**Origination Date:** 10/06/2020

**Originator:** 10x People, iconectiv

### Change Order Number: 554

**Description:** XML LSMS Query Recovery

**Functional Backwards Compatible:** Yes

**IMPACT/CHANGE ASSESSMENT**

|  |  |  |
| --- | --- | --- |
| DOC | FRS | IIS |
| Y | Y |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| CMIP | GDMO | ASN.1 | **NPAC** | SOA | LSMS |
| N | N | N | N | N |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| XML | XIS | XSD | **NPAC** | SOA | LSMS |
| Y | Y | Y | N | Y |

**Business Need**

When an XML LSMS is not responding to NPAC SMS download messages for either a period of time or after a certain volume of messages are queued to be sent, NPAC SMS operations staff may disable downloads to the XML LSMS or change the state of the XML LSMS to Inactive. When this occurs, the only mechanisms for XML LSMS systems to recover missed downloads are either

* by requesting and processing a BDD file for the time range when the XML LSMS downloads were disabled or the XML LSMS was in an Inactive state or
* performing queries to obtain the missed data while simultaneously processing new downloads.

Having a mechanism that is analogous to the CMIP interface’s recovery functionality would allow for XML LSMS systems to recover missed data without the need for a BDD file or querying data while processing downloads from the NPAC SMS. Also see PIM 130.

**Description of Change:**

This change introduces a new concept called “suspend mode,” which causes the NPAC SMS to keep or queue new messages generated for an LSMS. While the NPAC SMS queues these messages for an LSMS, the LSMS can query the NPAC SMS for objects (Portable NPA-NXX, NPA-NXX-X, LRN, Subscription Version, Number Pool Block) that were missed during a period when the download indicators for the LSMS were turned off at the NPAC SMS. This allows for more efficient recovery by the LSMS, as the LSMS is able to process the queries and query responses without simultaneously processing new download request messages from the NPAC SMS.

This functionality would only need to be invoked when an LSMS has been unavailable for a period of time and the NPAC SMS operations staff determines that the download indicators for the LSMS need to be turned off in order to mitigate impacts to other users. It is anticipated that this is a rare occurrence, certainly not daily or even weekly, based on historical data.

December 2020 NPIF meeting: Changes made to introduce SpidAndNetworkDataQueryRequest and SpidAndNetworkDataQueryReply messages in XML interface. This message would be used to query Customer and Network Data objects by activity timestamp range and could only be used by an LSMS in suspend mode. Previously proposed changes to NPA-NXX, LRN, and NPA-NXX-X query parameters to add activity timestamp as a query parameter were removed.

FRS:

**1.2.13 Recovery Functionality**

The NPAC SMS provides a mechanism that allows a Service Provider to recover messages sent to either the SOA or LSMS, during a period of time that the Service Provider was not available to receive messages from the NPAC SMS.

* The CMIP Interface recovery mechanism (also referred to as resynchronization) is initiated when a Service Provider’s SOA or LSMS re-associates to the NPAC SMS, by setting the recovery mode indicator to TRUE on the Access Control structure, then requests the recovery of missed messages, by requesting the missed Network Data, Subscription Versions and/or Notifications.
* The XML Interface does not have a recovery mechanism for SOA as messages are retried until successful (therefore, resynchronization is not a concept that is available over the XML Interface for SOA). For LSMS systems, the XML Interface supports an optional recovery-like mechanism that allows the NPAC SMS to suspend sending of new messages to the LSMS while the LSMS queries the NPAC SMS for missed data.

The CMIP Interface SOA requests network data and notification data for a specific period of time from the NPAC SMS, which is sent by the NPAC SMS as requested. The NPAC SMS will send the recovery data requested based on the Service Provider’s Linked Replies Indicator setting (separate indicators for SOA and LSMS). If the Linked Replies Indicator is set to TRUE the NPAC SMS will send the updates in smaller, linked messages (e.g., groups of 50 at a time). If the Linked Replies Indicator is set to FALSE the NPAC SMS will send the updates in a single larger, non-linked message. In the case of linked replies, data is sent in multiple linked M-ACTION replies, followed by an “empty” non-linked normal response (indicating the end of the linked reply data). During the recovery process, new messages are queued on the NPAC SMS. Additionally, during the recovery process, the “x by y” retry functionality (where “x” is the number of attempts, and “y” is the interval in number of minutes in between attempts) continues on the NPAC SMS, but message sending is suspended to the SOA, and the retry attempts counter is not decremented, as long as the SOA is still in recovery mode. Once the recovery is finished, the SOA sends a recovery complete message to the NPAC SMS, which in turn triggers the NPAC SMS to send the previously queued messages to the SOA, at the next normally scheduled retry interval. At the completion of sending the previously queued messages, the interaction between the SOA and the NPAC SMS resumes for normal message processing.

