

**MEDIATION INTERFACE
REQUIREMENT SPECIFICATION
ON GSM NETWORKS AND OTHER
PRIVATE TELEPHONE
OPERATORS (PTOs)**

BY

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99/8079EE**

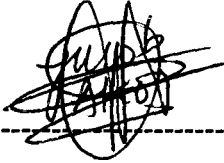
**DEPARTMENT OF ELECTRICAL/
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**FEDERAL UNIVERSITY OF
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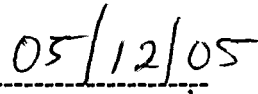
**PROJECT SUBMITTED IN
PARTIAL FULFILMENT OF THE
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DECLARATION

I, AKOR JACOB ADA hereby declare that this project was written by me and the content is result of my research work, information obtained from the published work has being well acknowledged by means of reference.



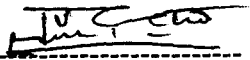
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CERTIFICATION

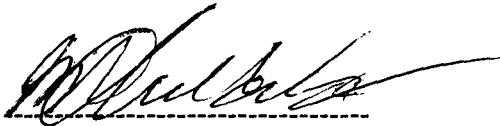
This is to certify that this project "MEDIATION INTERFACE REQUIREMENT SPECIFICATION ON GSM NETWORKS AND OTHER TELEPHONE OPERATORS (PTOs)" was carefully research and written by AKOR JACOB ADA for the partial fulfillment of the award of Bachelor Degree in Electrical/Computer Engineering.



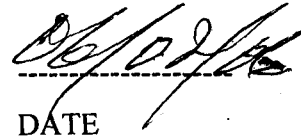
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Thank you all.

DEDICATION

I dedicate this project work to my late father Mr. Benedict Idoko Akor who was not opportune to see the end of what he started few years ago. May his gentle soul rest in peace.

Also my lovely Mum, who supported me through thick and thin to achieve this great success, my elder brother Engr. Seth Akor, my twin sister Mrs. Grace Onogwu and mostly my aunty Rev. Sister Grace Abakpa who inspired me greatly morally and spiritually to attain this present height.

Lastly my uncles, Daniel Akor, Daniel Okwori, Augustine Ogidi Pastor John Onoja.

ABSTRACT

This research work describes the Mediation Interface requirements for the generation of Interconnect Input Call Data Records.

When a call is placed through to Mtel network whether from a GSM network or Private Telephone Operators (PTOs) network, the call is captured and censored through the billing gate way machine which has the billing mediation device (bmd). A Call Data Record (CDR) tape is inserted into the machine, the Interconnect with the aid of the mediation, interfaces the network and specifies the requirement to the nature of call that enters or exits the telephony network.

The Interconnect requires Ingress and Egress CDRs, so not only the call that enters the Mtel network is being mediated so also those that exits the Mtel network.

These mediation processes helps to reconcile the billing proceedings between Mtel and the other networks.

The calls that transit though an operator from either a direct or an indirect operator are ascertain some billing rates for termination.

Since Mtel is a GSM operating network, MTN, Econet and Globacom are not indirect operators.

Oracle is database application software that is use for telecommunication procedure and manipulations. The application software has commands that makes the interconnect manipulations easier. The UNIX is the most portable operating system the Interconnect program can work with.

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CHAPTER ONE

1.0 INTRODUCTION

This Specification describes the mediation interface requirements for generating Interconnect Input Call Data Records (CDR) for MTEL.

The purpose of this project is to specify requirements in enough detail to enable Mtel as the case study use their Information Technology (IT) staff to develop a mediation interface from the Mtel mediation system to the interconnect system, it would enable Mtel or other third party vendor to configure a mediation product to generate Interconnect Call Data Records (CDRs).

Mediation will generate no interconnect transit CDRs. These CDRs represent calls that enter the Mtel network and exit the Mtel network but generate only a single CDR (for example: a call originate from a fixed network delivered to a Mtel number, and then automatically forwarded to fixed line number). Instead, mediation will generate two separate CDRs for all interconnect transit calls, one Incoming CDR, describing the inbound leg of the call, and one Outgoing CDR, describing the outbound leg of the call.

These requirements provide a definition of the interconnect CDR and are not based on detailed knowledge of the raw CDRs generated by Mtel network devices.

1.1 CDR FILE TRANSFER INTERFACE REQUIREMENTS

After mediation has generated interconnect input CDR files, it must copy or move the interconnect input CDR files to the interconnect input directory on the interconnect server (<device>/bmd/input).

The Interconnect application poles this directory at an interval defined by system configuration settings and processes any files that match the filename mask defined in the interconnect system configuration table.

For Mtel, the interconnect CDR file naming is as follows:-

“ICT” + NNNNNN + YYYY + MM + DD + HH + mm + SS + hh + “cdr” eg

ICTMSC0012003060411012322.cdr where:

ICT = Text string. All Interconnect input CDR files will begin with “ICT”

NNNNNN = Identification of the network source (MSC ID, etc). Mtel IT and engineering staff are responsible for developing a coding conversion for all network devices.

YYYY = Four digit year when the CDR file was generated.

MM = Two digit month when the CDR file was generated, padded with leading zero (01 – 12)

DD = Two digit day when the CDR file was generated, padded with leading zero (00 – 31)

HH = Hour (using the 24 hour clock) when the CDR file was generated, padded with leading zero (00 – 24)

mm = Minute when the CDR file was generated, padded with leading zero

- (00 – 59)
- SS = Second when the CDR file was generated, padded with leading zero
(00 – 59)
- hh = Hundredths of the second when the CDR file was generated, padded
with leading zero (00 – 99)

Interconnect validate input CDR file names and rejects files with duplicate file names. There is no checking for duplicate CDR records.

Once a CDR file has been processed by Interconnect it is moved from the input directory (<device>/bmd/input) to either:

