

MDM/R CIS Interfaces Workshop

- SDP Creation and Synchronization
- Billing Quantity Delivery

Holiday Inn Oakville @ Bronte
2525 Wycroft Road, Oakville
October 20, 2010



Purpose

- § The Master Data Synchronization and Billing Quantity interfaces generally involve interaction between a LDC's Customer Information System (CIS) and the MDM/R

- § The purpose of this session is to provide:
 - A technical overview of the MDM/R operations supporting SDP creation and synchronization of SDP attributes between the LDC's CIS and the MDM/R Master Directory (MMD)
 - A technical overview of the MDM/R operations supporting Billing Quantity delivery from the MDM/R to the LDC's CIS

Objectives

- § After this session, you will be able to:
- Describe the use of the File Transfer Services (FTS) in supporting the Universal SDP ID Request/Response process, Synchronization processes, and the Billing Quantity delivery processes
 - Describe an SDP, its identifiers, and the process and reporting involved in obtaining a Universal SDP ID from the MDM/R
 - Describe master data and the Incremental Synchronization and Periodic Audit Synchronization processes and related reports used to ensure that master data in the LDC's systems and the MDM/R are “in sync”
 - Describe Billing Quantity data and the billing services and reporting involved in requesting and delivering Billing Quantity data from the MDM/R

Agenda

§ FTS Specifics

- Data Files and Reports related to MDM/R to CIS interfaces

§ Universal SDP ID Assignment Request/Response

- SDP and its Identifiers
- Universal SDP ID Assignment Request/Response file types and related reporting

§ Synchronization

- Master data
- Incremental and Periodic Audit Synchronization and related reporting

§ Delivery of Billing Quantities

- Billing Quantity data
- ‘Push’ and ‘Pull’ billing services
- Billing Quantity Request, Response and Reporting

FTS Specifics

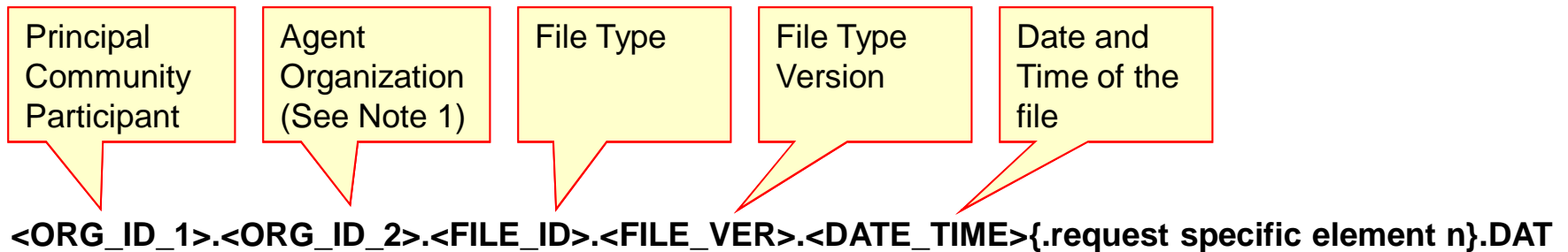
- MDM/R to CIS Interfaces



File Transfer Services

File Name Elements - Data Files

§ All data files sent to and from the MDM/R follow a specific file name structure:



Three specific file name elements apply to:

Periodic Audit Synchronization – File Type: 3000, Version: 01

Incremental Synchronization – File Type: 4000, Version: 00

You must include the file name elements <TX_ID>.<FILE_NO>.<SEGMENT_NO> in all files used for synchronization for the following purposes:

