

Roaming

Roaming describes the possibility of a mobile customer to use a mobile phone outside of the home network.

There are two major terms :

- Home Public Mobile Network (HPMN)

The network with which the customer has a contract for the use of mobile services.

- Visited Public Mobile Network (VPMN)

A network, which the customer uses in regions not covered by his or her HPMN. As a prerequisite for using the mobile services of the VPMN, there has to be a [roaming contract](#) between the HPMN and the VPMN.

Example A customer of a German mobile network is visiting Singapore. This customer wants to use his mobile phone with the same services (telephony or SMS) in Singapore. If the mobile customer wants to use the mobile network as a guest, the HPMN in Germany needs a roaming agreement, which describes the terms of condition using different services in the foreign network in Singapore.

There are two possibilities of roaming:

- National roaming: The visited network is in the same country as the home network.
- International roaming: The visited network is outside the home country.

Network Technologies

There are two mobile network technologies that support roaming functionality:

- Global System for Mobile Communications (GSM)

The data exchange between mobile network operators is based on [TAP and RAP files](#).

- Advanced Mobile Phone Service (AMPS)

The data exchange between mobile network operators is based on [CIBER files](#).

Data Exchange

Data exchange is realized using the following standards:

- [TAP and RAP Files](#)
- [CIBER Records](#)

TAP and RAP Files

TAP Files Transfer Account Procedure (TAP) is the process that allows a visited network operator to send billing records of roaming subscribers to their respective home network operator. The VPMN network in which the roaming customer uses a mobile phone produces TAP files, which contain all the usage information.

The network operator must be able to handle TAP files in two ways:

- as [incoming TAP files](#)
If the operator is the HPMN, it receives incoming TAP files, sent by the roaming partner. These TAP files contain usage data of HPMN customers using mobile services in a roaming partner's network.
- as [outgoing TAP files](#)

If the operator is the VPMN, it creates outgoing TAP files and sends them to the corresponding roaming partner. These TAP files contain usage data of the roaming partner's customers using mobile services in the VPMN.

Example You are a customer of a German mobile network provider and you are using mobile services outside your HPMN area, for example in Singapore. The German network provider needs a roaming agreement with the network provider from Singapore. This network provider is responsible for delivering TAP files to the German network provider for billing the calls of the customer.

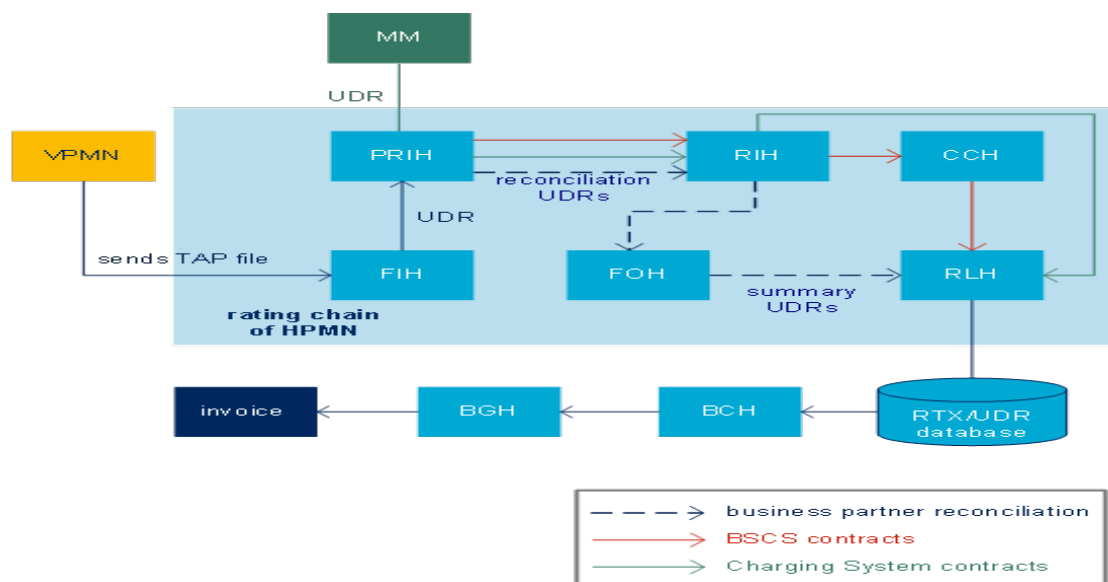
RAP Files Returned Account Procedure (RAP) files are used to report errors in TAP files, which are sent to the roaming partner. The format and content of RAP files are described in the TD.32 specification documentation.

The network operator must be able to handle RAP files in two ways:

- as [outgoing RAP files](#)
If the operator is the HPMN, it receives incoming TAP files, sent by the roaming partner. If the TAP files contain errors, the HPMN creates outgoing RAP files to inform the roaming partner of the errors in the TAP files.
- as [incoming RAP files](#)
If the operator is the VPMN, it sends TAP files to the roaming partner. If the TAP files contain errors, the VPMN receives incoming RAP files, sent by the roaming partner, to correct errors in the TAP files.

Incoming TAP Files

This section provides a short process description on how TAP files are handled by the HPMN of the customer.



Incoming TAP File - Normal processing, simplified

Situation: BSCS receives a TAP file containing usage data records from customers who have used mobile services outside of the home network. These will be billed to the subscribers. Depending on whether a customer has a BSCS or a Charging System contract, either BSCS (for BSCS contracts) or Charging System (for Charging System contracts) performs the home subscriber rating. Business partner reconciliation is always performed by BSCS.

1. BSCS in the role of the HPMN receives TAP files from the business partner (in the role of the VPMN).

2. File Input Handler (FIH) converts the files into UDRs and performs various checks. If everything is fine, a duplicate record check is performed to ensure that the file is not processed twice in the system.



If the TAP file is not correct due to a severe or fatal error, a RAP file is produced. For further information about RAP, refer to [Handling RAP Files](#).

3. Pre-Rate Input Handler (PRIH) analyzes the pre-business scenarios, identifies the subscribers involved in the call and checks whether the contract of the charged party is a BSCS or a Charging System contract.
4. PRIH forwards the UDR for rating of the home subscriber to Rate Input Handler (RIH) in the case of a BSCS contract or to Multi Mediation (MM) in the case of a Charging System contract.
5. PRIH generates reconciliation UDRs and forwards them to RIH.
6. RIH performs the following actions depending on the use case:
 - In case of home subscriber rating, RIH analyzes the business scenarios, which also describe the rate plan to be used for rating of a subscriber with a BSCS contract. It forwards the rated UDR to Cost Control Handler (CCH) to apply possible discounts to the call.
 - In case of business partner rating, RIH processes the reconciliation UDRs and sends them to File Output Handler (FOH).
7. Rate Load Handler (RLH) receives home subscriber UDRs sent by CCH as well as summary UDRs forwarded by FOH and stores them in the UDR database.

