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Registration Extensions (REGEXT)
for
Signalling User Adaptation Layers

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Abstract

This memo describes ***Registration Extensions (REGEXT)*** that provides the ability for an Application Server Process (ASP) to modify existing *Routing (Link) Keys* with a Signalling Gateway (SG).

Current procedures in the SS7 Signalling User Adaptation Layers (UAs) [M2UA..SUA, ISUA, TUA] do not provide for the modification of *Routing (Link) Keys* without deactivation of the Application Server (AS). This causes problems in making changes to live systems.

The extensions described in this memo permit modification of Signalling Link membership in Application Servers for SS7 MTP2-User Adaptation Layer [M2UA], modification of Circuit Identification Code (CIC) ranges for the SS7 MTP3-User Adaptation Layer [M3UA], modification of Circuit Identification Code (CIC) ranges for the SS7 ISUP-User Adaptation Layer [ISUA], modificiation of Destination Local Reference (DLR) ranges for SS7 SCCP-User Adaptation Layer [SUA], and modification of Transaction Identifier (TID) ranges for SS7 TCAP-User Adaptation Layer [TUA].

Contents

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1. Introduction

1.1. Scope

This Internet-Draft provides parameters and procedures in extension to the parameters and procedures of the SS7 Signalling User Adaptation Layers (UAs) [M2UA..SUA, ISUA, TUA], for the purpose of supporting changed to *Routing (Link) Keys* to be made in live systems.

UA implementations with *REGEXT* are intended to be compatible with UA implementations not supporting this extension.

1.2. Abbreviations

AS	—Application Server.
ASP	—Application Server Process.
IANA	—Internet Assigned Numbers Authority
I-D	—Internet-Draft
IETF	—Internet Engineering Task Force
IP	—Internet Protocol.
IPSP	—IP Signalling Point.
SCCP	—Signalling Connection Control Part.
SCTP	—Stream Control Transmission Protocol.
SG	—Signalling Gateway.
SGP	—Signalling Gateway Process.
SIGTRAN	—IETF Signalling Transport WG
SPP	—Signalling Peer Process.
SS7	—Signalling System No. 7.
SUA	—SS7 SCCP-User Adpatation Layer.
TCAP	—Transaction Capabilities Application Part.
TUA	—SS7 TCAP-User Adaptation Layer.
UA	—User Adaptation Layer.
WG	—Working Group

1.3. Terminology

REGEXT adds the following terms to the terminology presented in the UA documents:

Registration Extension (REGEXT) **–** The parameters and procedures described by this memo.

Signalling Peer Process (SPP) **–** refers to an ASP, SGP or IPSP.

Signalling User Adaptation Layer (UA) **–** one or more of the Stream Control Transmission Protocol (SCTP) [RFC 2960] SS7 Signalling User Adaptation Layers [M2UA..SUA, ISUA, TUA] supporting Registration.

1.4. Overview

Existing registration management procedures do not provide for the alteration of *Routing (Link) Keys* on live systems. This can lead to significant operational difficulties in large scale deployments. This memo provides extension procedures that permit this modification.

1.4.1. Limitations of Existing Registration Management

Each of the SS7 UAs [M2UA..SUA, ISUA, TUA] provides procedures for registration and deregistration of *Routing (Link) Keys*. None of these procedures currently provides for alteration of *Routing (Link) Keys* for a Application Server (AS) in the active state.

1.4.1.1. Limitations of Registration for M2UA

In SS7 MTP2-User Adaptation Layer [M2UA] registration of a *Link Key* associates a signalling link with an *Interface Identifier (IID)*. However, registration does not provide a mechanism for associating groups of *Interface Identifiers* together into Application Servers (AS), nor does it provide a mechanism for altering the membership of signalling links associated with an Application Server.

1.4.1.2. Limitations of Registration for M3UA

The SS7 MTP3-User Adaptation Layer [M3UA] registration of a *Routing Key* associates a range of traffic with an Application Server through a *Routing Context*. However, it does not provide procedures for changing the range of traffic associated with an Application Server and *Routing Context* without deactivating the Application Server and deregistering the *Routing Key*. This can cause difficulties when M3UA is used in support of ISUP MTP3-Users where normal circuit management expects to add and remove specific circuits or ranges of circuits (circuit groups) to and from Application Servers.[1]

1.4.1.3. Limitations of Registration for ISUA

The SS7 ISUP-User Adaptation Layer [ISUA] registration of a *Routing Key* associates a range of traffic with an Application Server through a *Routing Context*. However, it does not provide procedures for changing the range of traffic associated with an Application Server and *Routing Context* without deactivating the Application Server and deregistering the *Routing Key*. This can cause difficulties where normal circuit management expects to add and remove specific circuits or ranges of circuits (circuit groups) to and from Application Servers.[2]

1.4.1.4. Limitations of Registration for SUA

The SS7 SCCP-User Adaptation Layer [SUA] registration of a *Routing Key* associates a range of traffic with an Application Server through a *Routing Context* and the Address Mapping Function. However, it does not provide procedures for changing the range of traffic associated with an Application Server and *Routing Context* without deactivating the Application Server and deregistering the *Routing Key*. This can cause difficulties when SUA is used in the connection-oriented environment and the ASP wishes to dynamically assign connections to Application Servers.[2]

1.4.1.5. Limitations of Registration for TUA

The SS7 TCAP-User Adaptation Layer [TUA] registration of a *Routing Key* associates a range of traffic wtih an Application Server through a *Routing Context* and the Transaction Mapping Function. However, it does not provide procedures for changing the range of traffic associated with an Application Server and *Routing Context* without deactivating the Application Server and deregistering the *Routing Key*. This can cause difficulties when TUA is used in operation class 1, 2 and 3 (dialogues) and the ASP wishes to dynamically assign dialogues to Application Servers.