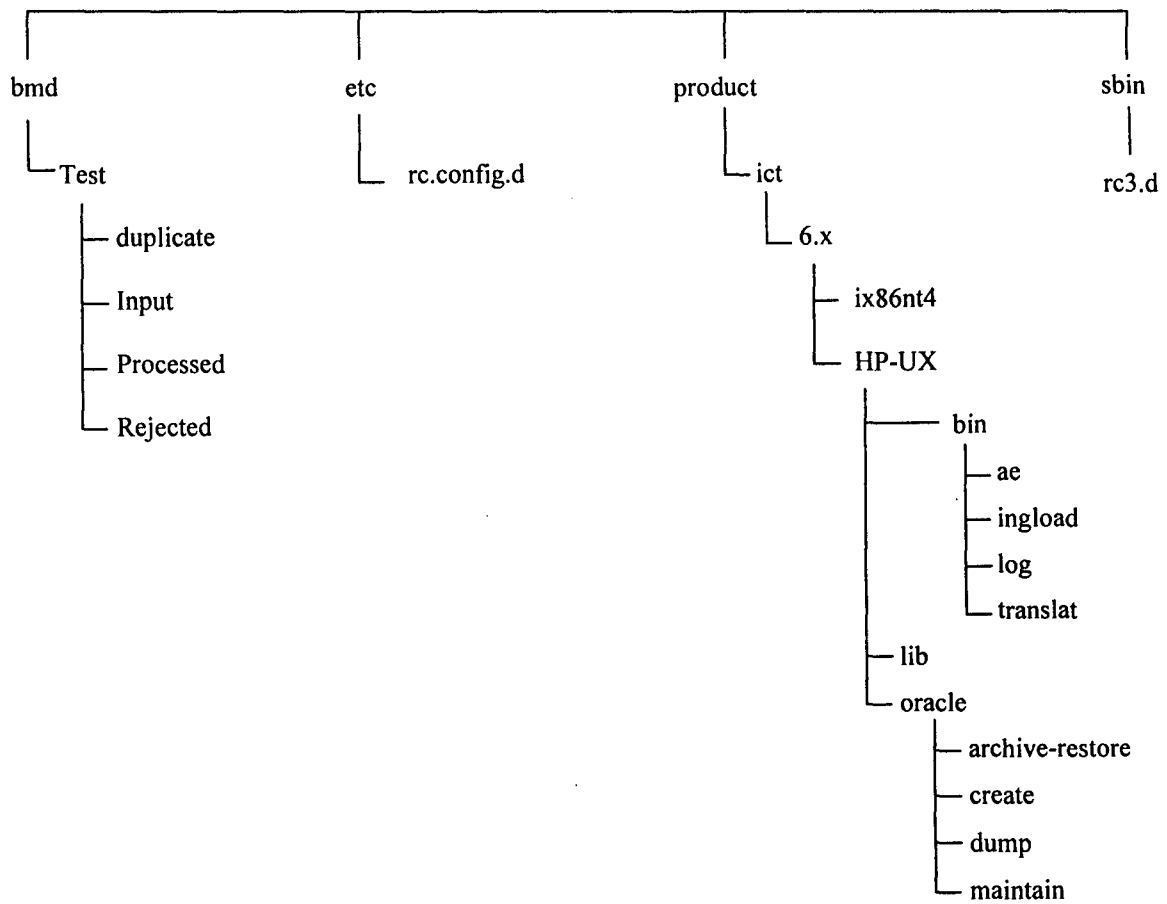
- <device>/bmd/processed for processed CDR files
- <device>/bmd/duplicate for CDR files with duplicate filenames (eg a file with the same name has already been processed).
- <device>/bmd/rejected for CDR files that are rejected (eg invalid file structure, invalid record format. etc).

1.2 INTERCONNECT SOFTWARE DIRECTORY STRUCTURE

For each version of Interconnect (ict) there is a version directory (6.x where x will be the actual software release) below which all the Interconnect specific code can be found.

The figure below shows the Interconnect Software Directory Structure on a HP UNIX system. In this case, the HP-UX sub-directory contains all the Interconnect code run on the HP UNIX system. The name of this sub-directory will be different, dependent on the operating system for the installation.

Fig 1.1 Interconnect Directory Structure



1.3 ORACLE SOFTWARE DIRECTORY

The Oracle Software Directory contains the Oracle Software and support directories. Guidance on setting up the directory is contained in the appropriate Oracle Reference manual.

Interconnect will be loaded into the Oracle database environment already set up at the client site, including the Interconnect creation and maintenance scripts that will be provided.

1.4 INTERCONNECT DATA

The Interconnect data is located in directories as defined using the online system. The system Config window from the Administration, system menu is used to define the following directories:

FDI:	Feeder Input Directory
FDD:	Feeder Duplicate Directory
FDP:	Feeder Processed Directory
FDR:	Feeder reject Directory

Interconnect checks before opening a file that the file is not currently being written to by any other process.

1.5 INTERCONNECT MACHINE ARCHITECTURE

It details the Interconnect machine architecture and the use of multiple environments. It also deals with the way in which the application is configured and the distribution of the processes to other hosts in the architecture.

The batch system has been designed to be scalable and can be configured with a network of UNIX servers. The technical architecture can utilize a single host containing multiple processors. If CDR volumes are (or become) very high a cluster of multiprocessor hosts can be adopted or it is possible to improve throughput via a

Virtual Host facility which simulates a multiple server environment on a single machine. Either way Interconnect will perform parallel pricing.

The main server is called the Primary System and any additional servers are called Auxiliary Systems.

The primary system holds the master reference database (known as the Online Schema). Both the primary and the auxiliary systems contain snapshot databases of reference data, known as Batch schemas. The Database Refresh program, which runs on each host, ensures the synchronization of these snapshot databases with the online schema on the primary system.