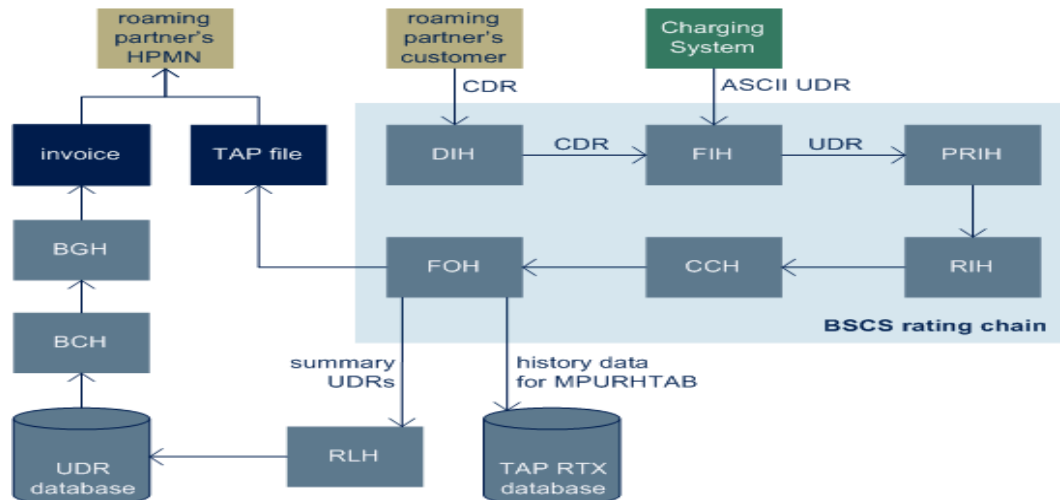
In most cases, a home operator checks invoices received by business partners. Therefore, it is possible to create a reconciliation UDR. The Billing area can produce a reconciliation statement, but these amounts are not booked in the database.

8. Billing Cycle Handler (BCH) and Bill Generation Handler (BGH) finally bill customers and business partners.

For more information refer to [Roaming and Interconnect Scenarios](#) in the **Workflows Between BSCS and Charging System** section.

Outgoing TAP Files

Customers of a roaming partner (for example, from Singapore) have used mobile services in your home network (for example, a German mobile network provider), which is the roaming partner's VPMN. One or more TAP files are produced by the roaming partner's customer. It has to be determined by configuration if BSCS or Charging System perform rating in this case. For more information on using either BSCS or Charging System as rating engine refer to [Charging Scenarios](#).



In case, **BSCS** has been configured **as rating engine** for foreign subscribers roaming in our network, the following steps are performed:

1. Device Input Handler (DIH) processes CDRs and forwards them to File Input Handler (FIH).
2. FIH converts CDRs to UDRs and forwards them to Pre-Rate Input Handler (PRIH).
3. PRIH analyzes the pre-business scenarios and identifies the subscribers.

In case of records from visitors, it also identifies the roaming partner's HPMN to be charged.

4. Rate Input Handler (RIH) analyzes the business scenarios, which also describe the rate plan to be used, and forwards the UDR to Cost Control Handler (CCH).



In case of records from visitors, this is normally the rate plan given to the HPMN in the roaming agreement.

5. CCH applies discounts to the UDR if possible and sends it to File Output Handler (FOH).
6. FOH creates summary UDRs and sends them to Rate Load Handler (RLH).

Additionally one or more TAP files (exchange files) are created and sent to the business partner's (roaming partner's) HPMN.

7. RLH loads the UDRs in the UDR database for further processing by Billing Cycle Handler (BCH) and Bill Generation Handler (BGH), which are responsible for creating a business partner invoice. The business partner uses the TAP files created by FOH to bill the customer.

In case, **Charging System** has been configured **as rating engine** for foreign subscribers roaming in our network, billing and business partner reconciliation are still performed by BSCS:

1. Charging System performs charging of CDRs that belong to foreign subscribers roaming in your network and provides the records in ASCII UDR format to BSCS.
2. FIH converts the ASCII UDRs to UDRs and forwards them to PRIH.
3. PRIH prepares the UDRs for billing and reconciliation of foreign subscribers and sends them to RIH.
4. RIH rates them based on the configured [roaming contracts](#) and forwards them to FOH.
5. FOH creates summary UDRs and sends them to Rate Load Handler (RLH).

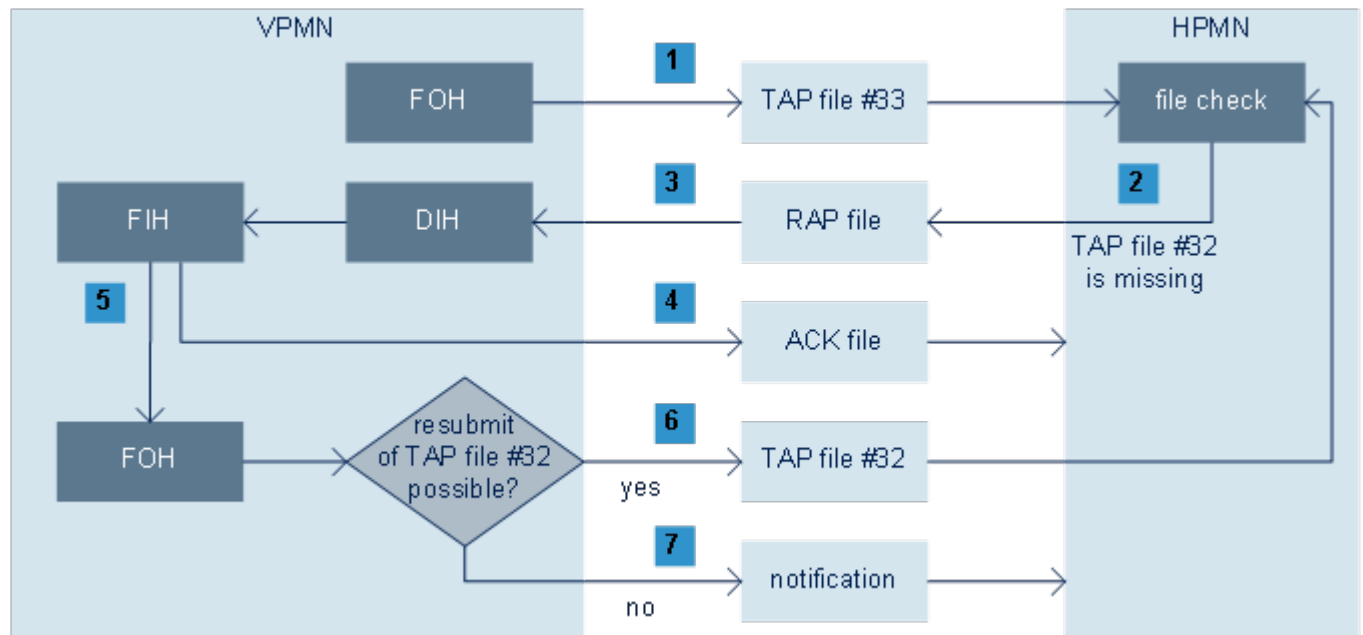
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6. RLH loads the UDRs in the UDR database for further processing by Billing Cycle Handler (BCH) and Bill Generation Handler (BGH), which are responsible for creating a business partner invoice. The business partner uses the TAP files created by FOH to bill the customer.