The CMIP Interface LSMS recovery functionality works similar to the SOA, with the addition of recovering subscription data.

CMIP Interface Service Provider systems may implement an optional recovery method called, *“Send What I Missed”* (SWIM). This implementation uses the existing recovery messages, and incorporates a new attribute (SWIM, rather than a time range). When the NPAC SMS receives a SWIM recovery request it issues a SWIM recovery response that contains only the messages that were previously *missed* by the requesting Service Provider system. Linked Reply functionality is utilized in the SWIM responses, so a Service Provider system must support that feature as well. SWIM improves the efficiency of recovery processing for the NPAC SMS and Service Providers because guesswork of determining a recovery timeframe that includes the actual messages that were missed is eliminated.

For the XML Interface, the NPAC SMS will retry messages to the SOA and LSMS until successful. For LSMS XML Interface only, the NPAC SMS can suspend sending of messages to the LSMS while the LSMS resynchornizes itself to the NPAC SMS by performing queries. The LSMS would need to perform this interface-based resynchronization if there is time when its download indicators are turned off and recovery is not performed using Bulk Data Download files.

**1.2.13.1 CMIP Network Data Recovery**

[snip]

**1.2.13.2 CMIP Subscription Data Recovery**

[snip]

**1.2.13.3 CMIP Notification Recovery**

[snip]

**1.2.13.4. CMIP Service Provider Data Recovery**

[snip]

3.1.2 NPAC Customer Data

| **NPAC CUSTOMER DATA MODEL** | | | |
| --- | --- | --- | --- |
| **Attribute Name** | **Type (Size)** | **Required** | **Description** | |
| [snip] |  |  |  | |
| LSMS XML Supports Suspend Mode Indicator | B | √ | A Service Provider Boolean that defines whether the NPAC Customer supports Suspend Mode for its LSMS XML Interface (only applies to the XML interface, not CMIP interface).  The default is FALSE. | |
| [snip] |  |  |  | |

R4-8 Service Provider Data Elements

NPAC SMS shall require the following data if there is no existing Service Provider data:

[snip]

NPAC Customer LSMS XML Supports Suspend Mode Indicator

Req 1 – Service Provider LSMS XML Supports Suspend Mode Indicator

NPAC SMS shall provide a Service Provider LSMS XML Supports Suspend Mode Indicator tunable parameter which defines whether an LSMS supports Suspend Mode for its XML interface.

Req 2 – Service Provider LSMS XML Supports Suspend Mode Indicator Default

NPAC SMS shall default the Service Provider LSMS XML Supports Suspend Mode Indicator tunable parameter to FALSE.

Req 3 – Service Provider LSMS XML Supports Suspend Mode Indicator Modification

NPAC SMS shall allow NPAC Personnel, via the NPAC Administrative Interface, to modify the Service Provider LSMS XML Supports Suspend Mode Indicator tunable parameter.

Req 4 – LSMS XML Suspend Mode

NPAC SMS shall support a Suspend Mode state for XML LSMS systems. By default, all XML LSMS systems are not in Suspend Mode.

Req 5 – LSMS XML Suspend Mode and Request Messages from NPAC SMS

The NPAC SMS shall inhibit the sending of request messages (notifications, downloads, queries) to an XML LSMS system that is in Suspend Mode. The NPAC SMS shall continue to generate request messages for an XML LSMS system that is in Suspend Mode, per the download indicators for the LSMS, and shall queue or hold these request messages while the XML LSMS system is in Suspend Mode.

Req 6 – LSMS XML Suspend Mode and Request Messages from LSMS

The NPAC SMS shall accept and process request and response messages from an XML LSMS while the XML LSMS is in Suspend Mode. That is, the Suspend Mode state of an XML LSMS shall not affect how NPAC SMS processes request and response messages from the XML LSMS, including sending responses to the XML LSMS.

Req 7 – LSMS XML Suspend Mode and NPAC SMS Request Retries

The NPAC SMS shall not send request retries (see RR6-221) for an XML LSMS system in Suspend Mode.

Req 8 – Entering LSMS XML Suspend Mode

The NPAC SMS shall allow NPAC Personnel, via the NPAC Administrative Interface, to place an LSMS XML system into the Suspend Mode state if there are no existing queued messages (i.e., message waiting for a synchronous or asynchronous response) that are to be sent to the LSMS and if the SPID of the LSMS has a value of True for its Service Provider LSMS XML Supports Suspend Mode Indicator attribute.

