the first byte of the original SS7 message following the Routing Label.

-------
New text: (Section 3.3.1)
-------

Protocol Data: (variable)

The Protocol Data field contains a byte string of MTP-User information from the original SS7 message starting with the first byte of the original SS7 message following the Routing Label [7].
3.3.3 Solution description

A proper reference to the different SS7 message label types was required.

3.4 NIF Not Available on SGP

3.4.1 Description of the problem

The text is not clear about how the SGP/SG should handle the case of the NIF becoming unavailable on a SGP or all SGPs (SG).

3.4.2 Text changes to the document

Old text: (None)

None.

New text: (Section 4.7)

If the SG (all the SGPs) is isolated from the NIF, then all the users are isolated from the SS7 network. A DUNA(*) message MUST be sent from the SGPs to all the ASPs.

If only one SGP in the SG is isolated entirely from the NIF, the SGP SHOULD abort its associations. An alternative would be for the SGP to send ASP Down Ack.

If one or more SGP suffer a partial failure (where aborting the association(s) would cause all active AS(es) to fail), then the SGP
MUST send DUNA messages for the affected SPC(es). This is the case where an SGP can continue to service one or more active AS(es), but due to a partial failure it is unable to service other(s) active AS(es).

3.4.3 Solution description

The addition of this text specifies the SGP/SG behavior for the different scenarios of the NIF becoming unavailable on the SGP/SG.

3.5 Scope of Network Appearance

3.5.1 Description of the problem

A problem was found with the scope of the NA parameter. It was not clear whether it should be unique across SG-AS or unique across SCTP associations.

3.5.2 Text changes to the document

----------
Old text: (Section 3.3.1)
----------

Network Appearance: 32-bits (unsigned integer)

The Network Appearance parameter identifies the SS7 network context for the message and implicitly identifies the SS7 Point Code format used, the SS7 Network Indicator value, and the MTP3 and possibly the MTP3-User protocol type/variant/version used within the specific SS7 network. Where an SG operates in the context of a single SS7 network, or individual SCTP associations are dedicated to each SS7 network context, the Network Appearance parameter is not required. In other cases the parameter may be configured to be present for the use of the receiver.

The Network Appearance parameter value is of local significance only, coordinated between the SGP and ASP. Therefore, in the case where an ASP is connected to more than one SGP, the same SS7 network context may be identified by different Network Appearance values depending over which SGP a message is being transmitted/received.

Where the optional Network Appearance parameter is present, it must be the first parameter in the message as it defines the format of the Protocol Data field.

IMPLEMENTATION NOTE: For simplicity of configuration it may be desirable to use the same NA value across all nodes sharing a particular network context.
Network Appearance: 32-bits (unsigned integer)

The Network Appearance parameter identifies the SS7 network context for the message and implicitly identifies the used SS7 Point Code format, the SS7 Network Indicator value, and the MTP3 and possibly the MTP3-User protocol type/variant/version used within the specific SS7 network. Where a SG operates in the context of a single SS7 network, or individual SCTP associations are dedicated to each SS7 network context, the Network Appearance parameter is not required. In other cases the parameter may be configured to be present for the use of the receiver.

The Network Appearance parameter value is of local significance only, coordinated between the SG and AS. Therefore, in the case where an AS is connected to more than one SG, the same SS7 network context may be identified by different Network Appearance values depending over which SG a message is being transmitted/received.

Where the optional Network Appearance parameter is present, it must be the first parameter in the message as it defines the format of the Protocol Data field.

IMPLEMENTATION NOTE: For simplicity of configuration it may be desirable to use the same NA value across all nodes sharing a particular network context.

3.5.3 Solution description

The text is modified to show that NA has to be coordinated between AS to SG. This correction also aligns this text with the NA definition in section 1.2 of the RFC.