Incoming RAP Files

RAP files are produced as a result of errors in TAP files (including missing sequence numbers, fatal or severe errors), which could not be handled by the system. This section shows how BSCS handles incoming RAP files. The RAP files are the response of the HPMN to outgoing TAP files. For more information about the error types, refer to [TAP3 and RAP Files](#).

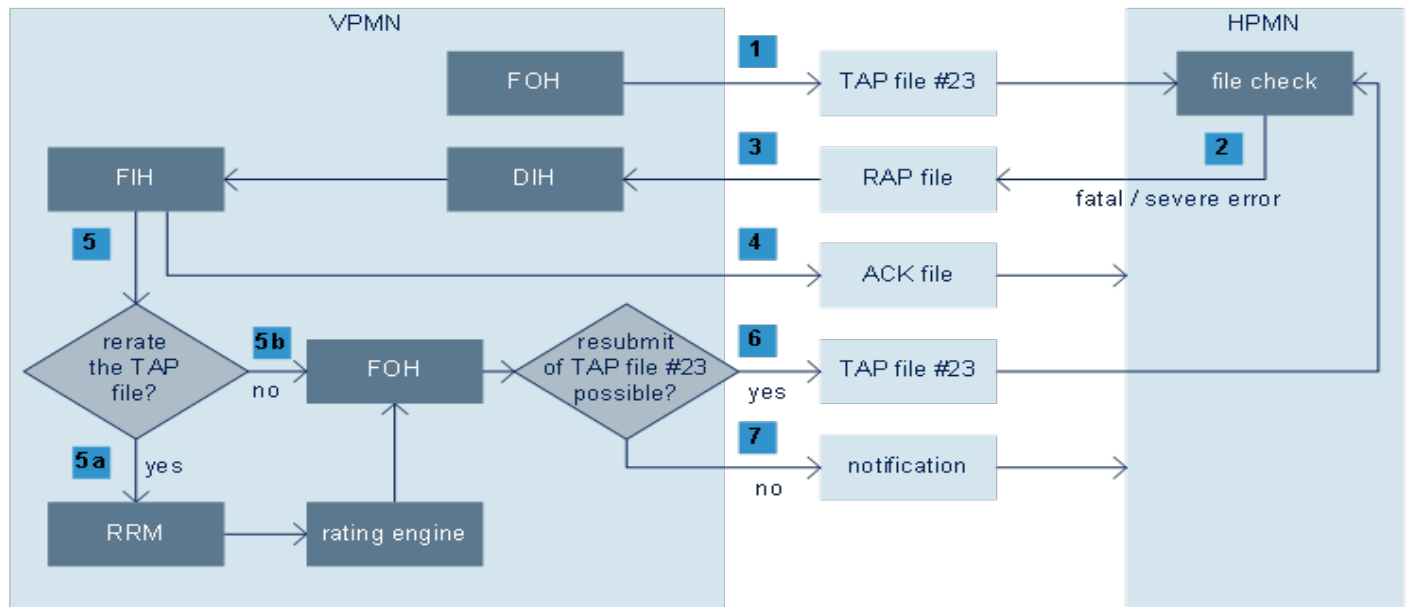
Missing Return Error **Situation:** The VPMN (BSCS operator) sends TAP file **No. 33** to the HPMN. The HPMN detects that the TAP file **No. 32** is missing and sends a RAP file back to the VPMN.



Incoming RAP file - missing return error, simplified

1. FOH sends TAP file **No. 33** to the HPMN and saves a copy in the RTX_TAP database.
2. HPMN checks the file and detects a gap in the numbering. It sends back a RAP file indicating the missing sequence number.
3. DIH indicates the RAP file and saves it to the input directory of FIH.
4. FIH sends an acknowledgement file to the HPMN which confirms that VPMN has received the RAP file.
5. FIH triggers FOH to resubmit the missing TAP file.
6. FOH searches for the sequence number in the RTX_TAP database and resubmits TAP file **No. 32**.
7. If the TAP file cannot be reprocessed, FOH sends a notification to the HPMN, which informs the HPMN that the TAP file cannot be reprocessed.

Severe or Fatal Error **Situation:** The VPMN (BSCS operator) sends a TAP file **No. 23** to the HPMN. The HPMN detects that the TAP file has severe or fatal errors and sends a RAP file back to the VPMN. RAP files with fatal or severe errors are handled the same way because in all cases the complete TAP file will be resent and not only single Call Event Details (CED).



Incoming RAP file - fatal or severe error, simplified

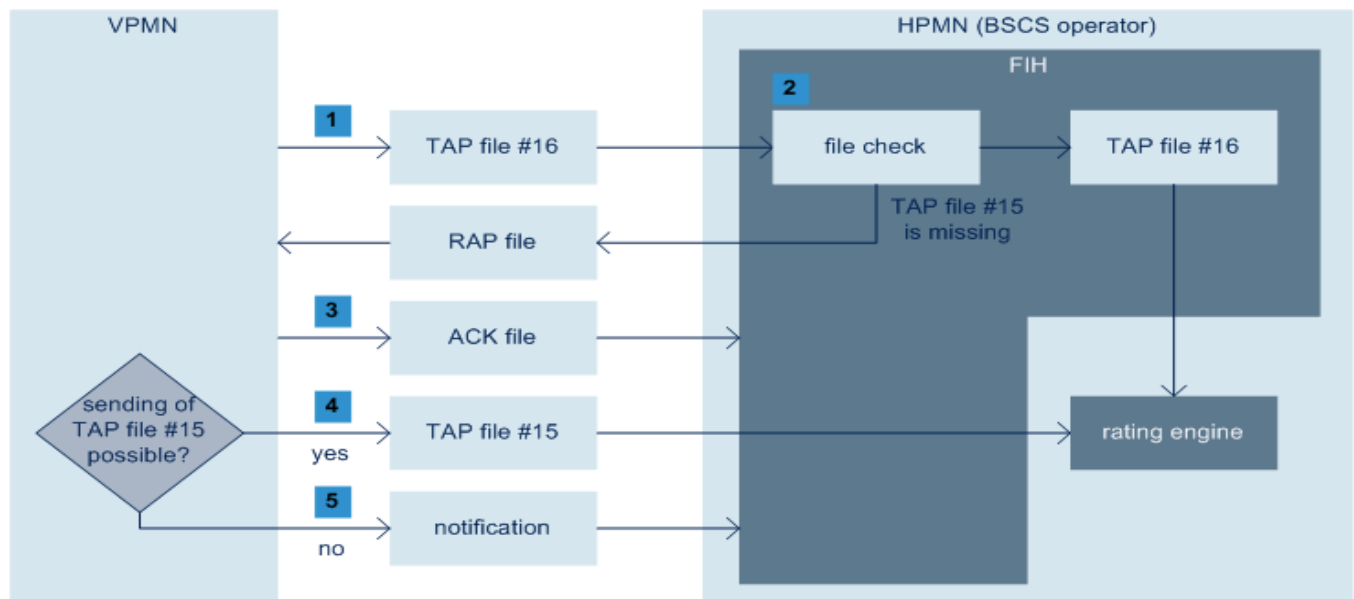
1. FOH sends TAP file **No. 23** to HPMN and saves a copy in the TAP_RTX database.
2. HPMN checks the file and detects a fatal or severe error. It sends back a RAP file indicating the fatal or severe error.
3. DIH indicates the RAP file and saves it to the input directory of FIH.
4. FIH sends an acknowledgement file to the HPMN to confirm that the VPMN has received the RAP file.
5. The VPMN finds out the reason for the error and decides what to do: rerate it or be reprocessed the TAP file via FOH.
 - o **5a:** If the VPMN decides rerate the UDR, FIH triggers RRM to delete the charge part and forward the UDR to the Rating chain. The Rating chain forwards the rated UDR to FOH.
 - o **5b:** If the VPMN decides not to rerate the UDR, FIH triggers FOH to resubmit the TAP file **No. 23**.
6. FOH searches the file **No. 23** in the RTX_TAP database and resends it to the HPMN.
7. FOH resubmits the TAP file **No. 23** or sends a notification to the HPMN that the TAP file **No. 23** cannot be reprocessed.

