**Origination Date:** 7/28/04

**Originator:** Verizon Wireless and SNET Diversified Group

### Change Order Number: NANC 397

**Description:** Large Volume Port Transactions and SOA Throughput

**Cumulative SP Priority, Average:** Mandatory

**Functional Backward Compatible:** YES

**IMPACT/CHANGE ASSESSMENT**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| FRS | IIS | GDMO | ASN.1 | **NPAC** | SOA | LSMS |
| Y | N | N | N | High | Med-High | Med-High |

**Business Need:**

*Overview – Service Providers have voiced concerns about the volume of port transactions that the NPAC can process per second when mass changes need to be made and broadcasted to the industry. Now that wireless service providers are porting throughout the United States, the volume of port transactions has increased and will continue to increase in general, and mass changes will need to be made more frequently as well. The consolidations of Carriers and Switches will also generate an increase in the number of Mass Modifications for the update of the Network Data Tables (LIDB, CNAM, CLASS, ISVM and SMSSC).*

As wireless service providers are continually managing their networks and load-balancing the traffic and subscribers on them, the need for HLR and DPC database changes may become more frequent and of larger volumes in the future. For example, the wireless carrier may need to modify LRNs for 100,000 ported in subscribers to effectively change their switch designations. Ultimately, the NPAC must be able to handle those 100,000 transactions in a short amount of time. The desired process would be to modify all the records in one evening rather than having to split up the changes over a period of days or weeks. Similarly, Service Providers who have consolidated or have changed business plans need to update the Network Tables in order to ensure proper routing to Database Storage (LIDB, CNAM, etc.).

Intense coordination is required to effect the changes necessary to properly route the queries associated with these databases, including LERG, LARG and CNARG updates, GTT changes in STPs and end office routing changes. Additionally, modifications need to be made to the Network Tables in the NPAC and the transaction limitations force such modifications to be spread over weeks and/or months straining the resources of an industry already processing changes on a 24X7 basis. The two methods available for large volume NPAC changes are 1) modifications done through the SOA and 2) modifications done using the industry Mass Modification process. Processing through the SOA, at the current rate of 4 to 6 transactions per second, it could take more than 4 hours to make LRN changes to 100,000 subscribers. If something goes wrong and the Service Provider needs to back out of the changes, then another 4 hours would be required to make the corrections. This could start to creep into regular business hours in large volume ports. There is a concern about technology migrations and the current 25K/night operational limitation (originally submitted as PIM 43, and now turned into a change order). This is not an immediate need, but something that should be planned for the three-five years out timeframe.

(**May ’07 LNPAWG mtg** – the following paragraph is retained for historical purposes, even though the quantity limitation on the industry Mass Modification notification process has been updated. The current value as of Mar ’07 is set to 10,000 changes per hour, per region, seven days a week). The industry Mass Modification process is limited to 25,000 changes per region per day Monday through Friday and 50,000 changes per region per day Saturday and Sunday. This limitation applies to all service providers requesting a change, so if more than one service provider wishes to make changes on a particular day, the limitation encompasses all service providers wishing to modify records. A wireless subscriber migration involves more than just that service provider; it also involves each of that service provider’s roaming partners updating their networks on the same night, resulting in a very large coordinated effort among many parties.

There are also concerns about multiple wireless service providers doing these same types of migrations on the same nights and what coordination needs to take place to ensure that all service providers are able to manage their networks as needed and when needed. Using the Mass Modification method for large volume projects requires a high level of coordination and scheduling especially if other service providers in the region also need to do large modifications at the same time.

Additional updates between the NPAC and the SOA may be needed using the Mass Modification process. This adds additional time and coordination to fully complete a large volume project.

**Description of Change:**

The performance impacts to the SOAs, NPAC, and LSMSs need to be determined for large volume ports.

As porting volumes increase, it will be very important for all systems to be capable of reliably receiving downloads while retaining their association under heavier loads.

All systems should be able to maintain their current required availability level under heavy loads. Large volume porting should not require scheduled downtime.

The current plan is for service providers to start compiling technology migration forecast estimates and provide this information to Steve Addicks by March ’05. At that time, the Architecture Team will begin a review of the data (without service provider names) and begin some analysis on next steps.

Jan ‘06 LNPAWG – moved to Accepted per LNPAWG discussion.

Jan, Mar ‘07 LNPAWG – continued discussion in Architecture Planning Team’s meeting.

For the May meeting, the requirements will be included to reflect current values and new values that would be necessary for 25K/hr.

The current (Mar ‘07) industry Mass Modification notification process is set to 10,000 changes per hour, per region, seven days a week.

May ‘07 LNPAWG – continued discussion in Architecture Planning Team’s meeting.

The updated requirements were reviewed. The performance increase would likely affect more than just software changes (i.e., hardware, network). When questioned again on the need to allow half the time for the back out, Verizon Wireless responded that a problem may not be known until the entire migration was completed, and therefore the back-out requirement would need a comparable time interval to perform the back out.