3.6 Semi-optional RC parameter

3.6.1 Description of the problem

Some optional parameters are not always optional. The text should be clear when optional parameters are not optional.
3.6.2 Text changes to the document

---------
Old text: (Section 3.3.1)
---------

3.3.1 Payload Data Message (DATA)

The DATA message contains the SS7 MTP3-User protocol data, which is an MTP-TRANSFER primitive, including the complete MTP3 Routing Label. The DATA message contains the following variable length parameters:

- Network Appearance: Optional
- Routing Context: Semi-Optional
- Protocol Data: Mandatory
- Correlation Id: Optional

---------
New text: (Section 3.3.1)
---------

3.3.1 Payload Data Message (DATA)

The DATA message contains the SS7 MTP3-User protocol data, which is an MTP-TRANSFER primitive, including the complete MTP3 Routing Label. The DATA message contains the following variable length parameters:

- Network Appearance: Optional
- Routing Context: Semi-Optional
- Protocol Data: Mandatory
- Correlation Id: Optional

---------
Old text: (Section 3.4.1)
---------

Routing Context: Optional

---------
New text: (Section 3.4.1)
---------

Routing Context: Semi-Optional

---------
Old text: (Section 3.4.2)
---------

Routing Context: Optional
New text: (Section 3.4.2)

Routing Context Semi-Optional

Old text: (Section 3.4.3)

Routing Context Optional

New text: (Section 3.4.3)

Routing Context Semi-Optional

Old text: (Section 3.4.4)

Routing Context Optional

New text: (Section 3.4.4)

Routing Context Semi-Optional

Old text: (Section 3.4.5)

Routing Context Optional

New text: (Section 3.4.5)

Routing Context Semi-Optional

Old text: (Section 3.4.6)
Routing Context          Optional
---------
New text: (Section 3.4.6)
---------
Routing Context          Semi-Optional

3.6.3 Solution description

Stating that the parameter is semi-optional, implies that it not either optional or mandatory. In the parameter description the text explains when it is mandatory and when optional.

3.7 Receiving REG for a RK already registered

3.7.1 Description of the problem

The RFC does not clearly specify what to do in this case.

3.7.2 Text changes to the document

---------
Old text: (Section 4.4.1)
---------
None.

---------
New text: (Section 4.4.1)
---------

If the SG determines that the received RK was already registered, the SGP returns a Registration Response message to the ASP, containing a Registration Result "Error - Cannot Support Unique Routing".

3.7.3 Solution description

By specifying the error code, the general problem of re-registering a RK is solved. This error response applies whether the Routing Key is Active or Inactive.
3.8 OPC list in the Registration Request Message

3.8.1 Description of the problem

It is not clear the reason of having an OPC list in the Registration Request message. What is it valid for?

3.8.2 Text changes to the document

---------
Old text: (Section 3.6.1)
---------

OPC List:

The Originating Point Code List parameter contains one or more SS7 OPC entries, and its format is the same as the Destination Point Code parameter. The absence of the OPC List parameter in the Routing Key indicates the use of any OPC value,

---------
New text: (Section 3.6.1)
---------

DPC List:

The Destination Point Code List parameter contains one or more SS7 DPC entries, and its format is the same as the Destination Point Code parameter. Multiple DPC values will only be valid in the case of Alias Point Code configuration. The absence of the DPC List parameter in the Routing Key indicates the use of the DPC value as the only possible DPC for the AS.
3.8.3 Solution description

Including the scenario where this parameter is used (Alias point code configurations), the problem is solved. The parameter name has also been changed to "Destination" since it is the way that the SG sees it.

3.9 Auditing procedure and congestion state

3.9.1 Description of the problem

The current description of the AUDIT procedure in regards to congestion state is not clear enough. When to send SCON is not completely specified.

3.9.2 Text changes to the document

--------
Old text: (Section 3.3.1)
--------

[...]. Where the SGP maintains the congestion status of the SS7 destination, and the SS7 destination is congested, the SGP MUST additionally respond with an SCON message before the DAVA or DRST message. If the SS7 destination is available and congested, the SGP MUST respond with an SCON message and then a DAVA message. If the SS7 destination is restricted and congested, the SGP MUST respond with an SCON message immediately followed by a DRST message. If the SGP has no information on the availability status of the SS7 destination, the SGP responds with a DUNA message, as it has no routing information to allow it to route traffic to this destination.
New text: (Section 3.3.1)

[...]. Where the SGP maintains the congestion status of the SS7 destination, the SGP MUST additionally respond with an SCON message before the DAVA or DRST message. If the SS7 destination is available, the SGP MUST respond with an SCON message (indicating the appropriate congestion level) and then a DAVA message. If the SS7 destination is restricted, the SGP MUST respond with an SCON message (with the appropriate congestion level) immediately followed by a DRST message. If the SGP has no information on the availability status of the SS7 destination, the SGP responds with a DUNA message, as it has no routing information to allow it to route traffic to this destination.