Outgoing RAP Files

RAP files are produced as a result of incorrect TAP files (including missing sequence numbers, fatal or severe errors), which could not be handled by the system. This section shows how BSCS creates RAP files if it detects missing sequence numbers, severe or fatal errors. For more information about the error types, refer to [TAP3 and RAP Files](#).

Missing Return Error

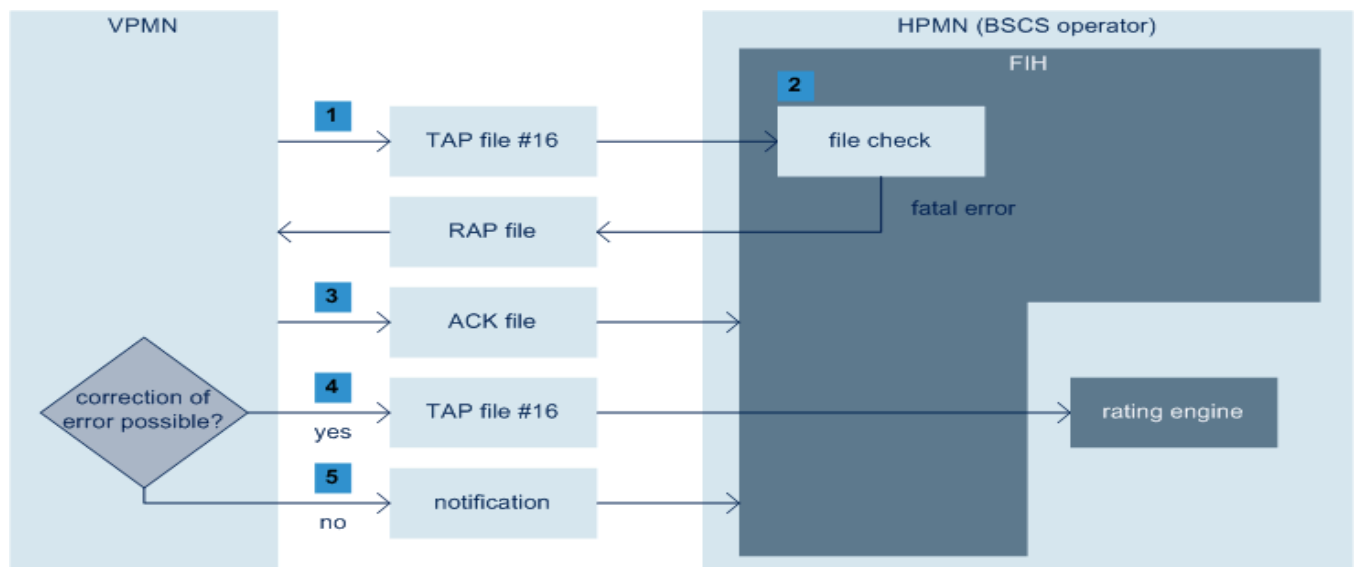
Situation: The HPMN receives TAP file **No. 16** from the roaming partner, but TAP file **No. 15** was never received.



Creation of RAP files due to missing return error

1. The VPMN sends TAP file **No. 16** to the HPMN.
2. FIH checks the TAP file and detects a gap in the numbering: File **No. 15** has not arrived yet. The HPMN therefore proceeds as follows: It produces a RAP file describing the error and forwards the records from file **No. 16** to normal rating.
3. The VPMN receives the RAP file and immediately produces an acknowledgement file (ACK).
4. If possible, the VPMN resubmits the TAP file **No. 15** to the HPMN, where it is processed by FIH and sent on to the Rating chain.
5. If file **No. 15** cannot be resubmitted, the VPMN sends a notification instead.

Fatal Error Situation: The HPMN receives TAP file **No. 16** from the roaming partner. It contains a fatal error, which makes it impossible to process any of the records.

