

Telephone Number Management in Oracle Communications Unified Inventory Management

*An Oracle White Paper
April 2009*

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Telephone Number Management in Oracle Communication Unified Inventory Management

Key Functions

- **Country-specific formats**
- **Categorize numbers**
- **Reserve numbers**
- **Organize numbers for allocation**
- **Manage TN life cycle**
- **Support Portability**
- **Age telephone numbers**
- **Provide TN history**

Number formats vary significantly from country to country

EXECUTIVE OVERVIEW

In most countries, regulatory authorities have plenary authority over telecommunications numbering resources. These organizations create regulations to control the allocation, reservations, and utilization of telephone numbers (TNs) once they are released to Communication Service Providers (CSPs).

Any Telephone Number Management System has to be cognizant of these regulations, and enable a CSP to:

1. Store telephone numbers with country specific formats
2. Support categorization of telephone numbers
3. Support reservation of telephone numbers for subscribers and sales orders
4. Support telephone number Porting
5. Provide a full life cycle for telephone numbers
6. Support a proper aging process
7. Provide flexible telephone number organization
8. Provide an assignment history

Oracle's Communication Unified Inventory Management (UIM) Telephone Number Management module provides a flexible platform to satisfy regulatory requirements and furnish the CSP the ability to model telephone numbers to fit its specific business context.

TELEPHONE NUMBER FORMATS

A telephone number represents a sequence of digits used to call from one telephone line to another in a network, as well as access other devices, such as computer and fax machines. The number contains the information necessary to identify the intended endpoint for the telephone call. Each such endpoint must have a unique number within the Public Switched Telephone Network.

Each country has the responsibility to define the number resources within its own networks. As a result, regional area codes can be:

- A fixed length, e.g. 3 digits in the United States and Canada; 1 digit in Australia and New Zealand.
- A variable length, e.g. between 2 and 5 in Germany, Argentina, and in the United Kingdom; between 1 and 5 in Japan; 1 or 2 in Syria and Peru.
- Incorporated into the subscriber's number, as is the case in many countries such as Spain or Norway. This is known as a "closed" telephone numbering plan. In some cases a trunk code (usually 0) must still be dialed, as in Belgium, Italy, the Netherlands, Poland, Switzerland and South Africa.

UIM telephone numbers are defaulted to an 8 digit number format. This default value can be altered by editing and associating the base rule of Telephone_Number_Formatting. The rules set allows for alteration of both the length and the display of the telephone number within UIM. It is important to know is that in UIM, the unformatted telephone number is stored in the Id field. The formatted telephone number is stored in the Name field.

For example, the US format is NPA-NXX-XXXX, which would be added to the rule set definition as ###-###-#### which will translate into a Number display of 212-555-1212.

The customized rule will be assigned to a telephone number specification. This specification will also describe the format and customized set of attributes which reflect the data a CSP deems necessary to manage the numbering resource, such as Responsible Provider or Country Code.

CATEGORIZING TELEPHONE NUMBERS

Regulatory agencies present the numbering resources to carriers without usage restriction. However, most service providers will organize their telephone number inventory for maximum usage and to accomplish administrative and marketing functions.

Administrative Numbers are described as numbers that the provider uses for internal functions such as test numbers and local routing numbers.

A wholesale provider might also have an arrangement with another provider to give the retail provider a set of numbers for its use. In both cases, the numbers used for administrative purposes and the wholesale arrangement will not be available in the providers inventory and will need to be categorized and blocked from assignment.

In UIM, this function is accomplished with associating condition codes to the telephone numbers. There are three types of condition codes: Informational, Warning and Blocked. The application allows the provider to associate multiple condition codes.

For example, TN 214-555-0001 is to be categorized as a Test Number, and TN's 214-555-1000 to 214-555-3000 are to be numbers that will be assigned to residential VoIP services.