1.4.2. Registration Extension

This memo provides extensions for the UA registration and deregistration procedures which addresses these limitations in the existing procedures. *REGEXT* provides support for altering an existing *Routing (Link) Key* for an active Application Server.

1.4.2.1. Registration Extensions for M2UA

The purpose of *REGEXT* for M2UA [M2UA] is to support the Dynamic Allocation of Signalling Data Links and Signalling Terminals [Q.704], and, in particular, the ability to associate a new Signalling Link as specified by the combination of Signalling Data Link Identifier (SDLI) and Signalling Data Terminal Identifier (SDTI), with an existing Application Server. This permits MTP Level 3 to perform the Level 1 Connect and Level 1 Disconnect primitives, as well as associating a new Signalling Terminal with an existing Signalling Data Link for the Dynamic Allocation of Signalling Terminals.

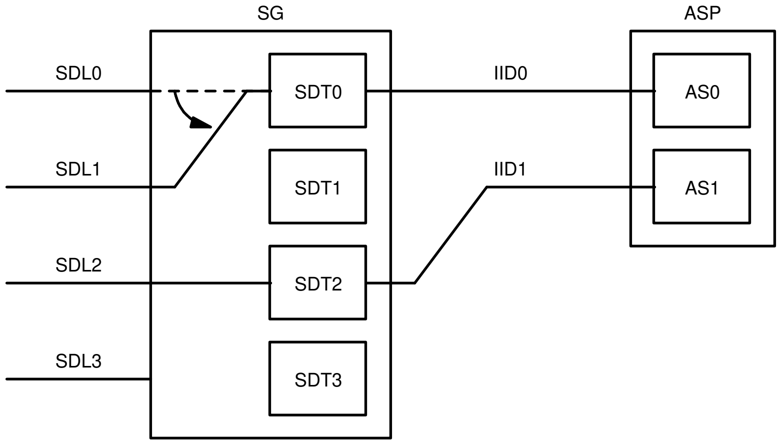

Figure A. Example (A) - M2UA Configuration

For example, an ASP is ASP-ACTIVE for a given Application Server and signalling data link and terminal wishes to replace the Signalling Data Link associated with a Signalling Link (under MTP Level 3 [Q.704] control). The ASP wishes to replace the Signalling Data Link (SDL1) with the Signalling Data Link (SDL0) for the Signalling Link represented by AS0/IID0 as illustrated in *Figure A*.

REGEXT permits the ASP to perform this switch using the ***REG REQ*** message with the *Interface Identifier* **IID0** placed in the message along with the *Link Key* **SDT0/SDL0**. Examples are provided in Section 6.

1.4.2.2. Registration Extensions for M3UA

The purpose of *REGEXT* for M3UA [M3UA] is to support the modification of traffic to and from an active Application Server for operations, maintenance, administration and provisioning. In particular this allows an MTP-User Part (SI value), Signalling Point Code or perhaps a Circuit Identification Code (CIC) range to be added or removed from an existing *Routing Key* associated with an active Application Server.

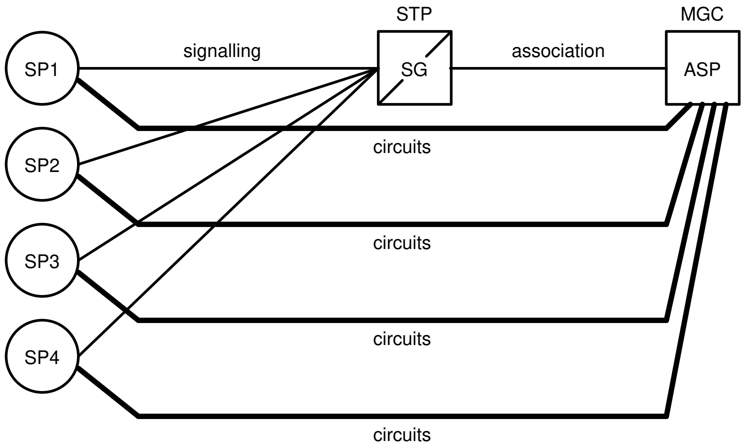

Figure B. Example (B) - M3UA Configuration

For example, an ISUP Application Server wishes to add new trunk group(s) to a new Signalling Point Code (i.e. MGC). The AS is currently registered against a *Routing Key* which includes several remote point codes, but does not include the remote point code of the switch to which the trunk group(s) are to be added (as illustrated in *Figure B*).

REGEXT permits the Application Server to provision the new trunk group(s) by adding the new remote point code to the *Routing Key* with the ***REG REQ*** message.

1.4.2.3. Registration Extensions for ISUA

The purpose of *REGEXT* for ISUA [ISUA] is to support the modification of traffic to and from an active Application Server for operations, maintenance, administration and provisioning. In particular this allows perhaps a Circuit Identification Code (CIC) range to be added or removed from an existing *Routing Key* associated with an active Application Server.