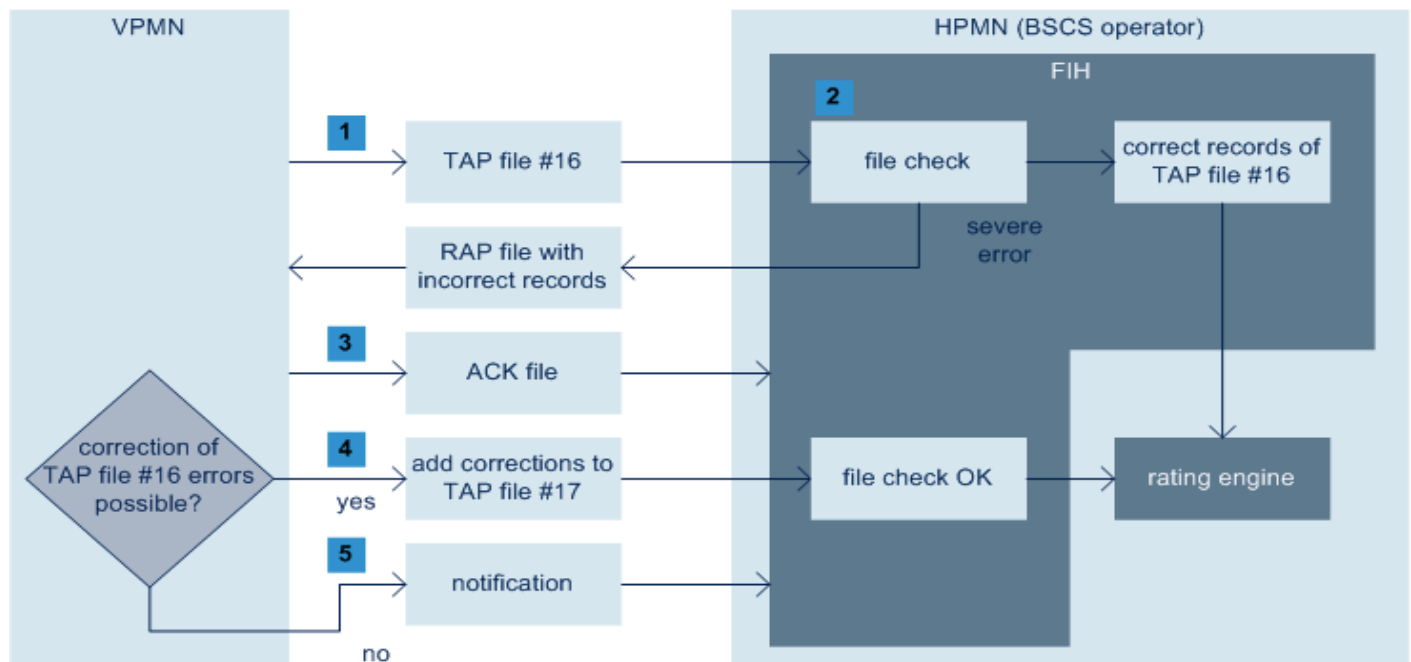


Creation of RAP files due to a fatal error

1. The VPMN sends TAP file **No. 16** to the HPMN.
2. FIH checks the file and detects an error in the header or trailer section. It may be related to a wrong format, missing tax or exchange data, or other errors. It therefore produces a RAP file and does not process the data any further.
3. When receiving the RAP file, the VPMN immediately produces an acknowledgement file (ACK).
4. If possible, the VPMN corrects the errors and resubmits the TAP file with the same sequence number. FIH passes the resubmitted file **No. 16** to the Rating chain.
5. If the file cannot be corrected, the VPMN sends a notification.

**Severe
Error**

Situation: The HPMN receives TAP file **No. 16** from the roaming partner. Header and trailer information is corrected, but some usage records cannot be processed.



Creation of RAP files due to a severe error

1. The VPMN sends TAP file **No. 16** to the HPMN.
2. FIH checks the file and an error in some usage records. It therefore produces a RAP file which contains the incorrect records and forwards them to the Rating chain.
3. When receiving the RAP file, the VPMN immediately produces an acknowledgement file (ACK).
4. If possible, the VPMN corrects the errors and adds the records to the next TAP file produced by the VPMN. If this new file, **No. 17** (or a higher sequence number), is correct, FIH proceeds with the normal processing of all records included in the new file.

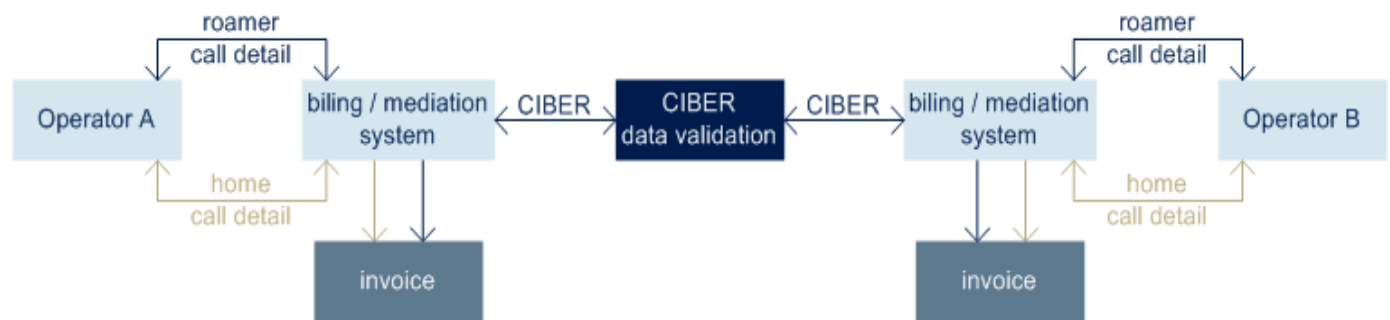
CIBER Records

The Cellular Intercarrier Billing Exchange Roamer record or CIBER record, engineered by Cibernet, represents a proprietary protocol and specification for the exchange of roaming billing information, for voice and data, among wireless telecommunication companies, their billing vendors, and data clearinghouses.

CIBER is the roaming record used by all carriers employing AMPS analog, CDMA and TDMA air-interfaces, regardless of frequency. CIBER contains the record types employed to bill for air and toll calls, additional features, surcharges, and other services. Also included in CIBER are the edit conditions, data dictionary and reject and return

processes. CIBER was created in the United States and originally intended for use by North American operators using AMPS technology. Since it only provides network services available in an AMPS (or AMPS-like) network, there is no direct support for GSM services like GPRS or HSCSD. The primary function of CIBER is the transfer of CDRs between roaming partners along with charging data.

For example, if a subscriber roams in a market, the serving carrier would generate CIBER records and submit those records to the home carrier for carrier-to-carrier settlement. The CIBER records are then processed by the home carrier billing vendor/system for end user billing:



The most important aspects of an operator's roaming operation are the timely and accurate exchange, settlement, billing, and collection of roaming related revenues. CIBER records address these industry requirement: they utilize standardized formats and procedures for the acceptance and/or rejection of roaming service details, including, for example, uniform record lengths and sequences and detailed field level specifications and definitions.

Using CIBER Records Each CIBER record provides the ability to convey a unique set of charges. For example, if just an air charge needs to be conveyed, a Type 10 record can be used. If an air and a toll charge is to be conveyed, then a Type 20 record is created.

Once the charges have been identified, the CIBER records that are generated are batched together on a System ID (SID) or Billing ID (BID) to SID/BID relationship. A batch must contain a header and trailer record and may contain zero, one or multiple charge records. For batches originating from a billing system, the Type 01 header and Type 98 trailer records are used. For batches originating from a clearinghouse used to return rejected records, the Type 02 header and Type 97 trailer records are used.

Record Description The CIBER record includes two header records, two trailer records, and ten charge records. The record types are as follows:

Record Type	Record Name
01	Batch Header Record
02	Batch Header Record for Clearinghouse Returns
10	Air Charge Record
11	Intersystem Network Charges Record
20	Air and Toll Charges Record
22	Air and Told Charges Record (to support Number Portability/Intertechnology Roaming)

30	Call Specific Charges Record
32	Call Specific Charges Record (to support Number Portability/Intertechnology Roaming)
42	Intersystem Network Charges Record (to support Number Portability/Intertechnology Roaming)
50	Billing OCC Charge Record
52	Billing OCC Charge Record (to support Number Portability/Intertechnology Roaming)
70	Selective Use Charge Record
97	Batch Trailer Record for Clearinghouse Returns
98	Batch Trailer Record

Key Identifiers and Fields

There are two sets of key identifiers used throughout the CIBER records. The first set is the carrier identifiers. Carriers are identified in the CIBER records by SIDs and BIDs. A variation of the "Home Carrier" SID/BID and "Serving Carrier" SID/BID can be found on each CIBER record.

The second set of identifiers is used to identify the end user. The end user is uniquely identified by the combination of the Mobile Identification Number (MIN) and the Electronic Serial Number (ESN). The MIN is also used to determine the Home Carrier's SID. The MIN and ESN can be found on all the CIBER records except the header and trailer records.

Because the CIBER records are used to convey usage information for the purpose of financial settlement, key fields in the CIBER record include charge fields. Common charge fields include airtime charges, toll charges, and taxes. Other key fields include the settlement period, used to determine whether the charges from a CIBER batch are to be included in one industry bill cycle or another, and the batch sequence number used for processing integrity.