Req 9 – Exiting LSMS XML Suspend Mode – NPAC Personnel

The NPAC SMS shall allow NPAC Personnel, via the NPAC Administrative Interface, to remove an LSMS XML system from the Suspend Mode state.

Req 10 – Exiting LSMS XML Suspend Mode – LSMS

The NPAC SMS shall allow an LSMS to request the LSMS be removed from Suspend Mode, via the NPAC SMS-to-LSMS XML Interface.

Req 11 – Exiting LSMS XML Suspend Mode – LSMS Request Validation

The NPAC SMS shall validate that an LSMS requesting removal from Suspend Mode is currently in Suspend Mode when the request is processed.

Req 12 – Exiting LSMS XML Suspend Mode – NPAC SMS Resumes Request Messages

When an LSMS exits Suspend Mode, the NPAC SMS shall resume sending request messages (notifications, downloads, queries) to an LSMS XML system, including any request messages that were generated while an LSMS was in Suspend Mode, and retry processing shall resume.

Req 13 – Query of Network Data by LSMS in Suspend Mode

The NPAC SMS shall support a mechanism for an LSMS XML system that in Suspend Mode to query for both existing and deleted Customer objects, Portable NPA-NXX objects, NPA-NXX-X objects, and LRN objects. For deleted objects, the NPAC SMS shall return data for any object matching the request criteria that was deleted within the retention interval specified by the History File Data Storage system tunable.

XIS:

**2.6 Recovery of Failed or Missed Messages**

[snip]

The NPAC will have the capability to turn off the continuous retries for any specific message or all queued messages for a SPID. When this is done, the SOA or LSMS system must take corrective action (a BDD, query, or audit) to recover what has been missed.

For LSMS systems, the NPAC can put the system into a Suspend Mode, which allows for the LSMS system to perform queries to recover missed data while the NPAC holds new request messages for the LSMS and ceases asynchronous request message retries. Once the LSMS system has completed querying the NPAC for missed data, it can send a message to the NPAC to remove the Suspend Mode state which allows the request messages that were held during Suspend Mode to be sent to the LSMS. NPAC Operations personnel can also remove an LSMS from the Suspend Mode state. Roll-up timers continue to run while an LSMS is in Suspend Mode. ProcessingError and KeepAlive messages are also sent by the NPAC SMS while an LSMS is in Suspend Mode.











**5.4 Message Flow**

[snip]

| **Request** | **Direction** | **Reply** |
| --- | --- | --- |
| [snip] |  |  |
| NpbQueryRequest | LSMS to NPAC | NpbQueryReply |
| SpidAndNetworkDataQueryRequest | LSMS to NPAC | SpidAndNetworkDataQueryReply |
| SpidQueryRequest | LSMS to NPAC | SpidQueryReply |
| SuspendModeEndRequest | LSMS to NPAC | SuspendModeEndReply |
| SvQueryRequest | LSMS to NPAC | SvQueryReply |
| [snip] |  |  |

**5.7.*X* SpidAndNetworkDataQueryRequest**

The SpidAndNetworkDataQueryRequest message is a request from the LSMS to obtain SPID, LRN, Portable NPA-NXX, or NPA-NXX-X data while the LSMS is in Suspend Mode. Only one type of object may be queried with any given request. This query request is only allowed for an LSMS in Suspend Mode. Attempts to use this query request when an LSMS is not in Suspend Mode will result in an access\_denied error reply.

The asynchronous reply to this message is a SpidAndNetworkDataQueryReply message

5.7.*X*.1 SpidAndNetworkDataQueryRequest Parameters

| **Parameter** | **Description** |
| --- | --- |
| object\_type | This required field indicates the type of object to be queried. Valid values are:   * lrn * npa\_nxx * npa\_nxx\_x * sp\_id |
| activity\_timestamp\_start | This required field specifies the earliest activity timestamp value that will be used to find objects of the type specified by object\_type. |
| activity\_timestamp\_end | This required field specifies the latest activity timestamp value that will be used to find objects of the type specified by object\_type. |

5.7.*X*.2 SpidAndNetworkDataQueryRequest XML Example

<?xml version="1.0" encoding="UTF-8" standalone="no"?>

<LSMSMessages xmlns="urn:lnp:npac:1.0"

xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

<MessageHeader>

<schema\_version>5.1</schema\_version>

<sp\_id>1111</sp\_id>

<sp\_key>123456789012</sp\_key>

<npac\_region>midatlantic\_region</npac\_region>

<departure\_timestamp>2020-12-08T00:00:15.034Z</departure\_timestamp>

</MessageHeader>

<MessageContent>

<lsms\_to\_npac>

<Message>

<invoke\_id>8684</invoke\_id>

<origination\_timestamp>2020-12-08T00:00:15.011Z</origination\_timestamp>

<SpidAndNetworkDataQueryRequest>

<object\_type>lrn</object\_type>

<activity\_timestamp\_start>2020-12-07T20:14:12.000Z</activity\_timestamp\_start>