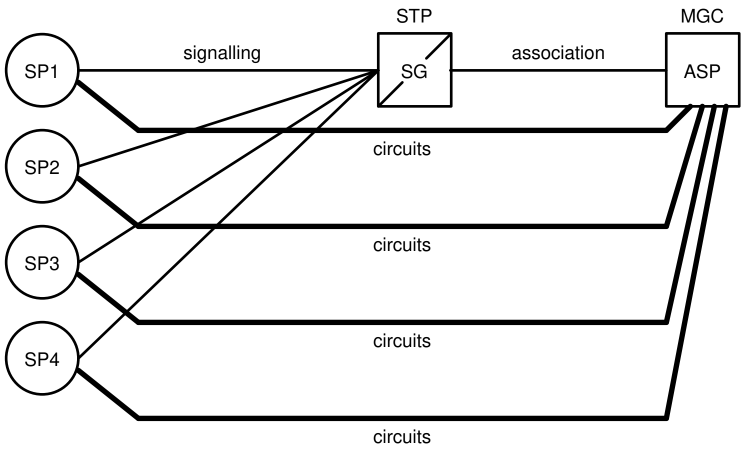

Figure C. Example (C) - ISUA Configuration

For example, an ISUP Application Server wishes to add new trunk group(s) to a new Signalling Point Code (i.e. MGC). The AS is currently registered against a *Routing Key* which includes several remote point codes, but does not include the remote point code of the switch to which the trunk group(s) are to be added (as illustrated in *Figure C*).

REGEXT permits the Application Server to provision the new trunk group(s) by adding the new remote point code to the *Routing Key* with the ***REG REQ*** message.

1.4.2.4. Registration Extensions for SUA

The purpose of *REGEXT* for SUA [SUA] is to associate a newly formed connection with an Application Server that is responsible for the connection. Almost all connection-oriented interface models (STREAMS, Sockets) rely on the concept of a listening stream or socket and an independent accepting stream or socket. *REGEXT* permits an accepted connection to be established on an Application Server which is independent from the Application Server upon which the connection request was received.

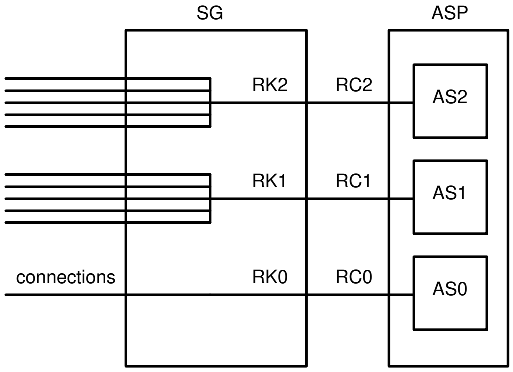

Figure D. Example (D) - SUA Configuration

For example, as illustrated in *Figure D*, one Application Server (AS0) is configured with a *Routing Key* which does not contain *Destination Reference Number* for SSN=5. Another Application Server (AS1) processes some connections for SSN=5 and AS2 processes other connections. When a CORE is received by AS0, and before sending a COAK, the ASP would like to assign the connection to one of AS1 or AS2 for further communication associated with the newly arrived connection.

REGEXT permits AS0 to modify *Routing Key* RK1 by sending a ***REG REQ*** message that includes *Routing Context* RC1 and the additional *Destination Reference Number* that is assigned to the connection, permitting the SCCP implementation to follow the Network Provider Interface [NPI].

REGEXT also permits AS0 to modify the *Routing Key* on another Signalling Gateway with the complete failover support of the Application Server, avoiding many of the problems associated with *DRN Label* approach.

1.4.2.5. Registration Extensions for TUA

The purpose of *REGEXT* for TUA [TUA] is to associate a newly formed dialogue or transaction with an Application Server that is responsible for the dialogue or transaction. Almost all connection-oriented interface models (STREAMS, Sockets) rely on the concept of a listening stream or socket and an independent accepting stream or socket. *REGEXT* permits an accepted dialogue or transaction to be established on an Application Server which is independent from the Application Server upon which the dialogue or transaction initiation was received.

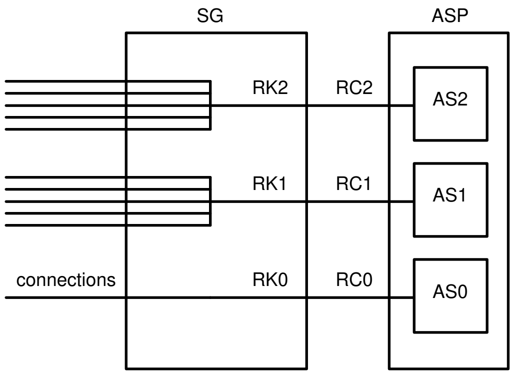

Figure E. Example (E) - TUA Configuration

For example, as illustrated in *Figure E*, one Application Server (AS0) is configured with a *Routing Key* which does not contain *Terminating Transaction Id* for a given *Application Context*. Another Application Server (AS1) processes some dialogues and transactions for the Application Context, and AS2 processes other dialogues and transactions. When a TBEG is received by AS0, and before sending a TCON, the ASP would list to assign the transaction to one of AS1 or AS2 for further communication associated with the newly arrived transaction.