Where the SGP does not maintain the congestion status of the SS7 destination, the response to a DAUD message should always be only a DAVA, DRST or DUNA message as appropriate.

Old text: (Section 5.4)

5.4 M3UA/MTP3-User Boundary Examples

New text: (Section 5.4, 5.5)

5.4 Auditing examples

5.4.1 SG State: Uncongested / Unavailable

<table>
<thead>
<tr>
<th>ASP</th>
<th>SGP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>------ DAUD -------&gt;</td>
</tr>
<tr>
<td></td>
<td>&lt;------- SCON(0) ------</td>
</tr>
<tr>
<td></td>
<td>&lt;------- DUNA ---------</td>
</tr>
</tbody>
</table>

5.4.2 SG state: Congested (Congestion Level=2) / Available

<table>
<thead>
<tr>
<th>ASP</th>
<th>SGP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>------ DAUD -------&gt;</td>
</tr>
<tr>
<td></td>
<td>&lt;------- SCON(2) ------</td>
</tr>
<tr>
<td></td>
<td>&lt;------- DAVA ---------</td>
</tr>
</tbody>
</table>
5.4.3 SG state: Unknown / Available

ASP                          SGP
---                          ---
|  -------- DAUD --------->  |
|  <------- DAVA ----------  |

5.4.4 SG state: Uncongested / Unavailable

ASP                          SGP
---                          ---
|  -------- DAUD --------->  |
|  <------- DUNA ----------  |

5.5 M3UA/MTP3-User Boundary Examples

3.9.3 Solution description

Whenever a DAUD is received, it has to be responded with DAVA/DUNA/DRST message depending on the peer node’s state. If the SGP has congestion control (i.e. no ITU international networks) an SCON message with the appropriate congestion level should precede to the DAVA/DRST messages upon a DAUD arrival.

A new examples section has been added to show this behavior.

3.10 Response to an ASPIA message

3.10.1 Description of the problem

It was not clear how to act in the following scenario:

ASP                          SGP
---                          ---
|  ------ ASPIA (RC1)----->  |
|  <----  ASPIA Ack -------  |
|  -----DEREG REQ (RC1)--->  |
|  <----DEREG RSP (RC1)----  |
|  -------ASPIA (RC1)------>  |
3.10.2 Text changes to the document

Old text: (Section 4.5.3)

When an ASP wishes to withdraw from receiving traffic within an AS, the ASP sends an ASP Inactive message to the SGP or IPSP. This action MAY be initiated at the ASP by an M-ASP_INACTIVE request primitive from Layer Management or MAY be initiated automatically by an M3UA management function. In the case where an ASP is processing the traffic for more than one Application Server across a common SCTP association, the ASP Inactive message contains one or more Routing Contexts to indicate for which Application Servers the ASP Inactive message applies.

New text: (Section 4.5.3)

When an ASP wishes to withdraw from receiving traffic within an AS, or the ASP wants to initiate the process of activation, the ASP sends an ASP Inactive message to the SGP or IPSP.

An ASP Inactive message MUST be always responded by the peer (although other messages may be sent in the middle):
- If the corresponding RK is registered (statically or dynamically), the peer should respond with an ASP Inactive Ack message.
- If the RK is not registered, or the RC information is not valid, the peer must respond with an ERROR message with Error Code = "Invalid Routing Context".
- If the RC is missing and its specification is needed according to the used configuration, the peer must respond with an ERROR message with Error Code = "No Configured AS for ASP".

The action of sending the ASP Inactive message MAY be initiated at the ASP by an M-ASP_INACTIVE request primitive from Layer Management or MAY be initiated automatically by an M3UA management function. In the case where an ASP is processing the traffic for more than one Application Server across a common SCTP association, the ASP Inactive message contains one or more Routing Contexts to indicate for which Application Servers the ASP Inactive message applies.

