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A Broad Assessment of Data Migration practice in Network Communication Industries

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Abstract:

"Data is the new Oil" Maybe this quote seems more familiar now days. More or less this quote self-defines its existence and importance in this world of digitization. With the growth of digital media and its relevance endeavors Data transaction must needs to be dealt in highly secured and efficient manner which not only confers its ultimate reliability but also focusses upon the ease and efficiency in its transfer mechanism. So hereby we are trying to introduce the common methods and practices performed to achieve this target. As the latest verdict and decision of our honorable Supreme Court of India in its judgment stated Right to Privacy as a fundamental right which hitherto needs to maintains and defines all the security measures must be conferred by any institution machinery who is dealing with the personal data management work. As per mandate it's also seems necessary to have data security audit for networking firms and hence it must comply and guarantees the most available techniques and methodology to adopt for its storing, transfer and migration purposes in personal data analysis and management working environment. We are not providing here any technical specialties and regulations that need to be dealt in such an environment but our sole focus lies upon to make aware and provide general sense of its transfer mechanism for the end user to understand this rigid mechanism in simple logistic form. As tracing fault and providing optimal solutions in this regards needs higher end machinery and manpower with high technicality which not available at source to us. So we simply try to present this techniques in as simple and lucid manner as possible.

Keywords — **Mobile Switching Center (MSC), Home Location Register (HLR), ESM (Enhanced Services Manager), Service Control Point (SCP).**

I. INTRODUCTION

Data migration is the process of converting data from one format to another. It is typically performed to launch new or upgraded systems, services, infrastructure, functions or features. The following are the common types of data migration.

A. Export & Import

In some cases, tools support exporting data to a neutral format and importing that same format. For example, business software may allow data to be imported from delimited text files. This allows a data analyst to work with data in a spreadsheet to get it in the expected format and then import it.

B. Scripts

Database scripts are a common way to import and export data from a database. This is essentially the same process as import/export with a script used as opposed to a user interface. If data is small enough, a spreadsheet may be used to prepare data for the target database. Alternatively, database operations Such as SQL commands can often be used to create temporary tables and move things around until they fit into the new data model.

C. Extract, Transform, Load

Extract, Transform, Load (ETL) is a class of tools that provide support for data migration. ETL tools can typically handle large data sets. They are designed to connect to a number of data sources and automate transformations such as mappings and business rules to convert from one data model to another.

II. METHODOLOGY

Here we are trying to provide you the basic introductory concepts and methodological process lies to create and understand this mechanism:-

A. Wireless networks

This module introduces the range of components that exist in a wireless network. It describes the role

of each component and their relationships to the other entities in the network. It outlines the various geographical regions defined within the cellular network and explains the meaning of some terminology specific to cellular networks. The module describes the main role of the HLR as a database and summarizes the data stored in the HLR.

1) Entities in a Cellular Network

The Advanced Mobile Phone System (AMPS) is an analogue standard which was developed in North America and introduced in 1984. The Digital Advanced Mobile Phone System (D-AMPS) is an evolution of the analog AMPS standard and implements Time Division Multiple Access(TDMA). D-AMPS conforms to the IS-136 standard defined by the Cellular Telecommunications Industry Association (CTIA).

The majority of cellular networks in North America, South America, New Zealand and Australia adhere to the Digital Advanced Mobile Phone System (D-AMPS) standard. There are various entities in a D-AMPS network, some of which are displayed in the figure below.

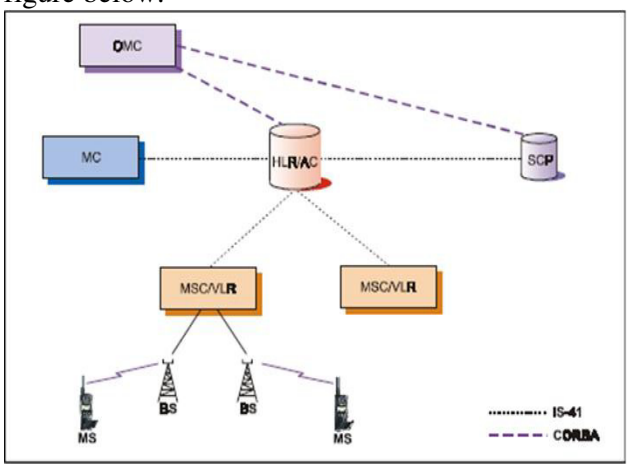

Fig. 1: D-AMPS network

a) Mobile Switching Center (MSC)