<activity\_timestamp\_end>2020-12-07T23:58:00.000Z</activity\_timestamp\_end>

</SpidAndNetworkDataQueryRequest>

</Message>

</lsms\_to\_npac>

</MessageContent>

</LSMSMessages>

**5.7.*X* SuspendModeEndRequest**

The SuspendModeEndRequest message is a request from the LSMS to indicate that it should be removed from the Suspend Mode state.

The asynchronous reply to this message is a SuspendModeEndReply message.

5.7.*X*.1 SuspendModeEndRequest Parameters

None

5.7.*X*.2 SuspendModeEndRequest XML Example

<?xml version="1.0" encoding="UTF-8" standalone="no"?>

<LSMSMessages xmlns="urn:lnp:npac:1.0"

xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

<MessageHeader>

<schema\_version>5.1</schema\_version>

<sp\_id>1111</sp\_id>

<sp\_key>123456789012</sp\_key>

<npac\_region>midatlantic\_region</npac\_region>

<departure\_timestamp>2020-08-16T09:30:48.101Z</departure\_timestamp>

</MessageHeader>

<MessageContent>

<lsms\_to\_npac>

<Message>

<invoke\_id>941</invoke\_id>

<origination\_timestamp>2020-08-16T09:30:47.244Z  
</origination\_timestamp>

<SuspendModeEndRequest/>

</Message>

</lsms\_to\_npac>

</MessageContent>

</LSMSMessages>

**5.8.*X* SpidAndNetworkDataQueryReply**

This message is the asynchronous reply to a SpidAndNetworkDataQueryRequest.

5.8.*X*.1 SpidAndNetworkDataQueryReply Parameters

| **Parameter** | **Description** |
| --- | --- |
| basic\_code | This required attribute will always be populated in this message. basic\_code indicates the high level success or failure, and is described in detail in the “Error Handling” section. |
| status\_code | status\_code is an optional field that specifies the error number. |
| status\_info | status\_info is an optional field that describes the error info. |
| lrn\_list | This optional (choice) element is a list of lrn\_data structures that contain the data resulting from the query. |
| lrn\_data | This required field is a list with one or more sets of the following 6 values: |
| sp\_id | This required field indicates the SPID that created the LRN. |
| lrn\_id | This required field specifies the unique numeric identifier of the LRN |
| lrn\_value | This required field specifies the value of the LRN. |
| download\_reason | This required field specifies the reason for the download of the LRN |
| lrn\_creation\_timestamp | This required field specifies the timestamp of when the LRN was created. |
| activity\_timestamp | This required field specifies the timestamp of when the NPAC last created a notification or download for the LRN object. |
| npa\_nxx\_list | This optional (choice) element is a list of npa\_nxx\_data structures that contain the results of the query |
| npa\_nxx\_data | This required field is a list with one or more sets of the following 8 values: |
| sp\_id | This required field specifies the SPID that owns the NPA-NXX |
| npa\_nxx\_id | This required field specifies the unique numeric identifier of the NPA-NXX |
| npa\_nxx\_value | This required field specifies the value of the NPA-NXX |
| npa\_nxx\_effective\_timestamp | This required field specifies the timestamp of when the NPA-NXX is effective. |
| download\_reason | This required field specifies the reason for the download of the NPA-NXX |
| npa\_nxx\_creation\_timestamp | This required field specifies the timestamp of when the NPA-NXX was created. |
| npa\_nxx\_modified\_timestamp | This optional field specifies the timestamp of when the NPA-NXX was last modified. |
| activity\_timestamp | This required field specifies the timestamp of when the NPAC last created a notification or download for the NPA-NXX object. |
| npa\_nxx\_x\_list | This optional (choice) element is a list of npa\_nxx\_x\_data structures that contain the results of the query. |
| npa\_nxx\_x\_data | This required field is a list with one or more sets of the following 8 values: |
| sp\_id | This required field specifies the SPID that owns the NPA-NXX-X |
| npa\_nxx\_x\_id | This required field specifies the unique numeric identifier of the NPA-NXX-X |
| npa\_nxx\_x\_value | This required field specifies the value of the NPA-NXX-X. |
| npa\_nxx\_x\_effective\_timestamp | This required field specifies the timestamp of when the NPA-NXX-X is effective. |
| npa\_nxx\_x\_creation\_timestamp | This required field specifies the timestamp of when the NPA-NXX-X was created. |
| npa\_nxx\_x\_modified\_timestamp | This required field specifies the timestamp of when the NPA-NXX-X was last modified. |
| download\_reason | This required field specifies the reason for the download of the NPA-NXX-X |
| activity\_timestamp | This required field specifies the timestamp of when the NPAC last created a notification or download for the NPA-NXX-X object. |
| spid\_list | This optional (choice) contains a list of spid\_data structures that contain the results of the query. |
| spid\_data | This required field is a list with one more more sets of the following 5 values: |
| sp\_id | This required field indicates the Service Provider ID. |
| sp\_name | This required field indicates the Service Provider name. |
| sp\_type | This optional field indicates the Service Provider type and, if supported, it will be populated as one of the following values:   * wireline * wireless * non\_carrier * class1\_and\_2\_voip\_with\_num\_assgnmt * sp\_type\_4 * sp\_type\_5 |
| activity\_timestamp | This required field specifies the timestamp of when the NPAC last created a notification or download for the Service Provider object. |
| download\_reason | This required field specifies the reason for the download of the Service Provider |