The diagram below illustrates the Interconnect operation in the system context

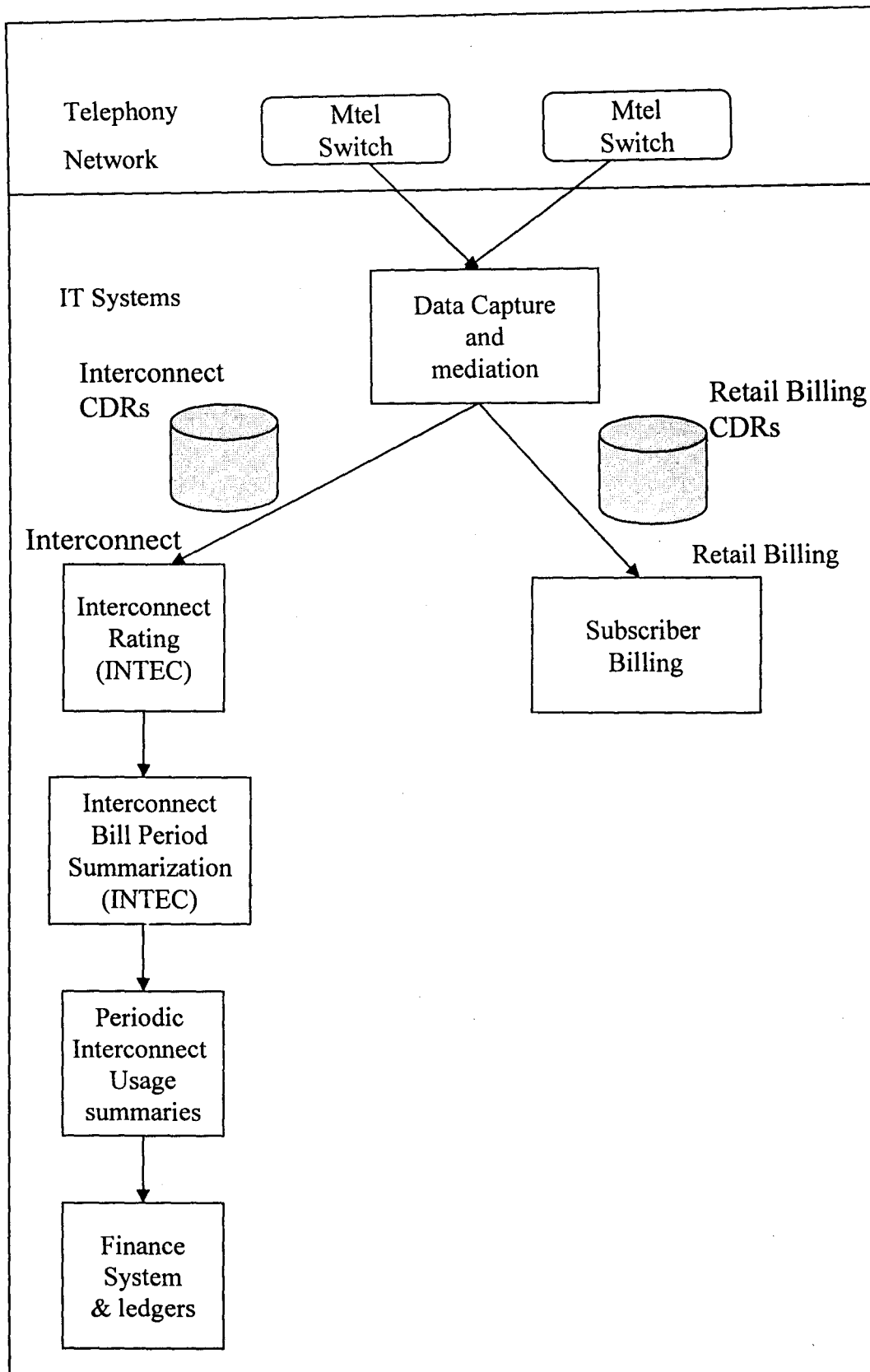


Figure 1.2 System Context

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 CDR FILTERING REQUIREMENTS

The Mediation device filters all non-interconnect CDR, so that only interconnect CDR, are sent to interconnect for processing. Interconnect CDRs are defined as CDRs that represent traffic that either entered the Mtel Network or exited the Mtel network.

2.2 INTERCONNECT CDR TYPES

The Interconnect system requires mediation to produce two (2) types of CDR, each with an identical record format. These Interconnect CDR types are:

- Ingress CDR – Used to describe calls that enter the Mtel network
- Egress CDR - Used to describe call that exits the Mtel network.

Interconnect only requires Ingress and Egress CDRs. These types of CDRs represent traffic entering and exiting the Mtel network on “Interconnect Trunk Groups”. An Interconnect trunk group is a trunk group that connects an Mtel network switch to an Interconnect partner’s switch.

Mediation generates Interconnect Ingress CDRs from raw CDRs where;

- The CDR call direction is incoming
- The originating trunk group is an Interconnect Trunk Group.

Mediation generates Interconnect Egress CDRs, from raw CDRs where:

- The CDR call direction is outgoing

- The terminating trunk ID is an Interconnect Trunk Group

2.3 DIRECT BILLING CDRs

Mtel have Interconnect agreements with certain operators where there is no physical network between them. These operators called indirect operators send and receive traffic to Mtel through a transit operator (NITEL). The diagram below illustrate the Direct Billing Interconnect Scenario.

The Interconnect contracts between Mtel and the transit and direct operators dictate the following settlement requirements:

- For Ingress call originated on an indirect operator's network and delivered to the Mtel network via a transit operator, Mtel will be paid for termination by the indirect operator and there will be no settlement with the transit operator. This settlement transaction will be enabled by Mtel mediation by modifying the incoming trunk ID as described in chapter three so that the combination of Incoming Trunk ID and Incoming Switch ID will identify the indirect operator for settlement calculation.
- For Egress calls that transit through the transit operator's network and terminate on an indirect operator's network, Mtel will pay the transit operator for the distance and a separate payment will be made to the indirect operator for termination. These two separate transactions will be enabled as follows:
 - The CDR generated by the Mtel Switch will be used for settlement calculation with the transit operator.

- The CDR generated by the Mtel switch will be replicated and the outgoing Trunk ID field modified as described in Chapter three to enable settlement calculation for the indirect operator.

Calls to and from indirect operators will be identified by analysis of the Call Direction, trunk ID and A or B Numbers as described for the identification of the DACC product in chapter four.