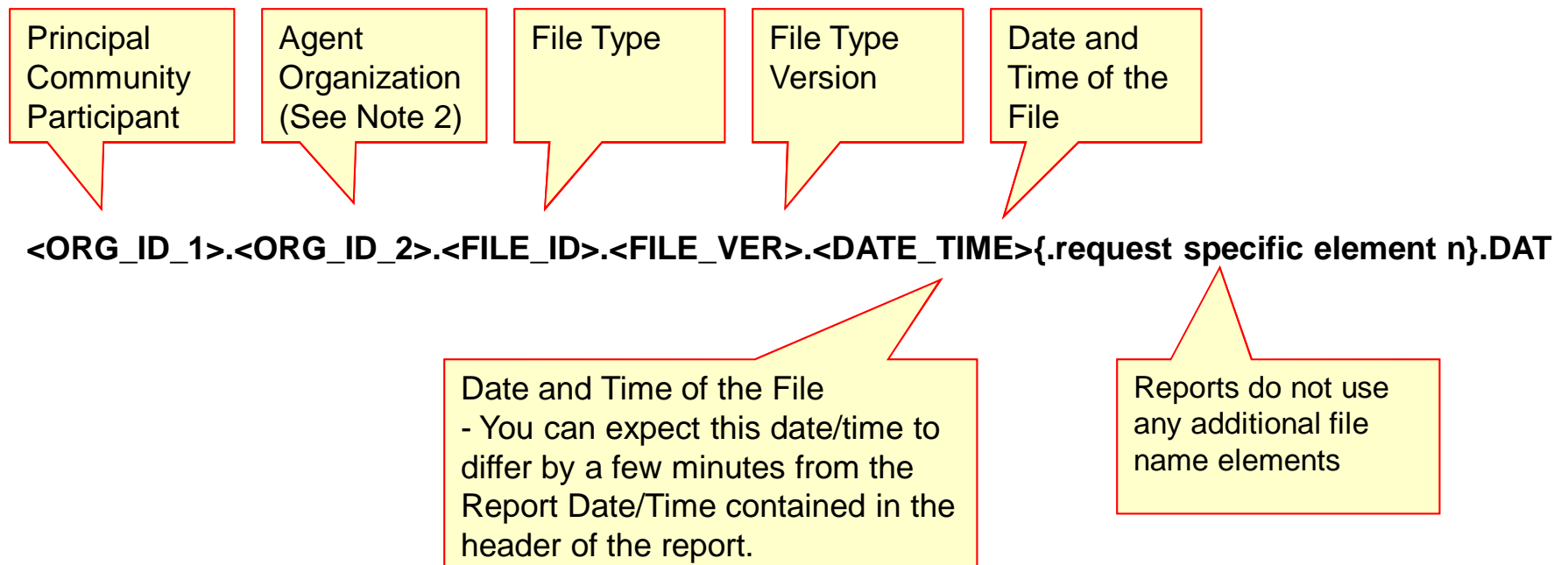
- **TX_ID**: Transaction Identifier - this number is required to group each synchronization file set together. You define the number value for your reference.
- **FILE_NO**: File Number - this number identifies each of the specific files that make up a synchronization file set. The numbers you must use are defined in the *“MDM/R Technical Interface Specifications”*.
- **SEGMENT_NO**: Segment Number - this number is used to allow you to break down large files into smaller files. If you send a file as a single segment you would use the value “01”.

Note 1: Use SME_FORM_0006 to authorized your agent(s) to submit/receive data files by type.

File Transfer Services

File Name Elements - Reports

§ All report files sent from the MDM/R follow a specific file name structure:



Note 2: Use SME_FORM_0006 to authorized your agent(s) to receive report files by type.

File Transfer Services

Universal SDP ID - Data Files and Reports (1 of 2)



Universal SDP ID Request/Response

§ Data Files

FILE_ID: 1000 - Universal SDP ID Assignment Request

Example file name: ORG11111.ORG22222.**1000**.00.200906082210.DAT

FILE_ID: 2000 - Universal SDP ID Assignment Response

Example file name: ORG11111.ORG22222.**2000.01**.200906082220.DAT

Note - With the deployment of *EnergyIP* Release 7.0, Version 00 of the response will be retired and replaced by Version 01 providing a file integrity enhancement using an End Of File record.

§ Reports

FILE_ID: IR01 - Universal SDP ID Assignment Request Summary Exception Report

Example file name: ORG11111.ORG22222.**IR01**.00.200906082222.DAT

File Transfer Services



Universal SDP ID - Data Files and Reports (2 of 2)

Universal SDP ID Request/Response

- § If you are the organization submitting a Universal SDP Assignment Request File Type 1000, you - as the submitting organization - will receive both the Response File Type 2000 and Report IR01 for each request file submitted.
- For example,
 - ORG22222 submits Request File Type 1000 on behalf of ORG11111 and receives Response File Type 2000 and Report File Type IR01.
 - ORG11111 does not receive either the response file or summary report IR01.
- § If you as the LDC authorize an agent to submit Universal SDP ID Assignment Request files, you must also authorize the MDM/R to transmit Report IR01 to your agent.