5.8.*X*.2 SpidAndNetworkDataQueryReply XML Example

<?xml version="1.0" encoding="UTF-8" standalone="no"?>

<LSMSMessages xmlns="urn:lnp:npac:1.0"

xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

<MessageHeader>

<schema\_version>5.1</schema\_version>

<sp\_id>1111</sp\_id>

<sp\_key>123456789012</sp\_key>

<npac\_region>midatlantic\_region</npac\_region>

<departure\_timestamp>2020-12-08T00:00:15.034Z</departure\_timestamp>

</MessageHeader>

<MessageContent>

<npac\_to\_lsms>

<Message>

<invoke\_id>8684</invoke\_id>

<origination\_timestamp>2020-12-08T00:00:18.814Z</origination\_timestamp>

<SpidAndNetworkDataQueryReply>

<reply\_status>

<basic\_code>success</basic\_code>

</reply\_status>

<lrn\_list>

<lrn\_data>

<sp\_id>1111</sp\_id>

<lrn\_id>95867</lrn\_id>

<lrn\_value>2155550000</lrn\_value>

<download\_reason>dr\_new</download\_reason>

<lrn\_creation\_timestamp>2020-12-07T23:10:02Z</lrn\_creation\_timestamp>

<activity\_timestamp>2020-12-07T23:10:02.211Z</activity\_timestamp>

</lrn\_data>

</lrn\_list>

</SpidAndNetworkDataQueryReply>

</Message>

</npac\_to\_lsms>

</MessageContent>

</LSMSMessages>

**5.8.*X* SuspendModeEndReply**

This message is the asynchronous reply to a SuspendModeEndRequest.

5.8.*X*.1 SuspendModeEndReply Parameters

| **Parameter** | **Description** |
| --- | --- |
| basic\_code | This required attribute will always be populated in this message. basic\_code indicates the high level success or failure, and is described in detail in the “Error Handling” section. |
| status\_code | status\_code is an optional field that specifies the error number. |
| status\_info | status\_info is an optional field that describes the error info. |

5.8.*X*.2 SuspendModeEndReply XML Example

<?xml version="1.0" encoding="UTF-8" standalone="no"?>

<LSMSMessages xmlns="urn:lnp:npac:1.0"

xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

<MessageHeader>

<schema\_version>5.1</schema\_version>

<sp\_id>1111</sp\_id>

<sp\_key>123456789012</sp\_key>

<npac\_region>midatlantic\_region</npac\_region>

<departure\_timestamp>2020-08-16T09:30:48.991Z</departure\_timestamp>

</MessageHeader>

<MessageContent>

<npac\_to\_lsms>

<Message>

<invoke\_id>941</invoke\_id>

<origination\_timestamp>2020-08-16T09:30:48.982Z  
</origination\_timestamp>

<SuspendModeEndReply>

<basic\_code>success</basic\_code>

</SuspendModeEndReply>

</Message>

</npac\_to\_lsms>

</MessageContent>

</LSMSMessages>

XSD:

[snip]