REGEXT permits AS0 to modify the *Routing Key* RK1 by sending a ***REG REQ*** message that includes *Routing Context* RC1 and the additional *Terminating Transaction Id* that is assigned to the transaction, permitting the TCAP implementation to follow the Transport Provider Interface [TPI, XNS].

REGEXT also permits AS0 to modify the *Routing Key* on another Signalling Gateway with the complete fail-over support of the Application Server, permitting SGs to be configured as STP pairs in the SS7 network.

1.5. Limitations

Although the methods for dynamic modification of *Routing Keys* and *Load Selections* presented in this document is consistent with that previously discussed on the SIGTRAN WG, it has a number of limitations. To change a *Routing Key* or *Load Selections* requires that the entire new key or selection be included in the ***REG REQ*** message. This may be especially inconvenient if the resulting *Routing Key* or *Load Selection* contains thousands of elements (as it might for CIC Ranges on large MGC).

A method more amenable to this situation would be to use the ***REG REQ*** message to "add" elements to the *Routing Key* or *Load Selection* and use the ***DEREG REQ*** to "delete" elements from the *Routing Key* or *Load Selection*.

A third approach would be to define two new messages, such as: ***Registration Add (REG ADD)*** and ***Registration Delete (REG DEL)***, but share the ***REG RSP*** message. This last approach would probably be more convenient.

The second approach is proposed by this memo.

Notes for §1

[1] **EDITOR'S NOTE:–** Text was included in the M3UA specification [M3UA] to permit this operation, however, detailed procedures and the addition of the *Routing Context* parameter to the *Routing Key*, and addition of the corresponding error code was missed.

[2] **EDITOR'S NOTE:–** Text was include in the SUA specification [SUA] to permit this operation, however, detailed procedures and the addition of the *Routing Context* parameter to the *Routing Key* was missed.
In addition, this mechanism can provide superior support for multiple SGs acting as STPs, and can replace the *DRN Label* and associated mechanism. The *TID Label* and associated mechanism is inadequate and should be removed from the SUA specification [SUA].

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 [RFC 2119].

3. Protocol Elements

The following subsections describe the parameters which are added or whose use is modified by this extension, their format and the messages in which they are used.

3.1. Parameters

This memo permits the use of the *Routing Context* (*Interface Identifier*) parameter within a *Routing (Link) Key* parameter. It also allows the use of the *Routing (Link) Key* parameter within a **DEREG REQ** message. This memo also defines a new *Reference Number Range* parameter for use in the SUA [SUA] *Routing Key*. In addition, this memo permits the use of the *Source Reference Number*, *Destination Reference Number* and *Reference Number Range* parameters in the SUA [SUA] *Routing Key*.

3.1.1. Routing Key Parameters

3.1.1.1. SUA Reference Number Range

REGEXT defines a new SUA [SUA] *Reference Number Range* parameter for use in the *Routing Key* in the ***REG REQ*** message. This parameter is used to associate a range of source or destination reference numbers with an Application Server.