NeuStar suggested an option that would use a new message to indicate “starting migration now”, and a subsequent message to indicate “migration complete” or “migration should be backed out”. This approach allows a potential to use much more of the maintenance window for the initial broadcast, since database back out or commits will be much faster than additional SV modification broadcasts. Discussion will continue during the Jul ’07 APT mtg.

Jul ‘07 LNPAWG – continued discussion in Architecture Planning Team’s meeting.

The discussion was centered on the volume number and the various options on the approach to accomplishing the 100K updates overnight. Pros and cons for each of these were discussed.
1.) is it 100K in eight hours with a single message to indicate begin and another single message to indicate end? (effectively up to 100,002 messages, assuming no ranges),
2.) is it 100K in four hours to allow a full back out by sending 100K back out messages? (effectively up to 200,000 messages, assuming no ranges),
3.) is it 100K in eight hours utilizing TN lists where there is enough time to perform both the updates as well as a potential back-out? (potentially as few as two messages, assuming one message with a list of 100K TNs, and another single message with a list of 100K TNs to back-out)
4.) is it a case where 100K+ could be accomplished using a selection criteria rather than TNs or TN-Ranges? (a single message that says “update where LRN =xyz”)
5.) is it a case where associating DPC data with an LRN and broadcasting as network data rather than SV data would help? (much fewer messages, but quantity unknown at this time) or
6.) is it a higher number than 100K to accommodate a large company merger where millions of numbers may be involved? This item reflects the discussion on NANC 349 and the batch offline mode, since the group agreed to stop working on 349 and just work the volume issues here in 397. (could possible use any method)

1. The single message approach. This method clearly cuts down on the number of messages sent across the CMIP interface. However, the updates to the SCP have been identified as the bottleneck, so this method might not be that effective. Additionally, this method is only effective if vendors and Service Providers implement the functionality to process this new message. This would require development on the NPAC side as well.

2. The full-back out approach. This method requires 50% of the time to be allocated for updates to be sent out, and the other 50% for revert-back messages to be sent out. It is expected that the quantity of messages would be the same for both the initial updates and the back-outs. The benefit of this method is that existing messages could be used, so no new development is required.

3. The TN range approach. This method reduces the number of messages sent across the CMIP interface. The current ASN.1 definition does not support a TN/TN-range list for modify requests, so there would be development required (GDMO/ASN.1 changes and NPAC code changes). The max size of the message would have to be discussed.

4. The selection criteria approach. This method reduces the number of messages sent across the CMIP interface AND minimize the size of those messages. The selection criteria may be sub-divided to better manage the groups of updates.

5. The single DPC associated to an LRN approach. This method could potentially cut down many messages. However, it loses the flexibility to associate more than one pair of DPC/SSN values to a single LRN, which several Service Providers indicated they use in production today. With this approach, the NPAC network data would be expanded to include associated DPC/SSN with each LRN. Other desired DPC values will continue to be populated at the SV level on an exception basis.

6. The larger volume question. This question is currently under discussion at the LNPAWG.

Sep ’07 LNPAWG – continued discussion in both the LNPAWG meeting (Change Management agenda item) and the Architecture Planning Team’s meeting.

The discussion during the LNPAWG meeting centered on the selection criteria. VZW, as originator of this change order, indicated that the LRN selection (change from value A to value B) is one way that changes are made. Would also want capability to perform a subset of the LRN. Very unlikely to use NPA as a criteria. The selection criteria could include any/all of the following: SPID, LRN, NPA or NPA ranges or lists, NPA-NXX or NPA-NXX ranges or lists, LNP Type. One problem that has not been discussed is “how best to handle failed lists?”, since it’s criteria based, and not TN based like production today.

Another option to include in this list is to add capacity. After some discussion, the group agreed to use 397 as the increase in performance numbers, and move all of the alternative options into a new change order. That new change order will be discussed during the APT meeting.

The discussion during the APT meeting provided a re-cap of the LNPAWG discussion, and walked through each of the six points from the Jul ’07 meeting notes (above).

1.) not needed for new change order,
2.) not needed for new change order,
3.) look at message efficiency and incorporate both TN lists and TN-range lists,
4.) the issue is determining the failed list. This assumes that the DBs are in sync. There are complex queries in both places. May need to break out these issues and talk through them to get agreement that we won’t pursue these at this time.
5.) today there are SPs that use more than one DPC for a single LRN code. Continue discussion on having the DPC at the LRN level and DPC at the SV level for exception basis (what are the pros/cons). Would want to explicitly broadcast at the LRN level, so that we know they have this data. Also a conversion effort to clean up or sync up the SVs to use this new approach,
6.) continue to discuss large volume as necessary.