As a test number, TN 214-555-0001 cannot be reserved or assigned to a subscriber and therefore a Condition Code of Type Blocked and a Reason of Test will be associated. UIM will verify on the condition code and will prevent reservation and service allocation of this number.

For TNs 214-555-1000 to 3000 a condition code of type Information will be associated and a reason of Residential VoIP numbers added.

Extended allocation rules could now key on the condition type and reason to select numbers for reservation and allocation.

After condition codes, the ability to reserve telephone numbers is the second defined consumer of the numbering resource. The third would be the assignment.

RESERVING AND REDEEMING TELEPHONE NUMBERS

Within the service fulfillment value chain, the use case of reserving resources ahead of the service creation is common. It is generally expected that telephone numbers should be provided to the subscriber during their initial contact to order service. The ability to satisfy this use case will reduce the necessity for a second contact, and thereby avoid increased costs. One of the main concerns is to prevent double use of the same telephone number. Since multiple Customer Service Representatives might launch a request for numbers at the same time, numbers once queried will be placed on a reservation to lock them from multiple queries and therefore multiple selections for different subscribers.

For example, if the CSR launches a query for a telephone number for Subscriber Suzy Quentin, the query for numbers might return the TN instance of 214-555-1234. To protect it from another CSR searching for a number for customer Peter Quinn, number 214-555-1234 will be placed on a short-term reservation. When the service for Suzy Quentin is created, the TN reservation has to be redeemed.

UIM may be configured to require that a tag be supplied to identify the appropriate customer or sales order before a TN reservation may be redeemed.

In addition, reservations have time periods or terms associated. The application provides for both a short term and a long-term reservation. The time period associated with both short term and long term reservation is defined by the service provider, and a global process will poll all reservations to determine if their terms have expired. Once the time periods have been exceeded, the reservation expires and the telephone number becomes available for further assignment.

Portability is the function of removing the number from the donator provider network and placing it in the receiving provider network.

SUPPORTING NUMBER PORTABILITY

For most service providers, an important function of a Telephone number Management system is the ability to manage Number Portability.

Local number portability, (LNP) for fixed lines, and **mobile number portability** (MNP) for mobile phones, refers to the ability to transfer either an existing fixed-line or mobile telephone number assigned by a local exchange carrier (LEC) and reassign it to another carrier. In most cases, there are limitations to transferability with regards to geography, service area coverage and technology.

In number portability the “donor network” provides the number and the “recipient network” accepts the number. The operation of donating a number requires that a number is “ported out” from a network and “ported into” the receiving network. If the subscriber ceases to need the number, then it is normal that the original donor receives the number back and “snaps back” the number to its network. The situation is slightly more complex if the user leaves the first operator for a second and then subsequently elects to use a third operator. In this case the second operator will return the number to the first who will then assign it to the third.

Donor Network: The porting process within UIM for a donor provider works as follows; when the provider receives notification that the number is to be ported out, it should be marked and recorded as a ported out number. The service and the number are disconnected and the aging process will need to address the ported out number with a different set of business logic than disconnected numbers which have not been ported out. The particular logic is explained in the ‘Aging of Telephone Numbers’ section.

Recipient Network: The porting process within UIM for receiving providers follows a similar pattern. The provider establishes a new service for the subscriber and creates a Number, which should be marked and recorded as Ported In. The service activation may proceed as usual. In the event that the subscriber selects another provider or just disconnects the service, the aging process is modified to deal differently with ported in numbers.

While UIM is capable of transitioning the ported in and ported out numbers through its various statuses and ensures that the donor provider has the capability to snapback their numbers and the receiving provider does not age ported in numbers to their inventory, it does not have out of the box business logic to handle regional porting logic such as geographic and service area restrictions. However, to accommodate such restrictions, the UIM software can be extended and customized for regional and country specific porting rules variations.

TELEPHONE NUMBER LIFE CYCLES

For resources such as telephone numbers, UIM provides a predefined set of Business actions and life cycles that are available for use.