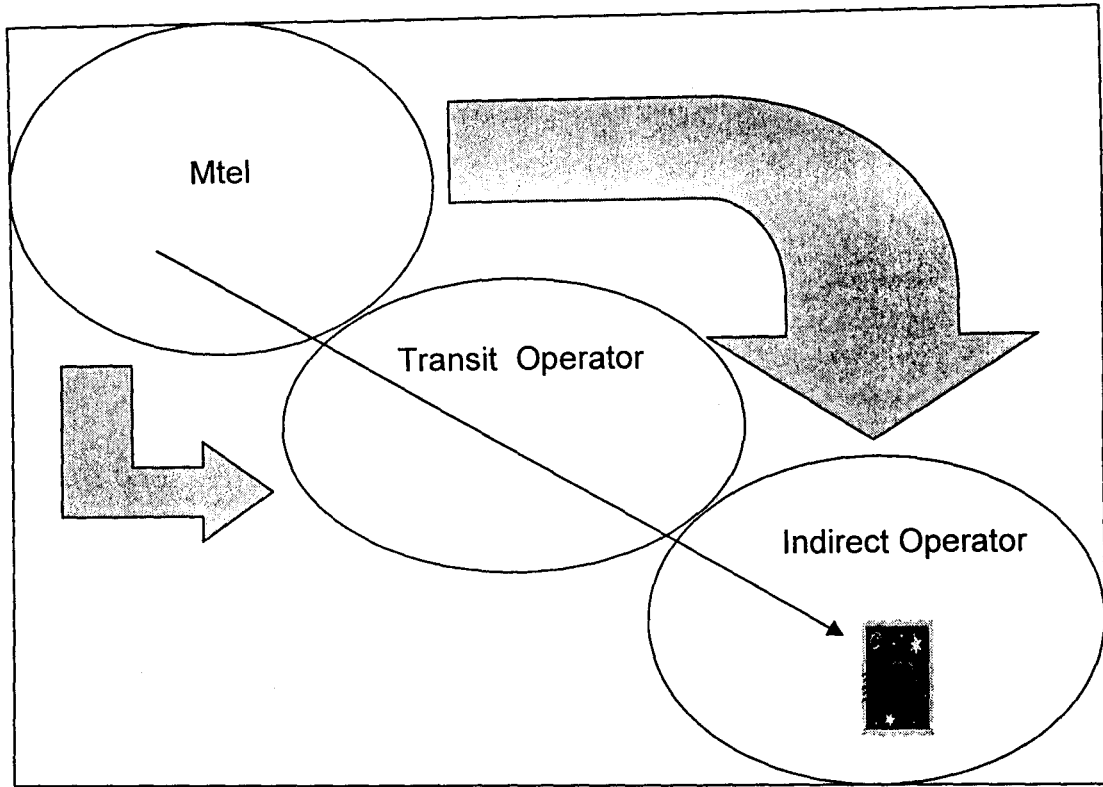


Figure 2.1 Egress Direct Billing Interconnect Scenario

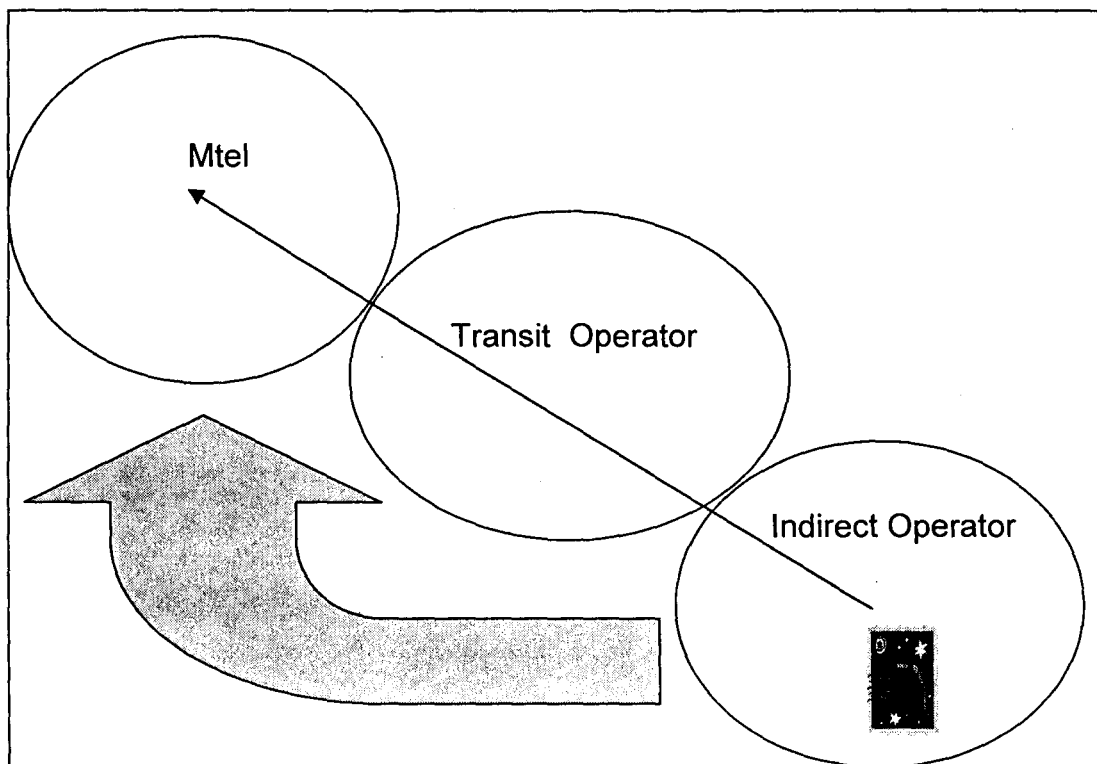


Figure 2.2 Ingress Direct Billing Interconnect Scenario

2.4 PRICING

Pricing validates the contents of the CDRs against the reference data on the database and classifies them as:

- Valid (in which case a price is calculated),
- Invalid (in which case they are rejected with a suitable error value).

Pricing can also suspend calls where negotiations to set Interconnect Agreements for new Carrier Products have not been completed. Users can specify a Network Operator or Network Operator/Product combination. Calls that match these criteria will be rejected with a specific error awaiting capture of the rating data. Once this is set up on the system the calls can be reprocessed.

Pricing provides a Dynamic Data Warehouse Feed (DDWF) depending on the setting of the system configuration parameter DWF. If the feed is required Pricing writes the Priced call information to an output comma delimited file for subsequent input to further analysis in a Data Warehouse.

Pricing can run on the Primary and Auxiliary systems but the error daemon, which improves pricing performance by handling errors, runs on the Primary system.

2.4.1 INPUT DATA

A pricing daemon obtains a group of CDRs to be priced from the PRICING_INPUT_CDR table using the PRICING_GROUP table to identify the next available group.

2.4.2 PRICING PROCESS

Pricing checks the groups of CDRs for validity against reference data. When Pricing identifies a number of CDRs for which one or more pieces of reference data is not valid, these error CDRs are rejected to the ERROR_CDR_TMP table. Those related to call retention queuing awaiting the input of rating data are rejected with a specific error code so that they are easily identifiable. The ERROR daemon then identifies the error for each CDR, writes it to the ERROR_CDR table with its appropriate error message and then removes the CDR from the ERROR_CDR_TMP table.

Pricing rates the valid CDRs and writes to the PRICED_CDR table, these are the successfully priced calls.

After a group of calls has been processed, PRICING marks this group as processed and the error daemon deletes it from the PRICING_GROUP (and PRICING_INPUT_CDR) tables. The error daemon maintains error summary statistics by error type and error value for use in the on-line system.

2.4.3 DYNAMIC DATA WAREHOUSE FEED

If the system configuration parameter DWF indicates that a feed to a Data warehouse is required each pricing engine will dynamically write the priced call information to a data warehouse file. The system configuration value DWD specifies the location for data warehouse feed files. The maximum number of records in this file is specified by system configuration value DWM. Pricing will generate the output file data until the maximum number of records is reached. The file is then closed, a matching tag file is written and a new file with a unique number suffix is opened. Note that these numbers suffixes may not be sequential. In the unlikely event of pricing failing at the moment it opens a file, it is possible that a sequence number could be missed.

2.4.4 SPLITTING OF CALLS AND CONTROL OF PRICING GROUP SIZE

Input records with valid formats are written to the PRICING_INPUT_CDR table. They are reformatted into the standard Interconnect format and given a unique identity of file number and record number (within the file) so that any record can tracked back to its source.

The records are group into PRICING_GROUPS so that the processing of large files can be distributed across multiple pricing daemons. The group size is held as a variable (FBS) in the SYSTEM_CONFIG table and can be tuned as required. A maximum of 1000 CDRs can be held in one group.

2.5 BATCH COMPONENTS

The Interconnect application receives Call Detail Record (CDRs) from a Billing Mediation Device (BMD) or Interconnect –PREP batched into files.

The Feeder validates the format of the input files and their records. The Feeder moves any rejected or duplicate files into error directories. For accepted files, rejected records are moved into the error CDR table on the database, whilst the valid records are converted to the internal format and written to the input-CDR database table ready for pricing.

Pricing reads the call records loaded on to the database by feeder and prices the calls according to various criteria, or moves rejected records into the error CDR table. When the records have been priced, storage & summary update stores the priced calls and creates summaries from the them. Summary Merge then aggregates the summary information from all hosts into a central daily summary table.

At the end of a business defined period, e.g. a calendar month, the period End process will be initiated to associate information relating to that periods activity (referred to as a billing period) and to calculate discounts.

2.6 NATIONAL LANGUAGE SUPPORT

Interconnect can be configured to display non-English characters. The environment variable setting is NLS_LANG in the Interconnect configuration file (on HP-UX installations in /etc/rc.config.d/ictvs). By default the setting is

NLS_LANG=AMERICAN-AMERICA.WE8ISO8859P1. This variable can be changed, as in the following examples, to display the required native language:

Portuguese NLS_LANG=PORTUGUESE_PORTUGAL.WE8ISO8859P1

German NLS_LANG=GERMAN_GERMANY.WE8ISO8859P1

French NLS_LANG=FRENCH_FRANCE.WE8ISO8859P1

As well as the NLS_LANG environment variable the following environment variables also need to be set (but are not changed for different languages) in the Interconnect configuration file.

NLS_DATE_FORMAT='DD-MM-YY'

NLS_DATE_LANGUAGE=AMERICAN

CHAPTER THREE

3.1 INTERCONNECT CDR

The following subsections describe the specific rules for the population of each of the Mtel Interconnect CDR fields.

A complete definition of the Interconnect CDR format is included in chapter four.

3.1.1 INCOMING SWITCH ID

The Incoming Switch ID is only populated in Ingress CDRs.