<xs:simpleType name="BlockStatus">

<xs:restriction base="xs:token">

<xs:enumeration value="block\_status\_active"/>

<xs:enumeration value="block\_status\_sending"/>

<xs:enumeration value="block\_status\_failed"/>

<xs:enumeration value="block\_status\_partial\_failed"/>

<xs:enumeration value="block\_status\_old"/>

</xs:restriction>

</xs:simpleType>

<xs:simpleType name="CustomerNetworkDataObjectType">

<xs:restriction base="xs:token">

<xs:enumeration value="lrn"/>

<xs:enumeration value="npa\_nxx"/>

<xs:enumeration value="npa\_nxx\_x"/>

<xs:enumeration value="sp\_id"/>

</xs:restriction>

</xs:simpleType>

<xs:simpleType name="DigitString">

<xs:restriction base="xs:string">

<xs:pattern value="[#\\*0123456789]{0,}"/>

</xs:restriction>

</xs:simpleType>

[snip]

<!-- Service Provider Network -->

<!--SPID and Network Data Query Requests/Reply allowed only when LSMS in Suspend Mode-->

<xs:complexType name="SPIDAndNetworkDataQueryRequestData">

<xs:sequence>

<xs:element name="object\_type" type="CustomerNetworkDataObjectType"/>

<xs:element name="activity\_timestamp\_start" type="xs:dateTime"/>

<xs:element name="activity\_timestamp\_end" type="xs:dateTime"/>

</xs:sequence>

</xs:complexType>

<xs:complexType name="SPIDAndNetworkDataQueryReplyData">

<xs:sequence>

<xs:element name="reply\_status" type="BasicStatus"/>

<xs:choice minOccurs="0">

<xs:element name="lrn\_list">

<xs:complexType>

<xs:sequence maxOccurs="unbounded">

<xs:element name="lrn\_data" type="LrnQueryData"/>

</xs:sequence>

</xs:complexType>

</xs:element>

<xs:element name="npa\_nxx\_list">

<xs:complexType>

<xs:sequence maxOccurs="unbounded">

<xs:element name="npa\_nxx\_data" type="NpaNxxQueryData"/>

</xs:sequence>

</xs:complexType>

</xs:element>

<xs:element name="npa\_nxx\_x\_list">

<xs:complexType>

<xs:sequence maxOccurs="unbounded">

<xs:element name="npa\_nxx\_x\_data" type="NpaNxxXQueryData"/>

</xs:sequence>

</xs:complexType>

</xs:element>

<xs:element name="spid\_list">

<xs:complexType>

<xs:sequence maxOccurs="unbounded">

<xs:element name="spid\_data" type="SPIDQueryData"/>

</xs:sequence>

</xs:complexType>

</xs:element>

</xs:choice>

</xs:sequence>

</xs:complexType>

<xs:complexType name="SPIDData">

<xs:sequence>

<xs:element name="sp\_id" type="ServiceProvId"/>

<xs:element name="sp\_name" type="ServiceProvName" minOccurs="0"/>

<xs:element name="sp\_type" type="ServiceProvType" minOccurs="0"/>

<xs:element name="download\_reason" type="DownloadReason"/>

</xs:sequence>

[snip]

<xs:complexType name="LSMStoNPAC">

<xs:sequence maxOccurs="unbounded">

<xs:element name="Message">

<xs:complexType>

<xs:sequence>

<xs:element name="invoke\_id" type="NumberString"/>

<xs:element name="origination\_timestamp" type="xs:dateTime"/>

<xs:choice>

<xs:element name="DownloadReply" type="BasicStatus"/>

<xs:element name="KeepAlive"/>

<xs:element name="LrnQueryRequest" type="LrnQueryRequestData"/>

<xs:element name="NotificationReply" type="BasicStatus"/>

<xs:element name="NpaNxxDxQueryRequest" type="NpaNxxXQueryRequestData"/>

<xs:element name="NpaNxxQueryRequest" type="NpaNxxQueryRequestData"/>

<xs:element name="NpbQueryRequest" type="NumberPoolBlockQueryRequestData"/>

<xs:element name="ProcessingError" type="BasicStatus"/>

<xs:element name="QueryLsmsSvReply" type="QueryLsmsSVsReplyData"/>

<xs:element name="QueryLsmsNpbReply" type="QueryLsmsBlocksReplyData"/>

<xs:element name="SpidAndNetworkDataQueryRequest" type="SPIDAndNetworkDataQueryRequestData"/>

<xs:element name="SpidQueryRequest" type="SPIDQueryRequestData"/>

<xs:element name="SuspendModeEndRequest"/>

<xs:element name="SvQueryRequest" type="SubscriptionVersionQueryRequestData"/>

</xs:choice>

</xs:sequence>

</xs:complexType>

</xs:element>

</xs:sequence>

</xs:complexType>

[snip]