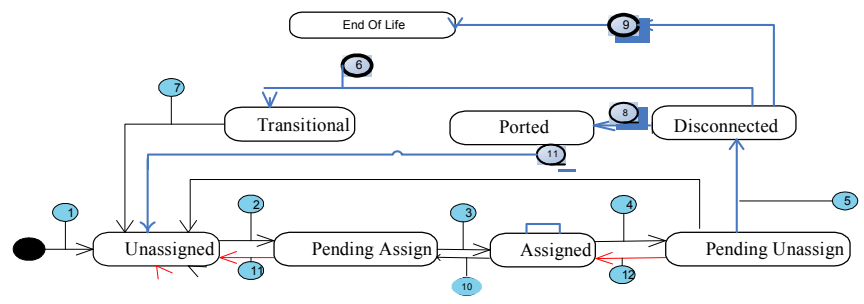
Every implementation of UIM will require an evaluation of the provider's existing TN management business action and state changes. Generally, there are 3 options available to providers to utilize and/or customize the Business actions and life cycle:

1. Evaluation determines the UIM default as adequate, and that some existing status changes can be accomplished with the use of a condition code might suffice.
2. Evaluation reveals that the statuses provided suffice, but the names should be changed to accommodate existing business processes.
3. Evaluation determined that new business action and status changes are required, which will lead to a change in the base transition file.

The definition and use of a resource life cycle is one of the primary methods for any inventory system to control and manage resources. This is especially true for a closely monitored resource such as telephone numbers.

The UIM default TN life cycle represents a set of well-defined business processes as well as the related state changes. Business actions within the context of state transitions can be thought of as the triggers that launch the application to change to the next logical state.

The following diagram presents a picture of the out-of-the-box states.



The business actions and state changes are:

1. Service Providers receives telephone numbers from a regulatory agency and creates the telephone number within the inventory. The Resource Assignment Status is set to Unassigned.
2. The user/application initiates a query to allocate a telephone number to a service. The Resource Assignment Status is set to Pending Assigned.
3. The user/application completes the service configurations and the Resource Assignment Status is set to Assigned.
4. The user/application initiate a de-allocation of the telephone number either because the subscriber wishes to change numbers, or leaves the provider. The Resource Assignment Status is set to Pending Unassign.
5. Once the de-allocation of the telephone number has been completed, the resource Assignment status is set to Disconnected.

6. The aging of the telephone number is controlled by a Disconnect expiry date. Once the Expiry business action is initiated, the Resource Assignment state is set to Transitional.
7. An additional expiry date will control the transition of the Resource Assignment State from Transitional to Unassigned.
8. If a number in disconnect is marked as ported out, the Resource Assignment status is set to Ported.
9. A number marked as ported in will be aged to End of Life . once it has been disconnected since the number does not belong to the service provider and therefore has to be returned to the donating provider.
10. The Number is in a Pending Assignment status, but the subscriber requests a cancellation, which will set the Resource Assignment Status to unassigned.
11. A Number that has been ported out is returned to the Provider. The Business action of Snapback will look for numbers in the Ported status and set the Resource Assignment status to Unassigned.
12. A request to de-allocate a telephone number is canceled, and the Resource Assignment status is set from Pending Unassign to Assigned.

AGING OF TELEPHONE NUMBERS

The aging period for a telephone number starts once a number has been disconnected from a service, and lasts until it is available for reassignment.

Not all telephone numbers are equal in the aging process. Numbers that are allocated to the provider age differently than toll free and ported number. Toll free and Ported in Numbers do not belong to the Service Provider and once disconnected can not be aged in to the available pool of numbers. Numbers that have been ported out also need to age differently since the provider in this case donated the number to another provider and therefore cannot use the number until the subscriber releases the TN.

Most regulatory authorities also place restrictions on the time period between subscriber assignments. In most countries, a telephone number has to stay in a transitional state for six and eighteen months.

UIM provides the capability to set expiry periods to allow for intercept messages and to meet the regulatory requirement.