3.10.3 Solution description
A more detailed specification of the messages to be sent upon the reception of an ASPIA has been added to the Inactive Procedures Section.

3.11 INFO and DIAG parameter length

3.11.1 Description of the problem

At the 2nd interop a question was raised about accepting length of 4 bytes for DIAG and INFO parameters.

3.11.2 Text changes to the document

--------
Old text: (Section 3.4.1)
--------

INFO String: variable length

The optional INFO String parameter can carry any meaningful UTF-8 [10] character string along with the message. Length of the INFO String parameter is from 0 to 255 octets. No procedures are presently identified for its use but the INFO String MAY be used for debugging purposes.

--------
New text: (Section 3.4.1)
--------

INFO String: variable length

The optional INFO String parameter can carry any meaningful UTF-8 [10] character string along with the message. Length of the INFO String parameter is from 0 to 255 octets. This means that No procedures are presently identified for its use but the INFO String MAY be used for debugging purposes. An INFO String with a zero length parameter is not considered as an error (this means that the Length field in the TLV will be set to 4).

--------
Old text: (Section 3.8.1)
--------

Diagnostic Information: variable length

When included, the optional Diagnostic information can be any information germane to the error condition, to assist in
identification of the error condition. The Diagnostic information
SHOULD contain the offending message.

---------
New text: (Section 3.8.1)
---------

Diagnostic Information: variable length

When included, the optional Diagnostic information can be any
information germane to the error condition, to assist in
identification of the error condition. The Diagnostic information
SHOULD contain the offending message. A Diagnostic Information with a
zero length parameter is not considered as an error (this means that
the Length field in the TLV will be set to 4).

3.11.3 Solution description

It has been explicitly included the fact that a parameter with length
zero is allowed.

3.12 IPSP stuff

3.12.1 Description of the problem

At the 2nd M3UA Plugtest several concerns were raised about the non-
interoperability of the two different IPSP exchanges defined in M3UA.

3.12.2 Text changes to the document

---------
Old text: (Section 4.3.1)
---------

Figure 4: ASP State Transition Diagram, per AS

```
+----------------------|  ASP-ACTIVE |
| Other +-------|              |
| ASP in AS |       +--------------+
| Overrides |           ^     |
| ASP Active |    ASP    |     | ASP Inactive |
|            |    Active |     | Inactive    |
|            |           |     v
```

Pastor, Morneault
New text: (Section 4.3.1)

The figure below shows the transitions for the ASP and IPSP cases.

Figure 5: IPSP State Transition Diagram, per AS

The transitions in brackets are just valid for the IPSP communication while the rest are valid for both ASPs and IPSPs.
Alternatively, an interchange of ASP Up messages from each end can be performed. This option follows the ASP state transition diagram. It would need four messages for completion.

New text: (Section 4.3.4.1.2)

None.

Alternatively, an interchange of ASP Active messages from each end can be performed. This option follows the ASP state transition diagram and gives the additional advantage of selecting a particular AS to be activated from each end. It is especially useful when an IPSP is serving more than one AS. It would need four messages for completion.

New text: (Section 4.3.4.3.1)

None.

Alternatively, an interchange of ASP Inactive messages from each end can be performed. This option follows the ASP state transition diagram and gives the additional advantage of selecting a particular AS to be deactivated from each end. It is especially useful when an IPSP is serving more than one AS. It would need four messages for completion.

New text: (Section 4.3.4.4.1)

None.
Old text: (Section 4.4.3)

The Registration/Deregistration procedures work in the IPSP cases in the same way as in AS-SG cases. An IPSP may register an RK in the remote IPSP. An IPSP is responsible for deregistering the RKs that it has registered.

New text: (Section 4.4.3)

The Registration/Deregistration procedures work in the IPSP cases in the same way as in AS-SG cases. An IPSP may register an RK in the remote IPSP. An IPSP is responsible for deregistering the RKs that it has registered.

It MAY be used one common RK for both IPSP participating in the communication using the Signaling Point Code granularity. It would basically consist of <OPC,DPC>.

In the case of RC use, RCs SHOULD be previously agreed between both peers.