The *Reference Number Range* parameter is formatted as follows: [1]

```
 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 = 0x0119          |             Length            |
+- - - - - - - - - - - - - - - -+- - - - - - - - - - - - - - - -+
\                                                               \
/                  Reference Number Parameter(s)                /
\                                                               \
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

The *Reference Number Range* parameter can contain the following fields:

Reference Number field: variable (TLV parameters)

The *Reference Number* field can contain the following parameters:

Parameters		
Source Reference Number	Conditional	*1
Destination Reference Number	Conditional	*1

Note 1: The *Reference Number* field must contain pairs of *Source Reference Numbers* or *Destination Reference Numbers* and **MUST** contain one and only one pair of addresses; but, **MUST NOT** mix *Source Reference Numbers* with *Destination Reference Numbers* in the same *Reference Number* field.

3.1.2. Routing (Link) Key

REGEXT extends the *Link Key* parameter of M2UA [M2UA] and the *Routing Key* parameters of M3UA, SUA, and TUA [M3UA, SUA, ISUA, TUA].

3.1.2.1. M2UA Link Key

The M2UA [M2UA] *Link Key* parameter is formatted 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 = 0x0309         |             Length            |
+-------------------------------+-------------------------------+
|                      Local-LK-Identifier                      |
+---------------------------------------------------------------+
\                                                               \
/                        Key parameter(s)                       /
\                                                               \
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

REGEXT extends the M2UA *Link Key* parameter by adding the following parameters to the *Link Key*:

Extension Sub-Parameters		
Interface Identifier	Optional	*1

Note 1: The *Interface Identifier* parameter is optional in the *Link Key*. This parameter identifies an existing Application Server for which the *Link Key* is to be altered. The format of the *Interface Identifier* consists of a single integer *Interface Identifier* or a single text *Interface Identifier*.

3.1.2.2. M3UA Routing Key

The M3UA [M3UA] *Routing Key* parameter is formatted 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 = 0x0207         |             Length            |
+-------------------------------+-------------------------------+
|                       Local-RK-Identifier                     |
+---------------------------------------------------------------+
\                                                               \
/                        Key parameter(s)                       /
\                                                               \
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

The *Routing Key* parameter is used in the ***REG REQ*** and ***DEREG REQ*** messages. It is used to identify the portion of traffic for which an ASP is registering or deregistering.

REGEXT extends the M3UA [M3UA] *Routing Key* parameter by allowing the following parameters to be used as optional sub-parameters within the *Routing Key*:

Extension Sub-Parameters		
Routing Context	Optional	*1

Note 1: The *Routing Context* parameter is optional in the *Routing Key*. This parameter identifies an existing Application Server for which the *Routing Key* is to be altered. The format of the *Routing Context* consists of a single *Routing Context* value.

3.1.2.3. ISUA Routing Key

The ISUA [ISUA] *Routing Key* parameter is formatted 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 = 0x0522          |            Length             |
+-------------------------------+-------------------------------+
|                  Local Routing Key Identifier                 |
+---------------------------------------------------------------+
\                                                               \
/                        Key parameter(s)                       /
\                                                               \
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

REGEXT extends the ISUA *Routing Key* [ISUA] by adding the following optional *Key parameters* to the *Routing Key*.

Extension Sub-Parameters		
Routing Context	Optional	*1

Note 1: The *Routing Context* parameter is included in the *Routing Key* when the ASP wishes to alter an existing *Routing Key* which corresponds to the indicated *Routing Context*. The *Routing Context* parameter **MUST** only occur once in the *Key* parameters.

3.1.2.4. SUA Routing Key

The SUA [SUA] *Routing Key* parameter is formatted 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 = 0x010E          |            Length             |
+-------------------------------+-------------------------------+
|                  Local Routing Key Identifier                 |
+---------------------------------------------------------------+
\                                                               \
/                         Key parameter(s)                      /
\                                                               \
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

REGEXT extends the SUA *Routing Key* [SUA] by adding the following optional *Key parameters* to the *Routing Key*.

Extension Sub-Parameters		
Routing Context	Optional	*1
Reference Number Range	Optional	*2

Note 1: The *Routing Context* parameter is included in the *Routing Key* when the ASP wishes to alter an existing *Routing Key* which corresponds to the indicated *Routing Context*. The *Routing Context* parameter **MUST** only occur once in the *Key* parameters.

Note 2: The *Reference Number Range* parameter is included in the *Routing Key* when the ASP wishes to accept or restrict connection oriented traffic within a Destination Local Reference (DLR) range for the Application Server being registered. The *Reference Number Range* parameter **SHOULD** only occur once in the *Key* parameters.

3.1.2.5. TUA Routing Key

The TUA [TUA] *Routing Key* parameter is formatted 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 = 0x041E          |             Length            |
+-------------------------------+-------------------------------+
|                 Local Routing Key Identifier                  |
+---------------------------------------------------------------+
\                                                               \
/                       Key parameter(s)                        /
\                                                               \
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

REGEXT extends the TUA *Routing Key* [TUA] by adding the following optional *Key parameters* to the *Routing Key*.

Extension Sub-Parameters		
Routing Context	Optional	*1

Note 1: The *Routing Context* parameter is included in the *Routing Key* when the ASP wishes to alter an existing *Routing Key* which corresponds to the indicated *Routing Context*. The *Routing Context* parameter **MUST** only occur once in the *Key* parameters.