The Mobile Switching Center (MSC) is the heart of the cellular network. It is responsible for switching calls from the initial origin to the final point of destination. The MSC handles all connections and disconnections of mobile calls. It supports the call processing and switching functions in the wireless network. It handles traffic within a cellular network, interfacing with other MSCs in the same or other cellular networks. It also interfaces with the Public Switched Telephone Network (PSTN) at the local, transit, or international gateway levels.

b) Base Station (BS)

The Base Station (BS) handles traffic to and from the mobile subscriber. It is connected to the MSC and includes the transceiver and control equipment located at one site. This control equipment handles and supervises the quality of the radio connection between the BS and mobile subscriber, and the communication link between the BS and MSC.

c) The Authentication Center (AC)

The Authentication Center (AC) establishes that the individual attempting to make a call is a genuine subscriber and has a valid subscription to the mobile network. The AC holds authentication data specific to each subscriber which prevents fraud in the network. Using this data, the AC can detect when someone is trying to access the network with a counterfeit subscription. The AC is often colocated with the Home Location Register(HLR).

d) Home Location Register (HLR)

The Home Location Register (HLR) acts as a centralized network element for storing subscriber information. It administers the subscriber information and sends that information to other network elements. Each mobile subscriber has a record in a HLR. An HLR stores subscriber information (such as location information, subscriber activity status or subscriber features) in the subscriber's record. An HLR may be located within an MSC or it may be a stand-alone network node. An HLR can serve more than one MSC. An operator may have more than one HLR installed in the network depending, on subscriber capacity. Each HLR can be duplicated for redundancy purposes.

e) Visitor Location Register (VLR)

The Visitor Location Register (VLR) is a database for storing information related to visiting subscribers. A visiting subscriber is a subscriber who is currently receiving service from an MSC. An MSC considers all mobile subscribers to be visiting subscribers. The visiting mobile subscriber identities and associated subscriber data are stored in VLR records similar to the HLR records.The VLR is normally co-located with an MSC, (leading to the term MSC/VLR), but is separate from the HLR. When a subscriber registers with the network,

subscriber information must be transferred from the HLR to the MSC where the subscriber is registered. The VLR acts as the interface between the HLR and the MSC for the transfer of subscriber related information. The MSC retrieves information from the VLR for handling calls to or from visiting subscribers. The signaling standard IS-41 can be used to transport messages between the MSC/VLR and the HLR.

f) Mobile Station (MS)

The Mobile Station (MS) is the physical handset that the subscriber uses to make a mobile call. It enables the user to access network services. The MS communicates with the mobile network; it is the interface equipment used to terminate the radio path at the user side. Different manufacturers produce many different variations of mobile stations, offering a variety of designs and features tailored to meet the individual needs of subscribers.

There are a range of standards for mobile stations that affect the capabilities of the mobile station. A mobile station, manufactured according to a particular standard, ensures that the mobile station can obtain service in a cellular system that adheres to the same standard. The MS communicates with the mobile network via the BS along a radio link. The communication path between the MS and BS is referred to as the air interface.

g) Message Center (MC)

A Message Center (MC) is a network node responsible for the reception and delivery of short messages (alphanumeric messages sent to the display screen of a mobile station).The MC communicates with the MSC and the HLR using IS-41/MAP signaling.

h) Service Control Point (SCP)

The Service Control Point (SCP) acts as a host for a variety of Wireless Intelligent Network (WIN) features in addition to those features offered by the MSC/VLR functionality. WIN features enhance the range, quality and flexibility of services that can be offered to mobile subscribers as well as the speed with which new services can be developed and introduced. Toll Free Calling and Private Numbering Plan are examples of WIN services. The SCP contains the logic to control the handling of WIN calls and services. The SCP allows operators to quickly deploy customized features enabling them to offer service differentiation, which ultimately leads to an increase in subscriber loyalty and revenue. The SCP can communicate with the HLR/AC and the MSC using IS-41 signaling.

i) Operation and Maintenance Center (OMC)

An Operation and Maintenance Center (OMC) is a computerized monitoring center which is connected to network components such as MSCs. In the OMC, staff are presented with information about the status of the network and can monitor and control nodes within the cellular network. The staff can remotely contol these nodes and perform operations on them without having to be on-site. There may be one or several OMCs within a network depending on the network size.