For Egress CDRs, the Incoming Switch ID field is left blank (e.g. populated with spaces).

The Incoming Switch ID is a unique identifier of the device through which the interconnect call entered Mtel's network. This is an identifier for an MSC (Mobile Switching Centre) or other device that generates charging data records for interconnect settlement such as MSC, SGSN (Future), etc.

The Incoming Switch ID may be taken from the raw CDR of generated by the mediation device depending on the availability of a unique identifier in the raw CDR.

3.1.2 OUTGOING SWITCH CDR

The Outgoing Switch ID is populated in Egress CDRs.

For Ingress CDRs, the Outgoing Switch ID is a unique identifier of the device through which the Interconnect call exits Mtel's network.

3.1.3 RECORD SEQUENCE NUMBER

The record Sequence Number field is optional. It can either:

- ❖ be used to store a unique sequential number to identify the CDR. This unique number can be taken from the raw CDR if available, or it can be generated by the mediation device or
- ❖ be left blank (e.g. populated with spaces). The Record Sequence Number is not used by the Interconnect Application.

It is recommended that Mtel populate this field with spaces.

3.1.4 LINK FIELD

The Link Field is used to manage correct pricing of Long duration calls which generate multiple CDRs. The valid values for this field are:-

- ✚ "01" for a CDR representing a whole call
- ✚ "02" for the first CDR of a long duration call there are subsequent intermediate CDRs, or an end CDR associated the call.
- ✚ "03" for the intermediate CDR of a long duration call
- ✚ "04" for the final CDR of a long duration call.

3.1.5 RECORD TYPE

The Record Type field may be used to describe the type of CDR. This field is not used by interconnect pricing and may be left blank (populated with spaces). For Mtel this field is not used (populated with spaces).

3.1.6 START DATE

The Start Date field is populated with the call date from the raw CDR. The format of field is YYYYMMDD where:-

YYYY = the four digit year

MM = the two digit month padded by leading zero

DD = the two digit day padded with leading zero

For example, 3rd June 2003 would be represented as 20030603.

3.1.7 START TIME

The Start Time field is populated with the start talk time (sometimes known as the call seizure time) of the call from the raw CDR. The format of this field is HHMMSShh where:-

HH = hour of the day padded by leading zero (values 00-23)

MM = minute padded by leading zero (values 00-59)

SS = second padded by leading zero (values 00-59)

hh = hundredths of a second padded by leading zero (values 00-99)

For example, a start time of 12:07am and 23.75 seconds must be represented as 00072375.

3.1.8 DURATION

The duration field is populated with the call conversion duration which is derived from the raw CDR. The duration may be calculated by subtracting the call seizure start time from the call seizure end time where the duration is not explicitly given on the raw CDR (network start and end times may also be used in the calculation depending on the interconnect agreement).

The format of this field is same as start time.

3.1.9 A - NUMBER

The A Number field is populated with the value of the calling Party Number (sometimes known as the Subscriber Number) from the raw CDR in all case except the following:

- All national numbers begin with) (zero) (e.g. 01260 Lagos E)
- All international numbers are prepended with the plus sign (+) (e.g. +44
For calls that originate in the UK).
- All short numbers appear as dialed (e.g. 192 = enquiries, 199 = emergency, etc).
- If the A Number is not present in the raw CDR, then the A number field is populated with the value "NOANUM".
- If the calling party is a foreign roamer using the Mtel network, then the A number field is populated with the Mobile Subscriber Roaming Number (MSRN) if available. If it is possible to have TACS roamers, the Temporary Local Directory Number (TLDN) is used to populate the A Number field in the interconnect CDR. If the MSRN or TLDN is not available on the CDR for

roamer originated calls, the interconnect A number field is populated with the value "ROAMER".

3.1.10B - NUMBER

The B Number filed will be populated with the value of the Calling Party Number (sometimes known as the dialed number). From the raw CDR. For MTEL, the B Number will adhere to the following business rules:

- ❖ All national numbers start with 0 with the exception of emergency calls, information services and premium rate services.
- ❖ Direct invoice dialing codes (carrier select indirect access) are included in the B Number. These codes are 5 digits beginning with 15 (eg 15xxx).
- ❖ All international access code 009 is replaced with the plus sign (+).
- ❖ Any other leading characters are removed (eg 009234 or +234 for national calls is replaced by), PBX access numbers removed and the number starts with 0, etc) and the resulting of the B Number always begin with 0 for national call and + for international calls.
- ❖ When the called party is a foreign roamer using the Mtel network, the B Number is populated with Mobile Subscriber Roaming Number (MSRN). If it is possible to have TACs roamers, the Temporary Local Directory Number (TLDN) is used to populate the B number field in the interconnect CDR for incoming calls to TACS roamers. If the MSRN or TLDN is not available on the CDR for roamer terminated calls, the interconnect B number field is populated with the value "ROAMER"

3.1.11 INCOMING TRUNK ID

The Incoming Trunk Id is only populated in Ingress CDRs.

For Egress CDRs, the Incoming Trunk ID field is left blank (eg populated with spaces).

- ❖ The Incoming Trunk ID field is populated with the value of the incoming trunk group or route through which the call entered the Mtel network from another network operator.
- ❖ For incoming calls from indirect operators with no physical connection to mtel's network the incoming trunk ID has a three character indirect operator code prepended to the trunk ID value depending on the originating indirect operator (ECO for Econet, GLO for Globacom, MTN for MTN or PTO for PTO consortium operators). If the existing incoming trunk ID is greater than 12 characters the trunk ID is truncated to 12 characters after the three character code is prepended. For example, a call from indirect billing operator MTN with an incoming trunk ID of "LGSCO" on the raw switch CDR results in "MTNLGSCO" in the interconnect CDR. The code to be used to identify indirect operator are listed in chapter four.

Trunk Id s do not have to be unique as the combination of Switch ID and Trunk ID is used by Interconnect to identify the interconnect partner.

3.1.12 OUTGOING TRUNK ID

The outgoing Trunk ID is only in Egress CDRs.

For Ingress CDRs, the Outgoing Trunk ID field is left blank.

- ❖ The Outgoing Trunk ID field is populated with the value of the outgoing trunk group or route through which the call exited the Mtel network to another network operator.
- ❖ For replicate CDRs generated to settle with indirect billing operators, the outgoing trunk ID has a three character indirect operator code also like the incoming trunk ID, if the existing outgoing trunk ID is greater than 12 characters the trunk is truncated to 12 characters after the three character code is prepended. For example, a call to direct billing operator MTN with an outgoing trunk Id of “LGSCO” in the raw switch CDR results in “MTNLGSCO” in the interconnect CDR.

3.1.13 CALL DIRECTION

The Call Direction field is not used for pricing by interconnect. During the pricing process interconnect calculates the call direction based on the presence of incoming or outgoing trunks IDs.

- ❖ “ I “ for Ingress CDRs, and
- ❖ “ X “ for Egress CDRs.

3.1.14 NETWORK TIME

The network time is the duration of the call from Call Setup Start Time to Call Setup End Time. It is not used by interconnect pricing, it is required for information purposes only. The Network Time is the full network time of the call which is greater than the talk time duration of the call which is calculated using the call seizure time and call hang up time.

The format is also that of Start Time in the above time scheduling.