3.1.3. Load Selection

3.1.3.1. M2UA Load Selection

The M2UA [M2UA] *Load Selection* parameter [LOADSEL] is formatted 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 = 0x0019          |            Length             |
+-------------------------------+-------------------------------+
\                                                               \
/                     Load Key parameter(s)                     /
\                                                               \
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

REGEXT extends the M2UA *Load Selection* [LOADSEL] parameter by adding the following optional *Load Key parameters* to the *Load Selection*.

Extension Sub-Parameters		
Load Selector	Optional	*1

Note 1: The *Load Selector* parameter is included in the *Load Selection* when the ASP wishes to alter an existing *Load Selection* which corresponds to the indicated *Load Selector*. The *Load Selector* parameter **MUST** only occur once in the *Load Selection* parameter.

3.1.3.2. M3UA Load Selection

The M3UA [M3UA] *Load Selection* parameter [LOADSEL] is formatted 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 = 0x0019          |            Length             |
+-------------------------------+-------------------------------+
\                                                               \
/                     Load Key parameter(s)                     /
\                                                               \
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

REGEXT extends the M3UA *Load Selection* [LOADSEL] parameter by adding the following optional *Load Key parameters* to the *Load Selection*.

Extension Sub-Parameters		
Load Selector	Optional	*1

Note 1: The *Load Selector* parameter is included in the *Load Selection* when the ASP wishes to alter an existing *Load Selection* which corresponds to the indicated *Load Selector*. The *Load Selector* parameter **MUST** only occur once in the *Load Selection* parameter.

3.1.3.3. ISUA Load Selection

The ISUA [ISUA] *Load Selection* parameter [LOADSEL] is formatted 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 = 0x0019          |             Length            |
+-------------------------------+-------------------------------+
\                                                               \
/                      Load Key parameter(s)                    /
\                                                               \
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

REGEXT extends the ISUA *Load Selection* [LOADSEL] parameter by adding the following optional *Load Key parameters* to the *Load Selection*.

Extension Sub-Parameters		
Load Selector	Optional	*1

Note 1: The *Load Selector* parameter is included in the *Load Selection* when the ASP wishes to alter an existing *Load Selection* which corresponds to the indicated *Load Selector*. The *Load Selector* parameter **MUST** only occur once in the *Load Selection* parameter.

3.1.3.4. SUA Load Selection

The SUA [SUA] *Load Selection* parameter [LOADSEL] is formatted 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 = 0x0019          |             Length            |
+-------------------------------+-------------------------------+
\                                                               \
/                      Load Key parameter(s)                    /
\                                                               \
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

REGEXT extends the SUA *Load Selection* [LOADSEL] parameter by adding the following optional *Load Key parameters* to the *Load Selection*.

Extension Sub-Parameters		
Load Selector	Optional	*1

Note 1: The *Load Selector* parameter is included in the *Load Selection* when the ASP wishes to alter an existing *Load Selection* which corresponds to the indicated *Load Selector*. The *Load Selector* parameter **MUST** only occur once in the *Load Selection* parameter.

3.1.3.5. TUA Load Selection

The TUA [TUA] *Load Selection* parameter [LOADSEL] is formatted 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 = 0x0019          |            Length             |
+-------------------------------+-------------------------------+
\                                                               \
/                     Load Key parameter(s)                     /
\                                                               \
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

REGEXT extends the TUA *Load Selection* [LOADSEL] parameter by adding the following optional *Load Key parameters* to the *Load Selection*.

Extension Sub-Parameters		
Load Selector	Optional	*1

Note 1: The *Load Selector* parameter is included in the *Load Selection* when the ASP wishes to alter an existing *Load Selection* which corresponds to the indicated *Load Selector*. The *Load Selector* parameter **MUST** only occur once in the *Load Selection* parameter.

3.1.4. Error Codes

3.1.4.1. SUA Error Codes

REGEXT extends the Common mandatory *Error Code* parameter by removing the following *Error Code* values:

Value	Description
0x17	*Routing Key Change Refused*

In addition, *REGEXT* removes the following text associated with the "Routing Key Change Refused" error code:

> The "Routing Key Change Refused" error is sent when the SG refuses a change in the Routing Key parameters. [SUA]

3.1.5. Registration Status

REGEXT extends the *Registration Status* parameter by adding the following values to the Common and UA-specific mandatory *Registration Status* parameter[2] in the ***REG RSP*** message:

Value	Description
11	*Error − Routing Key Change Refused*
17	*Error − Load Selection Change Refused*

3.1.5.1. Common Registration Status

The Common [SUA, ISUA, TUA] *Registration Status* parameter is formatted 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 = 0x0016          |            Length             |
+ - - - - - - - - - - - - - - - + - - - - - - - - - - - - - - - +
|                       Registration Status                     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

REGEXT extends the Common *Registration Status* parameter for ISUA [ISUA], SUA [SUA] and TUA [TUA] by adding the following values to the status field:

Value	Description
11	*Error − Routing Key Change Refused*
17	*Error − Load Selection Change Refused*

The *"Error − Routing Key Change Refused"* status is returned when the ASP has included an *Routing Context* in the *Routing Key* and the SGP is either unequipped to perform dynamic modification of the *Routing Key*, or dynamic modification of the *Routing Key* is not currently permitted.

The *"Error − Load Selection Change Refused"* status is returned when the ASP has included a *Load Selector* in the *Load Selection* and the SGP is either unequipped to perform dynamic modification of the *Load Selection*, or dynamic modification of the *Load Selection* is not currently permitted.

3.1.5.2. M2UA Registration Status

The M2UA [M2UA] *Registration Status* parameter is formatted as follows: [3]