2) Numbers in a Cellular Network

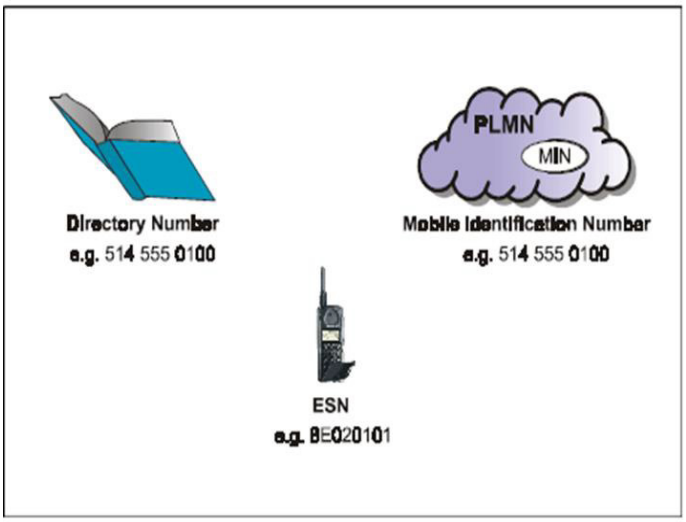

Fig. 2: Numbers in a Cellular Network

a) Directory Number (DN)

A Directory Number (DN) is a number which uniquely identifies a mobile telephone subscription in the PSTN numbering system. The DN is used when dialing calls to mobile subscribers. The mobile telephone numbering plan can be separate or integrated into the PSTN numbering plan. The DN consists of a 10 digit number of the format NPA nxxxxxx where n can have the value 2-9 and x can have the value 0-9.

b) Electronic Serial Number (ESN)

The Electronic Serial Number (ESN) is a number which uniquely identifies a subscriber's mobile station. There are eight digits in the ESN. It consists of three parts: a manufacturer's code, a reserved area, and a manufacturer-assigned serial number.

The ESN is used for protection from unauthorized use. Each mobile station is assigned a unique, fixed ESN which is stored in protected memory of the

mobile station during manufacture. If a mobile station is stolen, the operator can define the ESN to be fraudulent and prevent misuse.

c) Mobile Identification Number (MIN)

The Mobile Identification Number (MIN) is a number which uniquely identifies a mobile subscription on the radio path. It is used for signalling within the cellular network. The MIN is stored in the mobile station. In North America, the MIN value is often the same as the DN.

d) Personal Identification Number (PIN)

A Personal Identification Number (PIN) is a number which is unique to each mobile subscriber. The network administration supplies the mobile subscriber with a PIN code.

The subscriber can use their PIN to activate and deactivate certain subscriber features, for example call barring. In this manner, the PIN code protects against unauthorized access to subscriber controlled features.

e) Temporary Local Directory Number (TLDN)

The Temporary Local Directory Number (TLDN) is used for delivering calls to roaming subscribers. Each MSC has its own pool of TLDNs. During a call to a subscriber, the HLR asks the exchange where the subscriber is located (MSC-V) for a TLDN which is used to route the call to the MSC-V. The TLDN is a network address which is temporarily assigned for call set-up; once the call is routed to the subscriber, the TLDN is released back into the pool and can be used for other call set-ups.

f) Forward-To Number (C-Number)

A Forward to Number (C-Number) is the number of another phone to which a call is diverted during call forwarding. The operator can define this number (e.g. for forwarding Voice Mail) or the subscriber can define the number by means of procedure calls. A subscriber can have certain subscriber classes indicating that calls should be diverted.

3) Home Location Register

a) Database Function

The Home Location Register (HLR) acts as a central network element for storing mobile subscriber information. It administers the subscriber information and distributes that information to other network elements.

The HLR subscriber is always considered a roamer by the network and whenever the subscriber registers in a new service area the HLR copies most of the subscriber information from its database to the VLR. The serving MSC/VLR location of the subscriber is then stored in the HLR, which the HLR uses to deliver calls to the roaming subscriber.

The HLR stores subscription, location and activity data and provides administration procedures to allow this data to be added and maintained.

b) Subscriber Data

The HLR holds both static and dynamic data. Static data is mainly related to the mobile subscription and is generally added and updated manually.