3.1.15 DATA VOLUME

The data volume field is used to store the data volume for CDRs that are priced based on measure of volume. MTEL does not price any interconnect traffic by data volumes. For Mtel, the Data Volume field is left blank.

3.1.16 DATA UNIT

The Data Unit field defines the unit measure of the Data Volume field (E.G megabytes, kilobytes, packets etc).

3.1.17 USER SUMMARIZATION

The User Summarization field is available to the customer to populate with values that will be used in the summarization of interconnect summary data.

3.1.18 USER DATA

The User Data field is available to the customer to populate with values that will be stored with the priced CDR. The user Data field is not used in summarization.

3.1.19 END OF RECORD

The End of Record character is a line feed (Hexadecimal ASCII Value '0A') and is the final character of the Interconnect CDR.

3.2 ORACLE DATABASE

An Oracle relational database is used to store reference and call data for the Interconnect application. The reference data is updated online by the Interconnect Online system (e.g., new Network Operators, new point of Interconnect and Rate changes) and the call data is updated by the Interconnect Batch (e.g., Daily summary updates). Interconnect Batch prices the incoming CDR records and therefore requires a read consistent view of the reference data while the batch application is running.\

To allow the Interconnect Online application to concurrently update reference data in the database at the same time as Interconnect Batch is running, the oracle database snapshot facility is used. Oracle Snapshot creates a read only copy of the relevant data. This can be established in the same Oracle instance or a different instance for the Interconnect Batch to run against.

The Interconnect Online can be updating the Oracle reference data while the Interconnect Batch is referencing a read consistent copy of the data during the life of the batch run.

The Batch copy of the reference data is refreshed at the start of the run or upon request from the online system.

The STORED_PRICED_CDR tables are located on the same hosts that the storage & summary update process runs on (i.e. these are distributed database tables). The fact that the data is distributed across tables is transparent to the users.

FIG. 3.1 Interconnect Database tablespace

Data Tablespace	Index Tablespace	
ICT_REF_DATA	ICT_REF_INDEX	Holds all user reference data (lookup tables). Does not grow much after initial load. Only on Primary.
ICT_SNAP_DATA	ICT_SNAP_INDEX	Holds snapshots of the user reference data (lookup tables). The snapshots are used by the batch process so that it is not influenced by concurrent online activity.
ICT_STORED_DATA	ICT_STORED_INDEX	Holds all the priced CDRs.
ICT_WORK_DATA_A	ICT_SYSTEM_INDEX	Holds system-generated data (log messages, daily summaries, batch control, etc). Grows continually. Only on primary.
ICT_WORK_DATA	ICT_WORK_INDEX	Holds working data needed during a batch run. it is empty at the beginning and end of a batch run. Should be large enough to hold at least one day's processing.
RBS		Oracle tablespace that contains the rollback segments. The rollback segments contain before-images of all uncommitted data.
TEMP		Oracle tablespace that contains the temporary segments. Temporary segments are allocated during index creation, sorting etc.
TOOLS		Oracle tablespace for Oracle's tools.

3.3 SEMANTIC LAYER VIEWS

Views of the Interconnect data are accessible via the Interconnect Semantic Layer. These are not necessarily Oracle Views: they could be temporary database tables populated by a variety of programs. All the views available from Interconnect V6.0.6 are fully documented in the Semantic Layer Guide.

The Interconnect Semantic Layer has a number of objectives, namely:

- Provide an open business interface to the interconnect data, to be used by any other third party reporting tool capable of connecting to an Oracle database.
- Avoid the end users needing to be familiar with the underlying Interconnect data model and storage architecture.
- Minimise the impact on the users when underlying changes are made to the Interconnect data model and architecture.

3.4 BACKUPS

All of the Interconnect application data and parameters are held in the Oracle database. It is essential that attention is given to planning your backup strategy.

There are, in theory, three types of Oracle database backups you can take:-

1. **COLD BACKUP:-** The Oracle database is shut down and a backup is taken. Once the backup has completed the Oracle database can be started up again. Oracle database archive can be enabled (ARCHIVELOG Mode) or disabled (NOARCHIVELOG Mode) for this type of backup.

The database must be offline. Any backups taken in NOARCHIVELOG Mode while the database is still running cannot be used for recovery to the most recent committed transaction, but only to the time of the last backup.

2. **HOT BACKUP:-** The Oracle database is not shut down and an online backup of the database is taken using the Oracle online backup function. Oracle database archive (ARCHIVELOG Mode) must be enabled for this type of backup.

The advantage of this type of backup is that the database can be recovered to the latest commit point.

3. **EXPORT BACKUP:-** The Oracle database is exported using the Oracle Exp utility. The database need not be down or offline but there should not be any update activity on the database during the length of the export. Oracle database archive can be enabled (ARCHIVELOG Mode) or disabled (NOARCHIVELOG Mode) for this type of backups is not suitable for large databases. It is not possible to roll forward through the days work. Updates performed whilst the export is busy will result in an inconsistent backup.

CHAPTER FOUR

4.0 PRODUCT DERIVATION RULES

The following table illustrates a sample set of rules for determining the Interconnect Product ID for all Interconnect CDRs. These rules only apply to Interconnect CDRs. Once Mtel approve the Call Scenarios Specification document, the Products and associated derivation rules required by the Mtel interconnect agreement will be listed in this table.

Table 4.1 Product Derivation Table.

Product ID	Description	Rule
GACC	<p>GSM Access</p> <p>Incoming calls from a direct operator (an operator with a physical connection to the Mtel network) that terminate with Mtel Subscribers.</p> <p>AND</p> <p>Outgoing call that terminate with a direct operator (with a physical connect to the Mtel network).</p>	<p>(Incoming call from a trunk connected to Nitel) AND A# prefix operator prefix (Nitel prefix)</p> <p>OR</p> <p>(Outgoing call to a trunk connected to Nitel) AND B# prefix is a direct operator prefix (Nitel prefix).</p>
DACC	<p>Direct Accounting Calls</p> <p>Incoming call that originated on an indirect operator's network (an operator with no physical connection to Mtel) and are</p>	<p>(Incoming call from a trunk connected to Nitel) AND A# prefix is an indirect operator prefix.</p> <p>OR</p> <p>(Outgoing call to a trunk connected</p>

<p>delivered through a direct operator's network (an operator with a physical connection to Mtel e.g. Nitel)</p> <p>AND</p> <p>Outgoing calls that terminate on an indirect operator's network (an operator with no physical connection to Mtel) and are delivered through a direct operator's network (an operator with a physical connection to Mtel e.g. Nitel).</p> <p>These call transit through the Nitel network.</p>	<p>to Nitel) AND B# prefix is an indirect prefix.</p> <p>Note: Direct Invoice Dialing numbers (15xxx) are only used for outgoing calls.</p>
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4.1 INDIRECT OPERATOR PREFIXES

The following table contains the list of indirect operator prefixes. With the exception of MTN, Econet and Globacom all other operators listed in 2 will be treated as one indirect operator (PTO). The associated operator names in table 2 are listed for information purposes only to assist that the indirect operator prefix list is correct.