The aging rules, which can be customized by the UIM user, will look at the TN inventory as a whole and transition numbers when the expiry dates are reached. In addition, the aging rules will also interrogate the telephone numbers to determine what type of number it is to determine the correct state transition. For example as described in the life cycle definition, when during de-allocation a TN is marked as Ported out, the normal aging process is ignored and the number is set to ported. The same type of interrogation is utilized for Ported in and Toll free numbers.

ORGANIZING TELEPHONE NUMBERS

The very structure of a telephone number implies a geographic or purpose driven orientation. In most countries with area codes, the very name implies a geographic orientation, which is used for assignment purposes. Subscribers in New York City or London will not be assigned a number with an area code intended for Chicago or Manchester respectively.

On the other hand, some countries assign whole “area codes” not to a geographic area but to a mobile phone service provider. For instance, in Germany numbers starting with 0171 have been assigned to a mobile service carrier.

In order to serve these business needs, the Uniformed Inventory Management telephone number module supports a flexible organizational structure where telephone numbers can be grouped with geographic locations such as Cities, Counties or Zip codes, Service specifications such as Mobile Service versus Consumer VoIP service, or Logical Devices such as a Voice Server or a Class 5 switch. These organizational structures are called Inventory Groups. UIM places no restriction on the number of inventory groups created, or how the provider wants to organize their logical inventory. The primary purpose of these organizations is to provide a mechanism to support certain business scenarios.

With the aid of inventory groups, providers can create specialized business rules for telephone number assignment.

Business rules need to be established to answer the following questions:

- What telephone number can be assigned to a subscriber with a service location of 100 Market St. Chicago IL
- What telephone number can be assigned to a Mobile Service.
- 214-555-1234 needs to be added as a ported in telephone number, and the service location is 100 Main St. Plano TX

TELEPHONE NUMBER ASSIGNMENT HISTORY

Another regulatory mandate in many countries is the ability to preserve telephone number assignment history over a prescribed number of years.

In UIM Telephone number assignments are always associated with services. In the service construct, configurations are set up. Telephone numbers are allocated and deallocated to a service configuration item, and this allocation and deallocation will be stored. For instance when the number 214-555-5001 is allocated to a service for Mary Good on January 21 2007, and deallocated on 18 February 2008, the service configuration will store both configurations. If the number is now allocated to Jim Smith on 1 June 2008, an additional assignment record will record this assignment.

MOBILE CARRIER BUSINESS EXAMPLE

Putting it all together: This example demonstrates the flexibility of Unified Inventory Management, illustrating how its Telephone Number Management functions may be utilized by a mobile carrier in resource management and service fulfillment.

The service provider is a US carrier using the ANSI/CDMA network architecture, with the following business requirements:

1. Provide inventory capabilities for US telephone numbers, MSIDs and ESN.
2. Provide full life cycle for all inventoried items. The life cycle for telephone numbers must include the following status: Quarantined, Unassigned, Assigned, Disconnected, Aged and a status for Ported out numbers.
3. Ensure that numbers can be ported in as well as ported out.
4. Provide that numbers can be assigned to Customer Service Areas (CSAs) to aid in the assignment to subscribers.
5. The system must be able to swap a telephone number while the ESN stays in service.
6. The system must be able to swap an ESN while the ESN stays in service. The system must be capable to report to regulatory agency on telephone number usage.

These requirements lead to certain solution design decisions and rules:

1. The carrier should utilize three of the UIM functional managers: Telephone Number Management, Universal Resource Management and Service Configuration Management for Mobile.
 - a. Telephone Number Management will manage telephone number and most of their life cycle.
 - b. Universal Resource Management will allow the carrier to model and manage ESN and MSID and most of their life cycle.
 - c. Service Configuration Management will allow the carrier to create, change mobile services and associated resources.
 - d. Oracle Communications Design Studio is the common configuration tool for UIM and other Oracle OSS products. This is where resources such as telephone numbers, ESN and MSIDs as well as Services will be modeled, and special business rules will be created.
2. The requirements told us that the telephone number is for the United States which is NPA-NXX-XXXX, and that gave a definition of the life cycle.
 - a. Within Design Studio, the telephone number modeler would create a telephone number specification, which represents the vehicle that can be decorated with rules and attributes and used to create inventory instances.
 - b. The TELEPHONE_NUMBER-FORMAT rule set will be edited with the US telephone number format, and associated to the telephone number specification.