- **System Identification Number (SID)**

The SID is a 15-bit binary number that translates into a five-digit decimal number. In all AMPS-based systems, the SID is used to notify wireless users as to whether they are in their home area or roaming. When operating, the mobile handset compares the SID initially programmed into the handset to the SID broadcast by the serving system's cell sites. If the SID broadcast by the cell site matches the SID programmed into the handset, then the "home" indicator on the mobile handset will be illuminated. If the SID broadcast by the cell site does not match the SID programmed into the mobile handset, then the "roam" indicator on the mobile handset will be illuminated. The intent of the "roam" indicator is to notify the wireless user that additional roaming-based charges may be applied for usage on the serving system.

Because each SID is unique to a particular operator, the SID is also used to properly route roaming call records for billing among roaming partners. It is possible, but not required, for a SID to be subdivided into one or more BIDs.

- **Billing Identification Number (BID)**

Similar to a SID, a BID is a five digit decimal number. A BID can exceed the 15-bit constraint because a serving carrier's cell sites do not broadcast BIDs. The intent of a BID is to either segment a carrier's subscriber base, or to further segment a geographic area defined by a SID. All BIDs are assigned and maintained by CIBERNET. Both, SIDS and BIDS, are used to group ranges of directory numbers together and to group regions of the coverage area.

- The **home** BID Identifies the home location for the mobile subscriber. The home BID is always identified according to the NPA/NXX range of the subscriber's Mobile Identity Number (MIN).

- The **serving** BID describes the physical location where the subscriber made the call. The serving BID is always identified according to the cell site that serviced the call.
Using BIDs: From a serving carrier's perspective, a BID can be used to identify a portion of a wireless service area. From a home carrier's perspective, the BID can be used to identify a particular customer segment or customers "homed" in a particular service area. This segment is achieved by associating a line range with a particular BID.

Refer to the following sections for details about CIBER record-related features:

- [Batch Segregation by SID/BID Pairs](#)
- [Batch Aggregation](#)
- [Automatic Sequence Recovery](#)
- [Generation of Type X0 vs. X2 Records](#)
- [Aging of Call Records](#)
- [Generation of Surcharges](#)
- [Negative File](#)
- [Generation of Transmission Report](#)
- [Reporting Outcollect Revenues](#)

For more details on CIBER records, refer to www.cibernet.com.

Batch Segregation by SID/BID Pairs

In the case of original submission of a CIBER batch, the Home SID/BID is used to route the batch to its proper recipient. Likewise, the serving SID/BIDs are used to direct reject batches to their originators. This routing of batches is typically performed by clearinghouses as a function of the service they provide to network operators. Because clearinghouses route at the batch level and not the individual call record, it is necessary to ensure that outcollect batches consist of call records from a single SID/BID pair only, and not a mix of SID/BIDs for a particular pair of networks.

SID/BID Pairs for CIBER The creation and routing of outcollect file batches for the CIBER format is directed by the use of SIDs and BIDs, and particularly SID/BID pairs. A CIBER file consists of one or more CIBER batches. Each batch consists of one header record, zero or more call detail records, and one trailer record. The network operators must populate both the Home and Serving SID/BID on each outcollect call record. The Home SID/BID and the Serving SID/BID constitute a SID/BID pair. Each batch may contain outcollect records for only one SID/BID pair. Since clearinghouses route call records at the batch level, it is essential that outcollect batches be properly structured. Any PLMN can contain many SID/BIDS.

Multiple output CIBER batches are created simultaneously during the processing of one input UDR file. The input UDR file may still be processed in a single pass, since the number of SID/BIDs within a given PLMN can be large enough that a multi-pass method would result in prohibitive amounts of additional processing time. This also means that a large number of output files, that can exceed the number of open files the operating system allows for a single process can be needed while processing a UDR file. To avoid this, the least recently used output file, is closed. A new file is then opened and a header (type 01) record followed by the detail record is written to it. These files are placed in the {WORK}/MP/IR/OUT/{VPLMN} directory and named CIBER{Serving SID/BID}{Home SID/BID}{Sequence Number}.

Batch Aggregation

The transmission of CIBER batches is typically done using files that consist of a number of batches for different SID/BID pairs. These files are then transmitted electronically (with FTP or some reliable variant such as DirectConnect) between the network operators and clearinghouses. This aggregation of batches is necessary because of the large number of individual batches that maybe be required at each interval in which a network operator submits initial issues to its clearinghouse, combined with the fact that tracking and account is most easily (and most often) performed at the file level.

To accommodate this practice, FOH accepts an alternate command-line argument, **-G <CODE>**, that specifies a group code, which links associate roaming partners with one another (for more information on this option, refer to 'Starting via Command Line' in the [Starting and Stopping](#) section of the FOH documentation). When supplied to FOH, this group code causes FOH to scan through all of the default level roaming agreements looking for the code. Each agreement found is processed during that run of FOH. Once all agreements have been processed, the individual batch output files will be combined together into a single file for delivery. This composite file is placed in the {WORK}/MP/IR/OUT directory and is named CIBER{CODE}{TIMESTAMP}.

When the VPMN is named using the command-line argument **-D VPLMN**, FOH still processes only the one VPMN outcollects. The individual batches created then are combined into a single file located in the {WORK}/MP/IR/OUT/VPLMN directory. The individual output files are named CIBER{VPLMN}{TIMESTAMP}.

Automatic Sequence Recovery

For a given SID/BID pair and direction, there exists a sequence that is used to number each batch transmitted between the two SID/BIDs. When a batch-level reject occurs for a previously submitted batch, the sequence number of that batch is considered free or unused and must be assigned to a subsequent batch. Two tables are used:

- CIBER_BATCH_SEQUENCE which stores the last used sequence for a SID/BID pair and direction, and
- CIBER_BATCH_SEQ_REJECT_VALUE which File Input Handler (FIH) populates with sequences from reject batches (except for batches rejected for duplicate sequence number).

This allows FOH to automatically recover the correct sequence number when generating outcollects. To determine the correct sequence number to assign to an outcollect, FOH first looks in the CIBER_BATCH_SEQUENCE table to get the last sequence number used for a given SID/BID pair. If none is found, it is assume to be the first outcollect for the SID/BID pair and 1 is used as the next sequence number. Otherwise, FOH next looks in the CIBER_BATCH_SEQ_REJECT_VALUE table for any rejected sequences for the SID/BID pair. If a contiguous block of rejected sequences is found that includes the last generated sequence (as found in the CIBER_BATCH_SEQUENCE table), the next sequence number used is the first sequence number of the block.

Otherwise, the next sequence number used is one more than the number obtained from CIBER_BATCH_SEQUENCE, adjusted to 1 if the number is greater than 999.

Additionally, if any sequence numbers are found in the CIBER_BATCH_SEQ_REJECT_VALUE table that are not within the contiguous block of numbers described above, an empty batch is created to recover the sequence number(s).