Old text: (Section 5.5)

These scenarios show a basic example for IPSP communication for the three phases of the connection (establishment, data exchange, disconnection). It is assumed that the SCTP association is already set up. Both single exchange and double exchange behavior are included for illustrative purposes.

5.5.1 Single exchange:

<table>
<thead>
<tr>
<th>IPSP-A</th>
<th>IPSP-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>---------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>&lt;--------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td></td>
<td>ASP Up</td>
</tr>
<tr>
<td></td>
<td>ASP Active(RCb)</td>
</tr>
<tr>
<td></td>
<td>DATA (RCb)</td>
</tr>
</tbody>
</table>

RC: Routing Context
(optional)
Routing Context are previously agreed to be the same in both directions.

5.5.2 Double exchange:

<table>
<thead>
<tr>
<th>IPSP-A</th>
<th>IPSP-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;-------ASP Inactive (RCb)--------&gt;</td>
<td>RC: Routing Context</td>
</tr>
<tr>
<td>------ASP Inactive Ack (RCb)------&gt;</td>
<td>(optional)</td>
</tr>
<tr>
<td>&lt;-------ASP Up-------------------</td>
<td>(optional)</td>
</tr>
<tr>
<td>------ASP Up Ack------------------&gt;</td>
<td></td>
</tr>
<tr>
<td>&lt;-------ASP Active (RCb)----------</td>
<td>RC: Routing Context</td>
</tr>
<tr>
<td>------ASP Active Ack (RCb)--------&gt;</td>
<td>(optional)</td>
</tr>
<tr>
<td>------ASP Active (RCa)------------</td>
<td>RC: Routing Context</td>
</tr>
<tr>
<td>&lt;------ASP Active Ack (RCa)------&gt;</td>
<td>(optional)</td>
</tr>
<tr>
<td>&lt;--------DATA (RCa)--------------</td>
<td></td>
</tr>
<tr>
<td>&lt;------DATA (RCb)----------------</td>
<td></td>
</tr>
<tr>
<td>&lt;-------ASP Inactive (RCb)--------</td>
<td>RC: Routing Context</td>
</tr>
<tr>
<td>------ASP Inactive Ack (RCb)------&gt;</td>
<td></td>
</tr>
<tr>
<td>------ASP Inactive (RCa)---------&gt;</td>
<td>RC: Routing Context</td>
</tr>
<tr>
<td>&lt;------ASP Inactive Ack (RCa)-----</td>
<td></td>
</tr>
<tr>
<td>&lt;-------ASP Down----------------</td>
<td></td>
</tr>
<tr>
<td>------ASP Down Ack----------------</td>
<td>(optional)</td>
</tr>
<tr>
<td>&lt;-------ASP Down Ack-------------</td>
<td>(optional)</td>
</tr>
</tbody>
</table>

In this approach, only one single exchange of ASP Up message can be considered as enough since the response by the other peer can be considered as a notice that it is in ASP_UP state.

For the same reason, only one ASP Down message is needed since once that an IPSP receives ASP_Down ack message it is itself considered as being in the ASP_Down state and not allowed to receive ASPSM messages.
This scenarios show a basic example for IPSP communication for the three phases of the connection (establishment, data exchange, disconnection). It is assumed that the SCTP association is already set up.

Routing Context are previously agreed to be the same in both directions.

### 3.12.3 Solution description

All the references to the "double exchange" (a.k.a. symmetric IPSP method) has been removed. Modifications in the ASP state machine has been done to include the IPSP model.

### 3.13 Messages and Streams

#### 3.13.1 Description of the problem

The relation between messages and what stream to use in order to send them is diffuse and spread all along the document.

#### 3.13.2 Text changes to the document

Old text: (Section 1.4.7)
None.

-----

New text: (Section 1.4.7)

The following rules MUST to be followed (see section 3.1.2):

1. DATA is never sent on stream 0.
2. ASPSM, MGMT, RKM should be sent on stream 0 (Other than BEAT and BEAT ACK)
3. SSNM, ASPTM, BEAT and BEAT ACK can be sent on any stream.

3.13.3 Solution description

A clear specification of how messages should be sent is included in the corresponding section.