For NANC 397, the group agreed to document that this 25K/hr would occur in no more than four regions at a time. (see LNPAWG update below for January 2011)

Nov ‘07 LNPAWG – continued discussion in the LNPAWG meeting (Change Management agenda item). The group accepted 397 as the change order that updates the transaction rate from 4.0/sec up to 7.0/sec. All other options have been moved into NANC 425, and will be discussed as necessary under that change order.

No additional requirements work is anticipated for NANC 397 now that the numbers have been updated. This change order is now awaiting prioritization and implementation.

Jan ‘11 LNPAWG – To clarify the discussion held during the Sep ’07 LNPAWG meeting, the last paragraph should be updated as follows (new wording in yellow highlight): “For NANC 397, the group agreed to document that this 25K/hr would occur in no more than four regions at a time for the type of network migration described in the business need section. This is provided to assist in network bandwidth planning for interfaces between the SOA/LSMS and the NPAC. However, given the regionalized NPAC solution, every region will support the 25K/hr rate, such that all regions could simultaneously be performing the 25K/hr rate, in addition to normal porting volumes/rates”. As discussed during the meeting, the updated requirement of 7.0 transactions per second is for an NPAC region, and since there are seven regions, the NPAC nationally has a performance requirement of 7x7 transactions per second. The four-region concept is a User behavior assumption, not an NPAC performance requirement (or limitation).

Mar/Apr ‘11 LNPAWG – Continued the discussion of the NANC 397 engineering assumption. The group agreed to add the revised text to the change order. That text is listed below, and will be added to the IIS:

NANC 397 increases the performance requirements for each NPAC region from 4 transactions per second per Service Provider to 7 transactions per second per Service Provider.

"Service Provider" assumption:

There is an engineering assumption; Service Providers must support the new performance requirements for NANC 397. The Service Provider's local systems will support the minimum throughput rate with each of a Service Provider's specific association to NPAC regions, based on the requirements of NANC 397.

As Service Providers are responsible for their local systems that support their interfaces to the NPAC (aka SOA, LSMS and corresponding downstream network elements), each Service Provider should work with their local system vendors to ensure that their (the Service Provider) interface solution will adequately support the same industry requirements with the NPAC without impact to other Service Providers in the industry.

It is recommended that each Service Provider spend time working performance requirements with their local system vendors as well as the NPAC vendor.

**Requirements:**

Current requirements, NANC 393, FRS 3.3, downloads to the LSMS are 14,760/hr. Change bars indicate new numbers to support 25K/hr.

R6-28.1 SOA to NPAC SMS interface transaction rates - sustained

A transaction rate of ~~4.0~~ 7.0 CMIP transactions (sustained) per second shall be supported by each SOA to NPAC SMS interface association.

R6-28.2 SOA to NPAC SMS interface transaction rates - peak

NPAC SMS shall support a rate of 10.0 CMIP operations per second (peak for a five minute period, within any 60 minute window) over a single SOA to NPAC SMS interface association.

R6-29.2 NPAC SMS to Local SMS interface transaction rates - peak

~~NPAC SMS shall, support a rate of 5.2 CMIP operations per second (peak for a five minute period, within any 60 minute window) over each NPAC SMS to Local SMS interface association.~~
***This requirement will be deleted. Therefore, the LSMS performance rate will be strictly a sustained rate.***

RR6-107 SOA to NPAC SMS interface transaction rates – total bandwidth

NPAC SMS shall support a total bandwidth of ~~40.0~~ 70.0 SOA CMIP transactions per second (sustained) for a single NPAC SMS region. (previously NANC 393, NewReq 1)

RR6-108 NPAC SMS to Local SMS interface transaction rates – sustained

NPAC SMS shall support a rate of ~~4.0~~ 7.0 CMIP transactions per second (sustained) over each NPAC SMS to Local SMS interface association. (previously NANC 393, NewReq 2)

RR6-109 NPAC SMS to Local SMS interface transaction rates – total bandwidth

NPAC SMS shall support a total bandwidth of ~~156~~ 210 Local SMS CMIP transactions per second (sustained) for a single NPAC SMS region. (previously NANC 393, NewReq 3)

IIS:

Add a new section for the text discussed during the Mar/Apr ’11 LNPAWG meetings.

**NPAC and SOA/LSMS Interface Performance (below will be a new section, 2.5, in Part I of the IIS)**

In NPAC Release 3.4, performance requirements were increased for each NPAC region from 4 transactions per second per Service Provider to 7 transactions per second per Service Provider.

An engineering assumption is that Service Providers must support these new performance requirements, such that a Service Provider's local systems will support the minimum throughput rate with each of a Service Provider's specific association to NPAC regions. As Service Providers are responsible for their local systems that support their interfaces to the NPAC (SOA, LSMS, and corresponding downstream network elements), each Service Provider should work with their local system vendors to ensure that the Service Provider’s interface solution will adequately support the same industry requirements with the NPAC without impact to other Service Providers in the industry.

It is recommended that each Service Provider spend time working performance requirements with their local system vendors as well as the NPAC vendor.

GDMO:

No change required.

ASN.1:

No change required.