```
 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 = 0x030E          |            Length             |
+ - - - - - - - - - - - - - - - + - - - - - - - - - - - - - - - +
|                       Registration Status                     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

REGEXT extends the M2UA [M2UA] *Registration Status* parameter by adding the following values to the status field: [4]

Value	**Description**
11	*Error − Link Key Change Refused*
17	*Error − Load Selection Change Refused*

The *"Error − Link Key Change Refused"* status is returned by and SGP when the ASP has included an *Interface Identifier* in the *Link Key* and the SGP is either unequipped to perform dynamic modification of the *Link Key*, or dynamic modification of the *Link Key* is not currently permitted.

The *"Error − Load Selection Change Refused"* status is returned when the ASP has included a *Load Selector* in the *Load Selection* and the SGP is either unequipped to perform dynamic modification of the *Load Selection*, or dynamic modification of the *Load Selection* is not currently permitted.

3.1.5.3. M3UA Registration Status

The M3UA [M3UA] *Registration Status* parameter is formatted as follows: [5]

```
 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 = 0x0212          |             Length            |
+ - - - - - - - - - - - - - - - + - - - - - - - - - - - - - - - +
|                      Registration Status                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

REGEXT extends the M3UA [M3UA] *Registration Status* parameter by adding the following values to the status field:

Value	**Description**
11	*Error − Routing Key Change Refused*
17	*Error − Load Selection Change Refused*

The *"Error − Routing Key Change Refused"* status is returned when the ASP has included an *Routing Context* in the *Routing Key* and the SGP is either unequipped to perform dynamic modification of the *Routing Key*, or dynamic modification of the *Routing Key* is not currently permitted.

The *"Error − Load Selection Change Refused"* status is returned when the ASP has included a *Load Selector* in the *Load Selection* and the SGP is either unequipped to perform dynamic modification of the *Load Selection*, or dynamic modification of the *Load Selection* is not currently permitted.

3.2. Messages

REGEXT extends the ***REG REQ*** and ***REG RSP*** messages.

3.2.1. Registration Request (REG REQ)

REGEXT extends the ***Registration Request (REG REQ)*** message by extending the *Routing Key* (*Link Key*) parameter and permitting the *Routing Context* (*Interface Identifier*) to be included in the ***REG REQ*** message.

REGEXT also extends the ***REG REQ*** message by extending the *Load Selection* parameter [LOADSEL] and permitting the *Load Selector* to be included in the ***REG REQ*** message.

3.2.2. Registration Response (REG RSP)

REGEXT extends the ***Registration Response (REG RSP)*** message by adding the following values to the mandatory *Registration Status* parameter in the mandatory *Registration Result* parameter in the ***REG RSP*** message: [6]

Value	Description
11	Error – Routing (Link) Key Change Refused
17	Error – Load Selection Change Refused

The new *Registration Status* values are interpreted as follows:

"Error – Routing (Link) Key Change Refused" This *Registration Status* is returned in a ***REG RSP*** message by the SGP when it is either unequipped to perform *Routing (Link) Key* modifications described in this memo, or is otherwise unable to modify the the *Routing (Link) Key* as requested by the ASP.

"Error – Load Selection Change Refused" This *Registration Status* is returned in a ***REG RSP*** message by the SGP when it is either unequipped to perform *Load Selection* modifications described in this memo, or is otherwise unable to modify the the *Load Selection* as requested by the ASP.

Notes for §3

[1] **IANA NOTE:-** The parameter tag values shown as **`0x0119`** will be assigned by IANA within the specific parameter range of SUA [SUA] and may change its value in further versions of this document.

[2] **IANA Note:–** Note that the *Registration Status* parameter has tag value 0x030e for M2UA [M2UA], tag value 0x0212 for M3UA [M3UA] and (perhaps not surprisingly) tag value 0x0016 for ISUA [ISUA], SUA [SUA] and TUA [TUA].

[3] **IANA NOTE:–** The *Registration Status* value shown as **`11`** and **`17`** will be assigned by IANA as a value of the Common *Registration Status* parameter for the SIGTRAN UAs and may change its value in further versions of this document.

[3] **EDITOR'S NOTE:–** The M2UA [M2UA] *Registration Result*, *Registration Status*, *Deregistration Result* and *Deregistration Status* parameter should be altered from the M2UA-specific tag values to the Common tag values to be consistent with the other UAs.

[4] **IANA NOTE:–** The *Registration Status* value shown as **`11`** and **`17`** will be assigned by IANA as a value of the M2UA-specific *Registration Status* parameter for M2UA [M2UA] and may change its value in further versions of this document.

[5] **EDITOR'S NOTE:–** The M3UA [M3UA] *Registration Result*, *Registration Status*, *Deregistration Result* and *Deregistration Status* parameter should be altered from the M3UA-specific tag values to the Common tag values to be consistent with the other UAs.

[6] **IANA NOTE:–** The *Registration Status* value shown as **`11`** and **`17`** will be assigned by IANA as a value of the M3UA-specific *Registration Status* parameter for M3UA [M3UA] and may change its value in further versions of this document.

[6] **IANA NOTE:–** The *Registration Status* values shown as **`11`** and **`17`** will be assigned by IANA as a value of the Common *Registration Status* parameter for SIGTRAN UAs and may change its value in further versions of this document.

4. Procedures

4.1. Registration

In extension to the registration procedures of M2UA [M2UA], *REGEXT* provides the following registration procedures:

4.1.1. Common Registration Procedures

In extension to the registration procedures of Common [M3UA, SUA, ISUA, TUA], *REGEXT* provides the following registration procedures:

An ASP **MAY** modify an existing *Routing Key* by including the *Routing Context* in the ***REG REQ***. If the SGP determines that the *Routing Context* applies to an existing *Routing Key*, the SG **MAY** adjust the existing *Routing Key* to match the new information provided in the *Routing Key* parameter. A ***REG RSP*** with *Registration Status "Error – Routing Key Change Refused"* is returned if the SGP does not accept the modification of the *Routing Key*. [1]