3.14 ASP Id for IPSP communication

3.14.1 Description of the problem

When using the IPSP communication it is no way of dynamically exchange the ASP Identifier in both directions.

3.14.2 Text changes to the document

-----

Old text: (Section 3.5.2)

-----

The ASP Up Ack message contains the following parameters:

INFO String (optional)

The format for ASP Up Ack message parameters is as follows:

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>++++++++++++++++++++++</td>
<td>Length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>\</td>
<td>INFO String</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
\ |     ++++++++++++++++++++++ |
\ |                     \ |
\ |                       \ |
\ |                          INFO String                          |
\ |     ++++++++++++++++++++++ |

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[Page 25]
The ASP Up Ack message contains the following parameters:
- ASP Identifier: Optional
- INFO String: Optional

The format for ASP Up Ack message parameters is as follows:

```
0                   1                   2                   3  
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         Tag = 0x0011          |           Length = 8          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                           ASP Identifier                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         Tag =0x0004           |             Length            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
\                          INFO String                          /
 \                           /                                     
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

The optional ASP Identifier parameter is specially useful for IPSP communication. In that case the IPSP answering the ASP Up message MAY include its own ASP Identifier value. For AS-SG communication this parameter MUST NOT be used.

3.14.3 Solution Description

By including the optional ASP Identifier in ASP Up message this can be achieved. In the AS-SG communication this optional parameter is not needed.

3.15 n+k redundancy

3.15.1 Description of the problem

The n+k redundancy is explained as a general model to use but there is no reference in the AS state and sometimes it is not clear when to use it.

3.15.2 Text changes to the document
AS-DOWN: The Application Server is unavailable. This state implies that all related ASPs are in the ASP-DOWN state for this AS. Initially the AS will be in this state. An Application Server is in the AS-DOWN state when it is removed from a configuration.

AS-INACTIVE: The Application Server is available but no application traffic is active (i.e., one or more related ASPs are in the ASP-INACTIVE state, but none in the ASP-ACTIVE state). The recovery timer T(r) is not running or has expired.

AS-ACTIVE: The Application Server is available and application traffic is active. This state implies that at least one ASP is in the ASP-ACTIVE state.

AS-PENDING: An active ASP has transitioned to ASP-INACTIVE or ASP-DOWN and it was the last remaining active ASP in the AS. A recovery timer T(r) SHOULD be started and all incoming signalling messages SHOULD be queued by the SGP. If an ASP becomes ASP-ACTIVE before T(r) expires, the AS is moved to the AS-ACTIVE state and all the queued messages will be sent to the ASP.

If T(r) expires before an ASP becomes ASP-ACTIVE, and the SGP has no alternative, the SGP may stops queuing messages and discards all previously queued messages. The AS will move to the AS-INACTIVE state if at least one ASP is in ASP-INACTIVE state, otherwise it will move to AS-DOWN state.

Figure 5 shows an example AS state machine for the case where the AS/ASP data is preconfigured. For other cases where the AS/ASP configuration data is created dynamically, there would be differences in the state machine, especially at creation of the AS.
For example, where the AS/ASP configuration data is not created until Registration of the first ASP, the AS-INACTIVE state is entered directly upon the first successful REG REQ from an ASP. Another example is where the AS/ASP configuration data is not created until the first ASP successfully enters the ASP-ACTIVE state. In this case the AS-ACTIVE state is entered directly.

---------
New text: (Section 4.3.2)
---------

AS-DOWN: The Application Server is unavailable. This state implies that the number of ASPs being in ASP-INACTIVE or ASP-DOWN is less than "n". Initially the AS will be in this state. An Application Server is in the AS-DOWN state when it is removed from a configuration.