Table 4.2 Indirect Operator Prefixes

Indirect Operator	Prefix Codes
MTN	0803
Econet	0802
Globacom	0805
North-West Communications Ltd., Lagos (PTO)	15553
North-West Communications Ltd., Lagos (PTO)	15554
North-West Communications Ltd., Lagos (PTO)	15555
Allied bond Standard Co. Ltd., Lagos (PTO)	15300
Connect Cards Links, Lagos (PTO)	15320
ITN Ltd., Lagos (PTO)	15342
Cell Comm. Ltd., Lagos (PTO)	01290
NNPC Abuja and Lagos (PTO)	012604
NNPC Abuja and Lagos (PTO)	012008
Multiple Services Ltd., Lagos (PTO)	15358
World Web Ltd., Kaduna (PTO)	15400
Telco Africa Ltd., Lagos (PTO)	15620
Bourdex Telecomm, Aba (PTO)	15365
Centrion N/W, Lagos	15200
I-Net Global Services Ltd., Kaduna (PTO)	15445
Microtel Ltd., Abuja (PTO)	15334
Atlasco Technologies Ltd., Lagos (PTO)	15470
Kall Directories Ltd., Lagos (PTO)	15900
Lima Services Ltd., Lagos (PTO)	15800
Pacific Global Telecomms, Ltd., Lagos (PTO)	15630
Imperial Telecomms Ltd., Lagos (PTO)	0144
Connect Cards Links., Lagos	013203
Easy Access Nig. Ltd, Lagos (PTO)	15374
Disc Comm. Ltd Lagos (PTO)	01345
Rainbownet Ltd., Enugu (PTO)	15460
Skyview Nig. Ltd., Lagos (PTO)	15360
Engineered Inter N/Ws Ltd., Lagos (PTO)	15380

Mobitel Ltd., Warri (PTO)	15388
Bourdex Telecomms, Awka (PTO)	04888
Bourdex Telecomms. Ltd., Calabar (PTO)	08777
Tara Systems Ltd., Lagos (PTO)	15432
Quick Digicom. Ltd., Lagos (PTO)	15701
Mobitel Ltd., Warri (PTO)	05332
Riskuwa Telecomms Ltd., Abuja (PTO)	15705
Infoweb Ltd., Lagos (PTO)	15370
Multiple Services, Lagos (PTO)	15357
Markgrey Computers Ltd., Abuja (PTO)	15894
3-Comms Nigeria Ltd., Lagos (PTO)	15355
IT Global Solutions Nig. Ltd., Lagos (PTO)	15454
Timicom Telecoms Ltd., Lagos (PTO)	15940
Global space Communications Ltd., Kano (PTO)	15734
Surich Technologies Ltd., Abuja (PTO)	15391
QV Communication Ltd., Abuja (PTO)	15678
Sagem for Nig. ID Card Abuja (PTO)	15666
S.A.Y. Communications Ltd., Abuja (PTO)	15570
Nakande Telecomms Nig. Ltd., Abuja (PTO)	15712
Quick Digicom Ltd., Lagos (PTO)	0115700
Microtel Ltd., Abuja (PTO)	0915333
Microtel Ltd., Ikeja Lagos (PTO)	15333
International N/W Communication Africa Ltd., Lagos (PTO)	15250
WSA Telecomm Ltd., Lagos (PTO)	15260
Sungold Communications Ltd., Lagos	15777
Intercellular Nig. Ltd., (PTO)	01473
Intercellular Nig. Ltd., (PTO)	01474
Florida Satellite Comm Ltd., Lagos (PTO)	15220
Allied Bond Standard Company, Enugu (PTO)	15301
Blueprint Business Technologies Lagos (PTO)	15240
Akkclaim Telecomms Ltd., NCC, Kano (PTO)	15330
Akkclaim Telecomms Ltd., NCC, Lagos (PTO)	15331
Akkclaim Telecomms Ltd., NCC, Kano (PTO)	06428
Imperial Telecomms Ltd., Lagos (PTO)	15440
Imperial Telecomms Ltd., Lagos (PTO)	15441
Data PRT Systems Ltd., Lagos (PTO)	15803
Jofel International Ltd., Lagos (PTO)	15520
Newline Technologies Ltd., Lagos (PTO)	15950
Sterling Communication Ltd., Lagos (PTO)	15860
Mac Telecommunication Ltd., Lagos (PTO)	15872
Tanglewood Investment Nig.Ltd., Lagos (PTO)	15810
Tanglewood Investment Nig. Ltd., Lagos (PTO)	15811
Interstella Communication Ltd., Lagos (PTO)	15575
Riskuwa Telecomms, Abuja (PTO)	15706
Allied Communication Ltd., Lagos (PTO)	15576

Hitest Nig Ltd., Illorin (PTO)	15970
Steem Broadcasting and Communications Ltd., Lagos (PTO)	15720
Mark Eanson Holdings Ltd., Lagos(PTO)	15325
Unicorn Network Services Ltd., Lagos (PTO)	15920
Unicorn Network Services Ltd., Lagos (PTO)	15921
Carsearch Nig. Ltd., Lagos (PTO)	15410
Starcomms Ltd., Lagos (PTO)	01811
North-west Communications Ltd., Lagos (PTO)	15557
Interstella Communication Ltd., Lagos (PTO)	15881
Maccon Communications Ltd., Lagos (PTO)	15310
Rosecomm Net, Abuja (PTO)	15657
Mark Eanson telecomm Ltd., Lagos (PTO)	15326
Eurame World Ltd., Abuja (PTO)	15780
Arcam Ltd., Lagos (PTO)	15230
Adesemi Nig. Ltd., Lagos (PTO)	15271
Adesemi Nig. Ltd., Lagos (PTO)	15272
Datatel Resources Ltd., Lagos (PTO)	15836
Datatel Resources Ltd., Lagos (PTO)	15837
World Scope Ventures Ltd., Lagos (PTO)	15510
DGC Services Ltd., Lagos (PTO)	15785
Skyview – O Nig. Ltd., Lagos (PTO)	15930
Petroleum Technology Development Fund (PTDF), Abuja (PTO)	09617
Tritel Network System Ltd., Lagos (PTO)	15640
Voix System, Lagos (PTO)	15540
Topcom Nig. Ltd., Lagos (PTO)	15980
Topcom Nig. Ltd., Lagos (PTO)	15981
Ceuna phone Ltd., Enugu (PTO)	15762
National Emergency Management Agency (NEMA), Abuja (PTO)	09655
DGC Services Ltd., Lagos (PTO)	15784
Connectivity Resources Ltd., Lagos (PTO)	15689
Connectivity Resources Ltd., Lagos (PTO)	15690
IT Global Solutions Nig. Ltd., Lagos (PTO)	15280
Unicorn Network Services., Lagos (PTO)	15922
Aeko Communications Ltd., Lagos (PTO)	15910
AFCO Petroleum and Communication Nig. Ltd., Imo State (PTO)	15960
Telemobile, Lagos (PTO)	15990
Afrique Communications Ltd., Kano (PTO)	15316
Econet (test number) (PTO)	10802
Messrs Siotel (Nig) Ltd., Asokoro, Abuja (PTO)	15585
Messrs Profile Computers, Wuse, Abuja (PTO)	15420
Messrs Service trail Nig. Ltd., Uyo, Akwa Ibom (PTO)	15986
Messrs ITXC Corporation for VOIP Services, Lagos (PTO)	15545
Messrs Intl. Monitors Internet services, Port-Harcourt (PTO)	15995
Messrs ITXC Corporation for VOIP Services, Lagos V	15546
Messrs T.Y.F., Lagos (PTO)	15601