An ASP **MAY** modify an existing *Load Selection* by including the *Load Selector* in the ***REG REQ***. If the SGP supports load selection extensions [LOADSEL] and determines that the *Load Selector* applies to an existing *Load Selection*, the SGP **MAY** adjust the existing *Load Selection* to match the new information provided in the *Load Selection* parameter. A ***REG RSP*** with *Registration Status "Error – Load Selection Change Refused"* is returned if the SGP does not accept the modification of the *Load Selection*.

4.1.2. M2UA Registration Procedures

In extension to the registration procedures of M2UA [M2UA], *REGEXT* provides the following registration procedures:

An ASP **MAY** modify an existing *Link Key* by including the *Interface Identifier* in the ***REG REQ***. If the SGP determines that the *Interface Identifier* applies to an existing *Link Key*, the SG **MAY** adjust the existing *Link Key* to match the new information provided in the *Link Key* parameter. A ***REG RSP*** with *Registration Status "Error – Link Key Change Refused"* is returned if the SGP does not accept the modification of the *Link Key*.

An ASP **MAY** modify an existing *Load Selection* by including the *Load Selector* in the ***REG REQ***. If the SGP supports load selection extensions [LOADSEL] and determines that the *Load Selector* applies to an existing *Load Selection*, the SGP **MAY** adjust the existing *Load Selection* to match the new information provided in the *Load Selection* parameter. A ***REG RSP*** with *Registration Status "Error – Load Selection Change Refused"* is returned if the SGP does not accept the modification of the *Load Selection*.

Notes for §4

[1] **EDITOR'S NOTE:–** ISUA [ISUA], SUA [SUA] and TUA [TUA] already contains the procedures described in this paragraph. The only difference provided by *REGEXT* is that the *Registration Status "Error – Routing Key Change Refused"* is actually defined.

5. Interworking

REGEXT also provides procedures for an SGP or ASP not supporting *REGEXT* to interwork with an ASP or SGP supporting *REGEXT*.

5.1. Registration Interworking

An ASP that determines than an SG is unequipped to perform *REGEXT* **SHOULD NOT** send any subsequent ***REG REQ*** messages containing a *Routing Context* (or *Interface Identifier*) to that SG.

An SG or ASP supporting *ASPEXT* [ASPEXT] will identify its ability or inability to support *REGEXT* using the ASP Extensions procedure [ASPEXT].

If an SG does not support dynamic registration, it also does not support *REGEXT*.

If an SG not supporting *REGEXT* receives a *Routing Context* (*Interface Identifier*) in the ***REG REQ*** message, it could respond with an existing non-zero *Registration Status* or an ***ERR*** message. If the ASP receives a ***REG RSP*** message containing a non-zero *Registration Status*, or receives an ***ERR*** message with an appropriate *Error Code* correlating to the ***REG REQ*** message and an indication that the *Routing Context* (*Interface Identifier*) parameter was considered invalid, from an SG not supporting ASP Extensions [ASPEXT], then the ASP **SHOULD** mark the SG as unequipped to perform *REGEXT* and not place any *Routing Context* (*Interface Identifier*) in any further messages to that SG, or attempt any of the extension procedures defined in this memo.

5.1.1. Registration Status REGEXT Unsupported

Examples of possible *Registration Status* errors returned in a ***REG RSP*** message when the peer does not support *REGEXT* are as follows:

Value	Description
4	Error – Invalid Routing Key
6	Error – Cannot Support Unique Routing Error – Overlapping (Non-unique) Link Key
7	Error – Routing Key not Currently Provisioned Error – Link Key not Provisioned
9	Error – Unsupported RK parameter field
11	Error – Routing Key Change Refused Error – Link Key Change Refused

5.1.2. Error Codes REGEXT Unsupported

Examples of possible *Error Codes* returned in a ***ERR*** message when the peer does not support *REGEXT* are as follows:

Value	Description
0x02	Invalid Interface Identifier
0x03	Unsupported Message Class
0x04	Unsupported Message Type
0x10	ASP Active for Interface Identifier(s)
0x11	Invalid Parameter Value
0x12	Parameter Field Error
0x13	Unexpected Parameter
0x19	Invalid Routing Context

6. Examples

7. Security

REGEXT provides adds some security risks to M2UA [M2UA], M3UA [M3UA], ISUA [ISUA], SUA [SUA] and TUA [TUA].

If the Signalling Gateway (SG) does cannot properly authenticate the peer, the peer might gain privileges to alter a *Routing (Link) Key* to which the peer should not have permission, or alter a *Load Selection* to which the peer should not have permission.

However, if the peer can imitate an ASP and gain access with the privileges of an ASP, use of the *Routing Context (Interface Identifier)* parameter in the ASPTM message can always be used to perform denial of service on traffic destined for legitimate Application Servers. As the *REGEXT* extensions require the use of the *Routing Context (Interface Identifier)* parameter in the ***REG REQ*** message, the same levels of protection afforded the

Routing Context (Interface Identifier) parameter in the ***REG REQ*** message as is experienced in the ***ASPAC (ACK)*** message.

8. IANA Considerations

REGEXT adds the following parameter tag value (described in Section 3) to the SUA-Specific Parameter numbering range for SUA [SUA]:

Tag Value	Parameter Name
0x0119	Reference Number Range[1]

Notes for §8

[1] **IANA NOTE:–** The *Reference Number Range* tag values shown through this document as **`0x0119`** will be assigned by IANA within the SUA-specific parameter range of the SUA [SUA] and may change its value in further versions of this document.

0. Revision History

This section provides historical information on the changes made to this draft. This section will be removed from the document when the document is finalized.

0.2. Changes from Version 0.1 to Version 0.2

- added list of abbreviations.
- moved change history here.
- updated references.
- split references.
- updated version numbers and dates.
- updated security section.
- moved notes to end of document.
- fixed spelling errors and typos.

0.1. Changes from Version 0.0 to Version 0.1

- added this history section,
- updated references,
- updated version numbers and dates,
- updated author's address.
- addition of *Source Reference Number*, *Destination Reference Number* and *Reference Number Range* to SUA [SUA14] *Routing Key*.

0.0.0. Change Log

```
$Log: draft-bidulock-sigtran-regext-02.me,v $
Revision 0.8.2.4  2003/08/01 12:23:16  brian
Added abbreviations, updated format.

Revision 0.8.2.3  2003/07/29 00:35:09  brian
Finalizing latest round of drafts.

Revision 0.8.2.2  2003/07/28 13:12:21  brian
Reformatting.

Revision 0.8.2.1  2003/07/27 08:15:30  brian
Checking in changes.
```

R. References

R.1. Normative References

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R.2. Informative References

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List of Illustrations

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