<xs:complexType name="NPACtoLSMS">

<xs:sequence maxOccurs="unbounded">

<xs:element name="Message">

<xs:complexType>

<xs:sequence>

<xs:element name="invoke\_id" type="NumberString"/>

<xs:element name="origination\_timestamp" type="xs:dateTime"/>

<xs:choice>

<xs:element name="KeepAlive"/>

<xs:element name="LnpSpidMigrationNotification" type="LnpSpidMigrationAction"/>

<xs:element name="LrnQueryReply" type="LrnQueryReplyData"/>

<xs:element name="LrnCreateDownload" type="LrnData"/>

<xs:element name="LrnDeleteDownload" type="LrnDeleteData"/>

<xs:element name="NewNpaNxxNotification" type="VersionNewNpaNxx"/>

<xs:element name="NotificationReply" type="BasicStatus"/>

<xs:element name="NpaNxxCreateDownload" type="NpaNxxData"/>

<xs:element name="NpaNxxModifyDownload" type="NpaNxxModifyData"/>

<xs:element name="NpaNxxDeleteDownload" type="NpaNxxDeleteData"/>

<xs:element name="NpaNxxDxCreateDownload" type="NpaNxxXData"/>

<xs:element name="NpaNxxDxDeleteDownload" type="NpaNxxXDeleteData"/>

<xs:element name="NpaNxxDxQueryReply" type="NpaNxxXQueryReplyData"/>

<xs:element name="NpaNxxDxModifyDownload" type="NpaNxxXModifyData"/>

<xs:element name="NpaNxxQueryReply" type="NpaNxxQueryReplyData"/>

<xs:element name="NpbCreateDownload" type="NumberPoolBlockData"/>

<xs:element name="NpbDeleteDownload" type="NumberPoolBlockDeleteData"/>

<xs:element name="NpbModifyDownload" type="NumberPoolBlockModifyData"/>

<xs:element name="NpbQueryReply" type="NumberPoolBlockQueryReplyData"/>

<xs:element name="ProcessingError" type="BasicStatus"/>

<xs:element name="QueryLsmsSvRequest" type="QueryExpression"/>

<xs:element name="QueryLsmsNpbRequest" type="QueryExpression"/>

<xs:element name="SpidAndNetworkDataQueryReply" type="SPIDAndNetworkDataQueryReplyData"/>

<xs:element name="SpidCreateDownload" type="SPIDData"/>

<xs:element name="SpidModifyDownload" type="SPIDData"/>

<xs:element name="SpidDeleteDownload" type="SPIDDeleteData"/>

<xs:element name="SpidQueryReply" type="SPIDQueryReplyData"/>

<xs:element name="SuspendModeEndReply" type="BasicStatus"/>

<xs:element name="SvCreateDownload" type="SubscriptionVersionCreateData"/>

<xs:element name="SvDeleteDownload" type="SubscriptionVersionDeleteData"/>

<xs:element name="SvModifyDownload" type="SubscriptionVersionModifyData"/>

<xs:element name="SvQueryReply" type="SubscriptionVersionQueryReplyData"/>

</xs:choice>

</xs:sequence>

</xs:complexType>

</xs:element>

</xs:sequence>

</xs:complexType>

EFD:

**A.3 CMIP Error Mapping to NPAC SMS Errors**

|  |  |  |  |
| --- | --- | --- | --- |
| [snip] |  |  |  |
| 14517 | HTTP message is not “POST HTTP/1.1” | 2 | accessDenied\_er |
| 14518 | LSMS is not in Suspend Mode | 2 | accessDenied\_er |
| 14519 | Customer/Network Data Query prohibited when not in Suspend Mode | 2 | accessDenied\_er |
| 15000 | MUMP File - Invalid Section Name | 10 | processingFailure\_er |
| [snip] |  |  |  |

**B.7 Local SMS and SOA Recovery**

[snip]

If the Local SMS or SOA supports the receipt of linked action replies (based on the Local SMS Linked Replies Indicator and SOA Linked Replies Indicator, in the NPAC Customer record), the NPAC SMS will send linked action replies when a recovery request is initiated and the amount of data returned is greater than the associated Blocking Factor.

Flow B.7.*X* does not apply to the CMIP interface; it is applicable only to the XML interface.

**XML Interface:** ~~None of the flows in this section (B.7) are applicable over the XML interface, as there is no recovery in XML (i.e., all XML messages are retried until successful).~~ For the XML NPAC-SMS-to-LSMS interface, only flow B.7.*X* applies. All other flows in this section are applicable only to the CMIP interface.