Lastly, database cleanup is performed on CIBER_BATCH_SEQUENCE and CIBER_BATCH_SEQ_REJECT_VALUE. The sequence number for the SID/BID pair is updated to that used by the current outcollect batch in the CIBER_BATCH_SEQUENCE table. All of the entries in the CIBER_BATCH_SEQ_REJECT_VALUE table are deleted, as the sequences should be up-to-date.

Generation of Type X0 versus X2 Records

CIBER Record release 2 currently supports two distinct sets of detail records, the older X0 records such as 10, 20, 30, etc. and the newer X2 records type 22, 32, 52. The X2 type records were introduced to support FCC mandated number portability and industry changes in the North American markets. Network operators must be able to accept both, the older X0 records as well as the X2 records, in order to be compliant with the CIBER Record. However, network operators generate either set as outcollects and remain compliant.

Aging of Call Records

Industry practices require that CIBER records be delivered to their destination within thirty days of when the call was placed or earlier if the thirty-day period ends on a weekend or holiday. The time allowed to deliver CIBER records can also be modified bilaterally by the roaming agreement and exceptions setup to handle problem situations that arise. By default, FOH does not exclude any input UDR records from the output CIBER batches, so every record that can

be sent is also sent. However, to enable the exclusion of CIBER records due to age from the output batches the **-A <DAYS>** command-line argument specifies the age in days of the oldest call records to be allowed through (for more information on this option, refer to 'Starting via Command Line' in the [Starting and Stopping](#) section of the FOH documentation). The age of each record is checked against <DAYS>. Records that are older than <DAYS> are rejected in the normal FOH manner and placed into the {WORK}/MP/ERROR directory in a file named FOH{TIMESTAMP}{PID}.RTX.

Generation of Surcharges

It has been common practice for network operators using CIBER to generate daily surcharges for subscribers that roam in their networks. While this practice is fading, it is still done by enough network operators to warrant implementation of support. The CIBER type 50/52 records are utilized to pass these surcharges between network operators.

FOH knows from the roaming agreement, whether a daily surcharge should be levied for a particular Serving SID/BID. To determine whether a specific subscriber should be charged, the LOGGED_CIBER_SURCHARGE table is kept of call records processed for affected SID/BIDs. This table contains the Serving SID/BID, MIN, and call date of call records processed. Each time a new record is processed, an attempt is made to insert a row for the record into the table. If the insert succeeds then the record represents the first call placed by a particular subscriber and a daily surcharge should be applied, in which case new type 50/52 records are produced.

One additional detail to this process is that daily surcharges are applied at either the BID or SID level. The roaming agreement indicates whether the particular daily surcharge is a BID level or SID level surcharge. When at the SID level, FOH only determines, whether the call was placed in a serving SID or BID. In the case of a Serving BID, it then looks up the parent SID of the BID and uses it when inserting into the daily surcharge-tracking table.

Negative File

To be CIBER-compliant, a network operator does not produce outcollects for mobile phones that have been placed in the negative file, which is an industry-level black-list of mobile phones that should be considered inactive, fraudulent, or otherwise unusable. A local copy of the negative file is maintained in the database and this information is downloaded into the NFDEFTAB XREF file. File Output Handler (FOH) loads this XREF during its initialization phase. Each UDR input record is looked for in the NFDEFTAB table by both ESN and MIN. Any record that is found is rejected in the normal FOH manner and placed into the {WORK}/MP/ERROR directory in a file named FOH{TIMESTAMP}{PID}.RTX.

Generation of Transmission Report

One of the accepted practices with CIBER is transmitting a report with each outcollect file to the clearinghouse that details the contents of the file. While this practice is only a suggestion in the CIBER record it is nonetheless a requirement of most clearinghouses. To support this, FOH creates a report file with each outcollect CIBER file that it produces. This transmission report file takes the form as show below.

```
Transmission report for CIBER file: <CIBER filename>
Date: <current date>
Batches: <Number of batches>
Serving SID/BID Home SID/BID Seq.# Records Value
-----
<BID> <BID> ### ##### $$$$$$$$$$.-
<BID> <BID> ### ##### $$$$$$$$$$.-
<BID> <BID> ### ##### $$$$$$$$$$.-
```

The information needed to populate the transmission report is obtained from the batch structure list that is maintained for each batch created during an FOH run. This batch structure list is also used to populate trailer records and database summaries. Transmission reports are placed into the same directory as their corresponding outcollect files and name similarly with an additionally extension of **RPT** appended.

Reporting Outcollect Revenues

File Output Handler (FOH) records summary information for each outcollect it produces to allow BCH to create invoices for roaming partners. FOH populates the following tables with the revenue information:

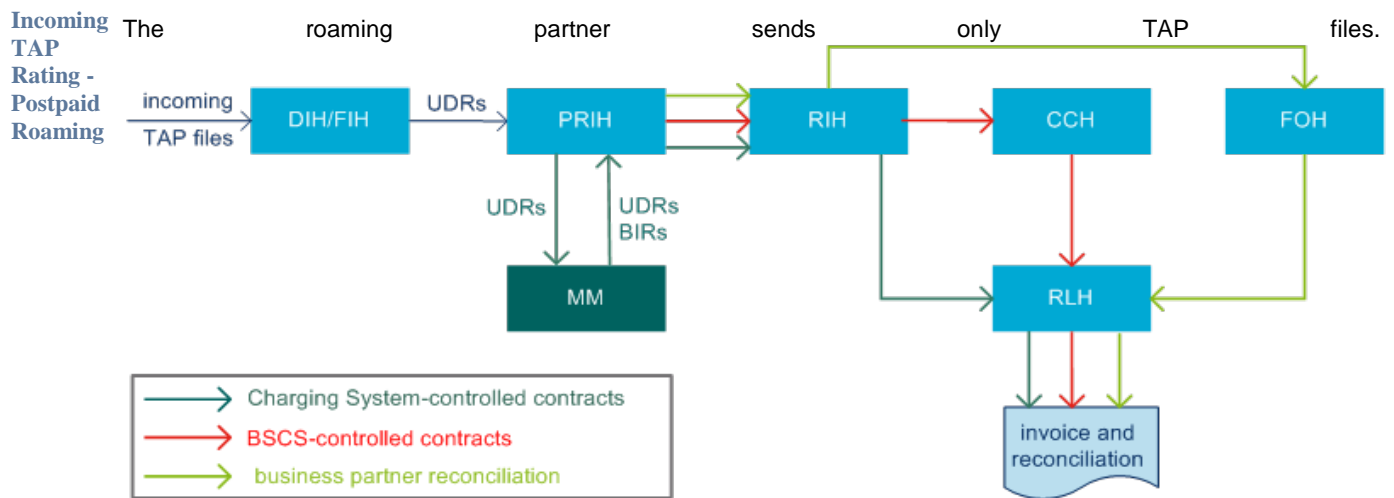
Table Name	Contents
CIBER_BATCH	name of the file containing the batch file create date VPMN code home and serving BID/SID pair batch sequence number file status number of records in the batch currency used total charges of batch in home currency total taxes of batch in home currency total charges of batch in batch currency total taxes of batch in batch currency

Roaming and Interconnect Scenarios

This section describes the workflow that is used when rating tasks for roaming subscribers are distributed:

- The Charging System charging engine is responsible for the following tasks:
 - rating of the roaming traffic of home subscribers (TAP-IN) with a Charging System-controlled contract.
- The BSCS charging engine is responsible for the following tasks:
 - rating of the roaming traffic of home subscribers (TAP-IN) with a BSCS-controlled contract
 - reconciliation for business partners in whose networks home subscribers (for Charging System- **and** BSCS-controlled contracts) roamed (TAP-IN)
 - rating of foreign (roaming) subscribers (TAP-OUT) if BSCS is configured as charging engine for roaming subscribers.