- c. A attribute of TN type is created for the telephone number sprcification, with drop down values of: Ported In, Ported Out , Owned and Toll free. Any additional attributes can be created.
 - d. Since there is no direct business action associated with the Quarantined telephone number status, a Condition Code of type blocked and condtion reason of Quarentined will be created. The other statuses match the default statuses and no status customization will be required.
 - e. The TN_AGING rule will be customized to reflect the carriers aging time periods.
 - f. In UIM telephone number instances are created using the new telephone number specification. These would be numbers given to the provider from the regulatory agency.
 - g. The Quarantined condition code is associated to the number that would require the condition.
3. The ESN and MSID would be modeled as Custom Objects within the Design Studio. The specification for ESN and MSID could have two separate sets of attributes. There are no specific life cycles set out in the requirements so the assumption is made that the default life cycle will be sufficient.
 4. An Inventory Group will be created. The grouping will be based on the CSA.
 - a. Once telephone number instances have been created, they can be assigned to a CSA inventory group.
 - i. CSA for Plano Texas will hold all telephone numbers with the NPA of 214 and 469.
 5. In the Design Studio the Mobile service and service configuration will be modeled.
 - a. The service configuration will have at least three service configuration items, which will be used to provide an allocation point for the three named resources.
 - i. Telephone Number
 - ii. ESN
 - iii. MSID
 - b. The service configuration will be extended with at least two specialized rules sets.
 - c. An allocation rule set that will pick the correct telephone number based on a criterion such as Subscribers Address.

A validation rule that will validate a number with the attribute TN Type set to Ported In. The validation rule will hold the specialized geographic limitations placed on ported in numbers within the United States, which need to be validated prior to service creation. Failure would indicate the number cannot be ported, and the subscriber needs to accept a carrier provided number.

6. Once the services have been modeled, UIM is ready to accept service instances, typically via interfaces with Order Management and/or CRM systems such as Oracle Communications Order & Service Management or Oracle Communications Siebel CRM.
7. When the service is created, the subscriber and the subscriber's address can be associated with the service.
 - a. A configuration is created and the allocation rule set will select a telephone number, a ESN and a MSID.
 - i. The allocation rule would not select a telephone number with the condition reason of Quarantined, since its condition type is Blocked.
 - ii. If the telephone number has been reserved for a subscriber, the telephone number, and the Reservation Type and Reserved For values will be needed to redeem the number from the reservation.
 - iii. If the telephone number is a Ported In number, the number will be created during allocation, and the TN type is set to Ported In.
 - b. The configuration is completed, which will set the status for the resources to assigned, and an activation system can be notified to activate the service and resources.
 - c. When a change order is received to change the telephone number, a second configuration is created for the subscriber's service. The second configuration has a copy of the assigned resources, and the assigned telephone number is de-allocated, and a new telephone number is allocated. The resources of ESN and MSID are not affected. The second configuration is completed and the change is communicated to an activation system.
 - i. Note the same process would be used to change the ESN.

CONCLUSION

Oracle Communication Unified Inventory Management gives service providers the strong and flexible telephone number management functionality, along with a proven method to extend and adapt its functionality to accommodate regional or organization-level differences in implementation and business practices.

The Telemanagement Forum's Shared Information/Data Model provides a solid foundation for UIM's telephone number modeling and management capabilities. Its state-of-the art SOA structure allow the right UIM components to be quickly integrated into powerful service fulfillment solutions for services requiring telephone numbers.



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April 2009

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