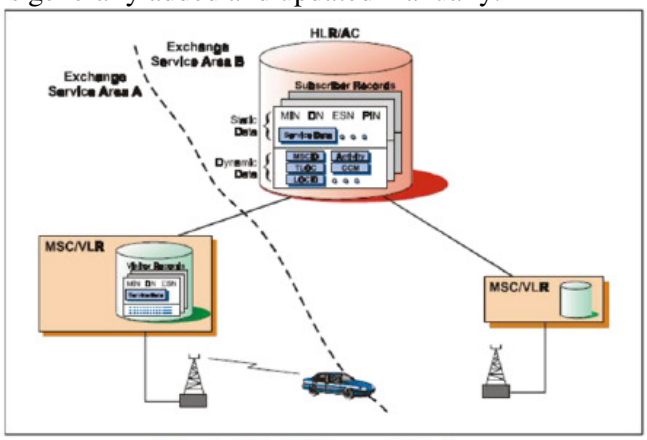

Fig. 3: The HLR as a Database

The main data items are listed below:

1) Mobile Identification Number (MIN)
2) Directory Number (DN)
3) Electronic Serial Number (ESN)
4) Personal Identification Number (PIN)
5) Terminal Type
6) Subscriber Features

Note that for certain features additional information will be stored, for example, for call forwarding a forward-to number and service activity state will also be stored. In some cases subscribers can reset these values by using service calls. Some features are assigned to all subscribers (for example traffic class, control channel capability) and some will be optional (for example call forwarding busy, preferred long distance carrier etc.).

Dynamic data is updated automatically as the mobile roams and becomes active or inactive this includes:

1) Serving MSC Identification (MSCID)

The serving MSCID is updated when the mobile registers in an exchange service area.

2) Temporary Location (TLOC)

When subscriber makes a call in an exchange where the subscriber is not previously registered the MSC

may send a registration message with a Temporary Location (TLOC). The TLOC may be used to route calls to the subscriber instead of the stored location. The TLOC is only set for a call on an analog voice channel and is cleared when the call finishes. This feature is used in Ericsson MSCs.

3) Location Area Identification (LOCID)

The LOCID is received when the mobile registers and can be sent to the MSC during call delivery in case the serving MSC does not have a valid location area for the subscriber.

4) Activity Status

The activity status indicates whether the mobile station is currently registered. The activity status is updated to active when a mobile station powers on and becomes inactive when the mobile powers off or misses a periodic registration.

5) Control Channel Mode (CCM)

This is stored and maintained for subscribers in order to check for fraudulent accesses. That is if the mode is not compatible with the Control Channel Capabilities (CCCs) of the phone. CCM is also used to check before delivering short messages that the mobile is on a digital CC. To support this a registration message must be sent from the serving MSC whenever the MS changes CC type.

4) Basic Service Data on the HLR

Defines the services a subscriber can use:

a) Bearer Services:

The basic capability of the network to transfer data between data interfaces.

This includes definitions of types of data call as well as transfer rates.

b) Teleservices:

The communication services provided to the users via terminals. This includes speech, short message service, facsimile and the emergency service.

III. RESULT AND CONCLUSION

A. Migration Technique

1) Manual Deletion and Manual creation

The manual deletion & manual creation procedure is the easiest way to migrate the subscriber's data from one server to another.

STEP 1: For this process first we need to take print of all the subscriber's number using a connector tool which is used for provisioning purpose.

STEP 2: In step 1 we took all the subscriber's number's print, next we will identify the services to each of the number. So that after migration it remains same as before.

STEP 3: After identify all the subscriber's profile the next step is to take (copy) one

number & create subscriber's profile on other server, after creation delete the same number from old server.

STEP 4: Next we need to check the services which previously belongs to the subscriber's profile.

This process should repeat for all the numbers.

B. `Drawback of this Process

Manual deletion & creation procedure is easy to perform but it also having some issue which are mentioned below.

While doing manual deletion & creation procedure we need to identify the services manually for each number.

While creation default profile, need to assign all the remaining services manually, which is taking too much time.

During time gap in deletion & creation, subscriber services will not be available, in this condition subscriber may sense his number is not working.

1) Using ESM (Enhanced Services Manager) Rehoming

a) ESM GUI

Using ESM GUI we can migrate 50000 subscribers data in 1 hour. To migrate the data by ESM is a time consuming process & we don't need to perform it manually. To run this process we need to follow some steps which are given below:

STEP 1: First prepare input file for one number with the help of unix command. File can be prepare with the help of vi editor.

STEP 2: In next step we use ESM tool & attached the file which we have created before having subscriber data.

STEP 3: next we need to verify system success log, system health check & testing, system should be fine & in service.

b) Advantages:

Migration process with the help of ESM tools worked seamlessly, no need to do manual work execution is simple & accurate. Subscriber's services will be same as before, subscriber will not sense any activity carried on his number.

IV. FUTURE SCOPE

After taking an overview we will next focus independently and solely concentrate our efforts and resources upon HLR data migration techniques which provides base for efficient and highly objective focused study in this domain which confers with its need dependencies and manipulation methodologies which were prevalent and the need of versatile and advance need in its future scope.

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