Both charging engines maintain the data of subscribers. Customer and contract maintenance as well as billing and general ledger accounting is performed by Customer Management and Billing.



1. Device Input Handler (DIH) receives the TAP files and forwards them to File Input Handler (FIH).
2. FIH receives the TAP files and converts them to UDRs ([TAP3/RAP Converter](#)).
3. FIH routes the UDR to PRIH.
4. PreRate Input Handler (PRIH) prepares the UDRs for reconciliation of roaming home subscribers (incoming TAP records (TAP-IN)).

UDRs for Charging System-controlled contracts are sent to Multi Mediation (MM). UDRs for BSCS-controlled contracts are routed to Rate Input Handler (RIH).

For more information refer to [Processing of Charging System-Controlled Contracts](#) in the PRIH documentation.

5. RIH rates the UDRs for BSCS-controlled contracts.

The UDR is sent to the cost control and billing applications afterwards.

For more information refer to [Processing of Charging System-Controlled Contracts](#) in the RIH documentation.

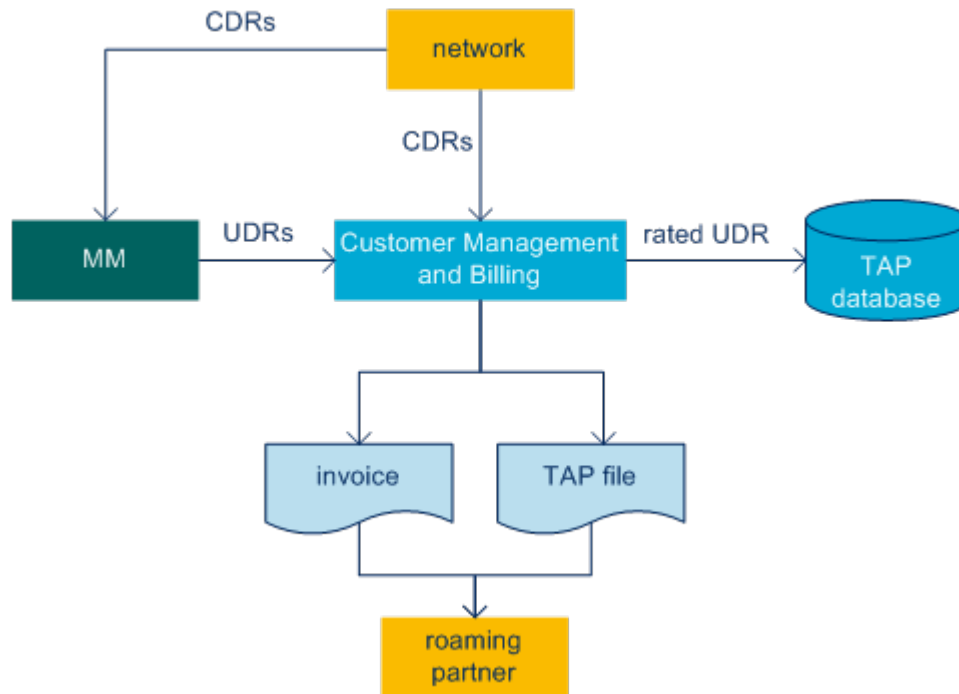
6. MM creates updated BIRs if accounts are impacted and UDRs which now contain information about the roaming partner and their charges and taxes. These files are sent to PRIH and processed by the Customer Management and Billing applications.

Incoming TAP Rating - Prepaid Roaming

For incoming TAP - prepaid roaming, rating is performed only if the usage charges have not been calculated yet. The `CAMEL_SERVICE_KEY` indicates whether or not a record has been rated already. If the record has not been rated yet, rating is performed by Online Charging. Online Charging receives real-time usage records directly from the network and performs the subscriber rating before the corresponding TAP files are provided by the roaming partner, as described [above](#). Business partner reconciliation has to be performed in any case regardless of whether or not a record has been rated.

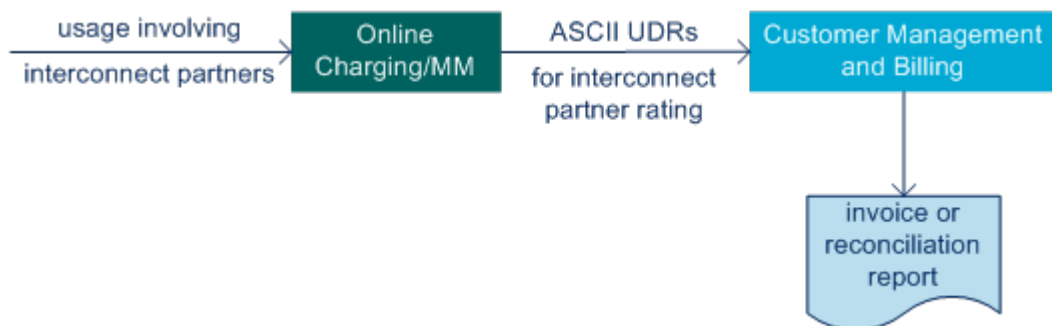
Outgoing TAP Rating

Subscribers of a roaming partner are roaming in the home network. It has to be determined by configuration if BSCS or Charging System perform charging in this case. For more information on using either BSCS or Charging System as charging engine refer to [Charging Scenarios](#).



1. If Online Charging receives usage records created for roaming subscribers, MM provides the usage data to PRIH in UDRs.
2. PRIH prepares UDRs for rating of foreign subscribers (TAP-OUT).
For more information refer to [Processing of Charging System-Controlled Contracts](#) in the PRIH documentation.
3. RIH rates them based on the configured [roaming contracts](#).
For more information refer to [Processing of Charging System-Controlled Contracts](#) in the RIH documentation.
4. File Output Handler (FOH) performs a [credit limit check](#) and creates outgoing TAP files that are sent to the business partner.
The TAP files are stored in the database in case they are rejected by the roaming partner and have to be reprocessed.
5. BCH bills them based on the roaming contract including the application of promotions if configured for the business partner.

Interconnect Rating The interconnect parts of calls and events are not rated by Online Charging. Online Charging only identifies if a call or event involves interconnect partners.



1. MM sends a copy of the relevant records as ASCII UDRs to FIH.
2. FIH converts the files to UDRs and forwards them to PRIH.
3. PRIH enhances the UDRs with the impacted parties and forwards it to RIH.

4. RIH rates the records.

For more information refer to the [Processing Logic](#) in the RIH documentation.

5. RLH aggregates the UDRs to summary UDRs.
6. BCH creates and provides the invoice and reconciliation information for the interconnect partners.