AS-INACTIVE: The Application Server is available but no application traffic is active. This implies that there are at least n ASPs in either ASP-INACTIVE or ASP-ACTIVE but the total number of ASPs in ASP-ACTIVE state has not reach n. The recovery timer T(r) is not running or has expired.

AS-ACTIVE: The Application Server is available and application traffic is active. This state implies that at least n ASPs are in the ASP-ACTIVE state.

AS-PENDING: An active ASP has transitioned from ASP-ACTIVE to ASP-INACTIVE or ASP-DOWN and it was the number n active ASP in the AS. A recovery timer T(r) SHOULD be started and all incoming signalling messages SHOULD be queued by the SGP. If an ASP becomes ASP-ACTIVE
before T(r) expires, the AS is moved to the AS-ACTIVE state and all the queued messages will be sent to the ASP.

If T(r) expires before an ASP becomes ASP-ACTIVE, and the SGP has no alternative, the SGP may stop queuing messages and discards all previously queued messages. The AS will move to the AS-INACTIVE state if at least the number of ASPs in either ASP-INACTIVE or ASP-ACTIVE sum n, otherwise it will move to AS-DOWN state.

Figure 5 shows an example AS state machine for the case where the AS/ASP data is preconfigured and a n+k redundancy model.

Figure 5: AS State Transition Diagram

DN2IA: One ASP moves to ASP-INACTIVE causing that n ASPs are in either ASP-ACTIVE or ASP-INACTIVE states.

IA2DN: One ASP moves to ASP-DOWN causing that the number of ASPs in either ASP-ACTIVE or ASP-INACTIVE drops below n.

IA2AC: one ASP moves to ASP-ACTIVE, causing number of ASPs in the ASP-ACTIVE state to be n.

AC2PN: one ASP in ASP-ACTIVE state moves to ASP-INACTIVE or ASP-DOWN states, causing the number of ASPs in ASP-ACTIVE drop below n.

PN2AC: One ASP moves to ASP-ACTIVE causing the number of ASPs in the ASP-ACTIVE state to be n.
PN2IA: T(r) Expiry, n or more ASPs are in either ASP-INACTIVE or ASP-ACTIVE state and number of ASPs in ASP-ACTIVE state is less than n.

PN2DN: T(r) Expiry, the number of ASPs in either ASP-INACTIVE or ASP-ACTIVE state is less than n.

For other cases where the AS/ASP configuration data is created dynamically, there would be differences in the state machine, especially at creation of the AS. For example, where the AS/ASP configuration data is not created until Registration of the first ASP, the AS-INACTIVE state is entered directly upon the nth successful REG REQ from an ASP belonging to that AS. Another example is where the AS/ASP configuration data is not created until the nth ASP successfully enters the ASP-ACTIVE state. In this latter case the AS-ACTIVE state is entered directly.

-------
Old text: (Section 4.3.4.3, for both loadsharing and broadcast)
-------

An SGP or IPSP, upon reception of an ASP Active message for the first ASP in a Loadshare AS, MAY choose not to direct traffic to a newly active ASP until it determines that there are sufficient resources to handle the expected load (e.g., until there are "n" ASPs in state ASP-ACTIVE in the AS). In this case, the SGP or IPSP SHOULD withhold the Notify (AS-ACTIVE) until there are sufficient resources.

-------
New text: (Section 4.3.4.3, for both loadsharing and broadcast)
-------

An SGP or IPSP, upon reception of an ASP Active message for the first ASP in a Loadshare AS, SHOULD NOT direct traffic to a newly active ASP until it determines that there are sufficient resources to handle the expected load (e.g., until there are "n" ASPs in state ASP-ACTIVE in the AS). In this case, the SGP or IPSP SHOULDN'T withhold the Notify (AS-ACTIVE) until there are sufficient resources.

3.15.3 Solution description

The AS state machine reflects the state changes as a function of the "n" number from the n+k redundancy configuration. This solution is compliance with the previous one: 1+0 model. The change from MAY to SHOULD NOT makes it recommendable to send traffic only when the require ASPs number are in ASP-ACTIVE state.
4. Acknowledgements

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6. References


7. Changes Control

7.1 Changes from v00 to v01

- Typos.
- Update all the RC references to show it is a semi-optional parameter.
- DUNA(*) substituted for ASPIA-ACK when NIF is not available.
- New sections added:
- IPSP stuff
- Messages and Streams
- ASP Id for IPSP communication
- n+k redundancy

7.2 Changes from v01 to v02

- ASPIA-ACK substituted for DUNA when NIF is not available since it also allows inter-ASP routing.
- Changed REGREQ's parameter from "Origination Point Code" to "Destination Point Code".

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