Ogbunike Analogue LE (PTO)	0465500
Ogbunike Analogue LE (PTO)	0465501
Ogbunike Analogue LE (PTO)	0465502
Ogbunike Analogue LE (PTO)	0465503
Messrs Western Pacific Communications Ltd., Lagos (PTO)	15845
Messr Camby Technical Services Ltd., Ibadan (PTO)	15395
Messr X.P.T., Lagos (PTO)	15820
Messrs Electronic Connections Ltd., Kano (PTO)	15743
Messrs Asonnet Technologies Ltd., Lagos (PTO)	15725
Messrs Asonnet Technologies Ltd., Lagos (PTO)	15726
Messrs Modern Telecoms Ltd., Lagos (PTO)	15373
Messrs ABG Communications Ltd., Lagos (PTO)	15351
Church of Nigeria (Anglican Communion), Abuja (PTO)	15490
Messrs 21 Centory Technologies, Lagos (PTO)	15525
Messrs 21 Centory Technologies, Lagos (PTO)	15526
Messrs Afritech (Nig) Ltd., Onitsha (PTO)	15264
Messrs Microcom Systems Ltd., Lagos (PTO)	15670
Messrs Access point Communication Ltd., Umuahia (PTO)	15644
Messrs Q4 Networks, Ibadan (PTO)	15254
Messrs Intercomm Data Network Ltd., Lagos (PTO)	15285
Messrs JTI Celestron Nigeria Ltd., Abuja	15425
Messrs Linkserve Ltd., Ibadan (PTO)	15123
Messrs Direct On PC Ltd., Lagos (PTO)	15793
Messrs First-Net Telecomms Ltd., Lagos (PTO)	15769
Messrs Steem Broadcasting & Communication Ltd., Lagos (PTO)	15721
Messrs Intercomm Data Network Ltd., Lagos (PTO)	15286
Messrs Montesines Ltd., Lagos (PTO)	15625
Messrs Afrione Ltd., Lagos (PTO)	15480
Messrs Global Digital Network PLC, Lagos (PTO)	15866
Messrs Rainbownet Ltd., Enugu, Aba, Onitsha & Lagos (PTO)	04230
Messrs Rainbownet Ltd., Enugu, Aba, Onitsha & Lagos (PTO)	08230
Messrs Rainbownet Ltd., Enugu, Aba, Onitsha & Lagos (PTO)	04630
Messrs Rainbownet Ltd., Enugu, Aba, Onitsha & Lagos (PTO)	04330
Messrs Nova Internet Solutions Big., Ltd., Lagos (PTO)	15535
Messrs Startech Connections Ltd., (PTO)	09222
Messrs Startech Connections Ltd., (PTO)	06422

4.2 MEDIATION FIELD MAPPING

4.2.1 CDR Character Formats

All the characters in the Interconnect CDR formats conform to the ASCII character set. All CDRs must end with a single line feed (LF) character (Hex '0A').

All CDRs are fixed length.

The format codes in the following tables relate to the following formats:

- A = Alpha characters from **A** to **Z** and **a** to **z**
- N = Numeric characters from **0** to **9**
- S = Space character
- X = An ASCII Control character (e.g. LF = Hex '0A')
- < = Left justified in the field (that is, with trailing spaces)
- > = Right justified in field (that is, with leading spaces)

4.2.2 Egress CDR Format

The following table describes the INTEC Egress Call CDR record Format.

#	Interconnect Field Name	No. of Bytes	Start Pos.	Format
1	Incoming Switch Id	7	1	A,N,S
2	Outgoing Switch Id	7	8	A,N,S <
3	Record Sequence Number	10	15	A,N,S <
4	Link Field	2	25	N,S
5	Record Type	2	27	N,S, <
6	Start Date	8	29	N
7	Start Time	8	37	N
8	Duration	8	45	N
9	A - Number	18	53	A,N,S, <
10	B - Number	18	71	A,N,S <
11	Incoming Trunk Id	12	89	A,N,S
12	Outgoing Trunk Id	12	101	A,N,S <

13	Incoming Product Id	4	113	A,N,S
14	Outgoing Product Id	4	117	A,N,S <
15	Call Direction	1	121	A
16	Network Time	8	122	N<
17	Reason for Cleardown	4	130	A,N,S
18	Data Volume	5	134	N,S
19	Data Unit	6	139	A,N,S
20	Repair Indicator	1	145	A,N,S
21	User Summarization	10	146	A,N,S
22	User Data	15	156	A,N,S
23	End of Record	1	171	X

4.2.3 Ingress CDR Format

The following table describes the Interconnect Ingress Call CDR record format.

#	Interconnect Field Name	No. of Bytes	Start Pos.	Format
1	Incoming Switch Id	7	1	A,N,S
2	Outgoing Switch Id	7	8	A,N,S <
3	Record Sequence Number	10	15	A,N,S <
4	Link Field	2	25	N,S
5	Record Type	2	27	N,S, <
6	Start Date	8	29	N
7	Start Time	8	37	N
8	Duration	8	45	N
9	A - Number	18	53	A,N,S, <
10	B - Number	18	71	A,N,S <
11	Incoming Trunk Id	12	89	A,N,S
12	Outgoing Trunk Id	12	101	A,N,S <
13	Incoming Product Id	4	113	A,N,S
14	Outgoing Product Id	4	117	A,N,S <
15	Call Direction	1	121	A
16	Network Time	8	122	N<
17	Reason for Clear down	4	130	A,N,S
18	Data Volume	5	134	N,S
19	Data Unit	6	139	A,N,S
20	Repair Indicator	1	145	A,N,S
21	User Summarization	10	146	A,N,S
22	User Data	15	156	A,N,S
23	End of Record	1	171	X

CHAPTER FIVE

5.0 CONCLUSION

In conclusion, the Mediation Interface Requirement Specification can help GSM service providers and Private Telephone Operators achieve proper interconnectivity in order to provide the customers the best services possible and also improve the quality of Mediation between the networks. Consequently, this would improve the efficiency of the overall system of operation of telecommunication sector.

5.1 RECOMMENDATION

Intec recommend that hot backups are made daily. The timing of the backup is best decided by the customer but consideration should be given to taking backups during the online function not during the batch run. The following is recommended:

- Hot backup - once a day.
- Cold back up - once a week.

The frequency of the backup will determine the recovery time. If running in a cluster, and one of the databases is restored to a point in time, they must all be restored to the same point in time.

The Oracle Enterprise Manager Backup utility (the GUI interface to the Recovery Manager) may be used to automate backup and recovery. Oracle recovery Manager Utility provides an incremental backup, but it is not true incremental as it backs up a whole table even if one block changes.

The Entire database must be backed up regularly, Oracle ARCHIVELOG mode should be used with the application as backups taken in NOARCHIVELOG mode cannot be used for recovery to the most recent committed transaction.

A normal installation of Interconnect will ensure that logs are placed in the archivelog directory and that there is space for at least one day's processing.

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