B.7.*X* Suspend Mode Processing for XML LSMS Recovery

This scenario demonstrates how an XML LSMS can resynchronize itself using Suspend Mode to inhibit new request messages and asynchronous retries from the NPAC SMS while it queries for missed data. This functionality is only available to those LSMSs that support the feature, as indicated by the Service Provider LSMS XML Supports Suspend Mode Indicator attribute.

NPAC

LSMS

NPAC SMS places  
LSMS in Suspend Mode

1. SNQQ – SpidAnd NetworkDataQueryRequest

2. SNQR – SpidAndNetworkDataQueryReply

3. SNQQ – SpidAnd NetworkDataQueryRequest

4. SNQR – SpidAndNetworkDataQueryReply

5. SNQQ – SpidAnd NetworkDataQueryRequest

6. SNQR – SpidAndNetworkDataQueryReply

7. SNQQ – SpidAnd NetworkDataQueryRequest

8. SNQR – SpidAndNetworkDataQueryReply

11. PBQQ – NpbQueryRequest

12. PBQR – NpbQueryReply

9. SVQQ – SvQueryRequest

10. SVQR – SvQueryReply

13. SMEQ – SuspendModeEndRequest

14. SMER – SuspendModeEndReply

After a period when new download message generation was turned off for an LSMS, due to LSMS unavailability, the LSMS reestablishes its ability to process requests from the NPAC SMS. All messages generated prior to the disabling of new downloads for the LSMS are then sent by the NPAC SMS to the LSMS. The LSMS now needs to recover data missed for the period when downloads were turned off by the NPAC SMS.

After the NPAC SMS places the LSMS into Suspend Mode and turns on generation of new download messages to the LSMS, NPAC Operations personnel provide a time range to the LSMS operator to be used for querying the NPAC SMS for missed objects. The LSMS will now query the NPAC SMS to recover the missed data.

1. The LSMS issues a SNQQ – SpidAndNetworkDataQueryRequest message to the NPAC SMS to query for Customer objects created, modified, or deleted, populating the start and end activity timestamp parameters with the time range provided by NPAC operations personnel.
2. The NPAC SMS responds with an SNQR – SpidAndNetworkDataQueryReply that provides all of the Customer objects requested by the query.
3. The LSMS issues an SNQQ – SpidAndNetworkDataQueryRequest message to the NPAC SMS to query for Portable NPA-NXX objects that were created, modified, or deleted, populating the start and end activity timestamp parameters with the time range provided by NPAC operations personnel.
4. The NPAC SMS responds with an SNQR – SpidAndNetworkDataQueryReply that provides all of the Portable NPA-NXX objects requested by the query.
5. The LSMS issues an SNQQ – SpidAndNetworkDataQueryRequest message to the NPAC SMS to query for LRN objects that were created or deleted, populating the start and end activity timestamp parameters with the time range provided by NPAC operations personnel.
6. The NPAC SMS responds with an SNQR – SpidAndNetworkDataQueryReply that provides all of the LRN objects requested by the query.
7. The LSMS issues a SNQQ – SpidAndNetworkDataQueryRequest message to the NPAC SMS to query for NPA-NXX-X objects that were created, modified, or deleted, populating the start and end activity timestamp parameters with the time range provided by NPAC operations personnel.
8. The NPAC SMS responds with a SNQR – SpidAndNetworkDataQueryReply that provides all of the NPA-NXX-X objects requested by the query.
9. The LSMS issues an SVQQ – SvQueryRequest message to the NPAC SMS to query for Subscription Version objects that were created or modified during the time range provided by NPAC operations personnel. The broadcast timestamp query parameter can be used to find any Subscription Version objects created, modified, or deleted during a time range.
10. The NPAC SMS responds with an SVQR – SvQueryReply that provides all of the Subscription Version objects requested by the query.
11. Optionally, the LSMS issues an SMEQ – Suspend Mode End Request to the NPAC SMS to indicate that it has finished querying for objects and normal downloads can be resumed. NPAC operations personnel can also submit this request through the Admin GUI.
12. The NPAC SMS removes the Suspend Mode status for the LSMS and responds with an SMER – Suspend Mode End Reply, if the Suspend Mode status was removed as a result of an SMEQ request from the LSMS.

It may be necessary for the LSMS to submit multiple requests in Steps 1, 3, 5, 7, 9, and 11 in order to retrieve all data. The NPAC SMS will only return data up to the document size and/or record limits specified by system tunables and will return a results\_too\_large error in the asynchronous reply if the limits are exceeded. In the case such an error is returned, the LSMS should change the query parameter values to reduce the scope of the query and submit a new query request. The NPAC SMS will return a not\_found error if no data was found based on query parameters.