File Transfer Services

Synchronization - Data Files and Reports (1 of 3)



§ Synchronization Data is submitted as a **File Set**

FILE_ID: 3000 - Periodic Audit Synchronization Version 01

Example file set - each file comprised in a single segment

–Manifest:	ORG11111.ORG22222.3000. 01 .2009005181015.abcdef. 00 .01.DAT
–Asset Data:	ORG11111.ORG22222.3000. 01 .2009005181015.abcdef. 01 .01.DAT
–Premise Data:	ORG11111.ORG22222.3000. 01 .2009005181015.abcdef. 02 .01.DAT
–Service Agreement:	ORG11111.ORG22222.3000. 01 .2009005181015.abcdef. 03 .01.DAT
–Parameter Data:	ORG11111.ORG22222.3000. 01 .2009005181015.abcdef. 04 .01.DAT
–Relationship Data:	ORG11111.ORG22222.3000. 01 .2009005181015.abcdef. 05 .01.DAT
–Component Data:	ORG11111.ORG22222.3000. 01 .2009005181015.abcdef. 07 .01.DAT

Note - Periodic Audit Synchronization Version 01 is the currently active interface.

FILE_ID: 4000 - Incremental Synchronization Version 00

- You must submit files 00, 01, 02, 03, 04, 05 consisting of the File Name Record and File Header Record. File Detail Records are required for changes, i.e. if there is no change, detail records need not be transmitted.

File Transfer Services

Synchronization - Data Files and Reports (2 of 3)



§ Synchronization Reports

FILE_ID: IR10 - Incomplete Synchronization File Set

Example file name: ORG11111.ORG22222.**IR10**.00.200906081342.DAT

FILE_ID: IR14 - Synchronization Staging Table Loader Exception Report

Example file name: ORG11111.ORG22222.**IR14**.00.200906080954.DAT

FILE_ID: IR06 - Synchronization Updates Report

Example file name: ORG11111.ORG22222.**IR06.02**.200906081129.DAT

FILE_ID: IR07 - Synchronization Exception Report

Example file name: ORG11111.ORG22222.**IR07.02**.200906081129.DAT

Note: With the deployment of EnergyIP Release 7.0, Version 01 of Reports IR06 and IR07 will be replaced by a Version 02 providing a file integrity enhancement using an End Of File record.

File Transfer Services

Synchronization - Data Files and Reports (3 of 3)



- § All synchronization reports are event based - this means that each report is triggered by the completion of processing each Synchronization File Set.
- § If you are the organization submitting the Synchronization File Set, only your organization will receive Reports IR10 and IR14.
- § The LDC receives both Report IR06 and Report IR07 for each Synchronization File Set for which synchronization is completed (successfully or unsuccessfully).
- § If you authorize an agent to submit synchronization files, you must also authorize the MDM/R to transmit Reports IR06 and IR07 to your agent.

File Transfer Services

Billing Services - Data Files and Reports (1 of 4)

Scheduled Billing Service - “PUSH” Billing Quantities

§ Data File:

FILE_ID: 8000 - Billing Cycle Schedule

Example file name:

ORG11111.ORG22222.**8000**.00.20070214221345.DAT

Request-Response Billing Service - “PULL” Billing Quantities

§ Data File:

FILE_ID: 5000 - Billing Quantity Request

Example file name:

ORG11111.ORG22222.**5000**.00.20070214221345.DAT

File Transfer Services

Billing Services - Data Files and Reports (2 of 4)



Billing Quantity response files for either “PUSH” or “PULL” are the same

§ Data Files:

FILE_ID: 6000 - Billing Quantity Response - TOU/CPP or Periodic Energy

Example file name:

ORG11111.ORG22222.**6000.01**.20070214221345.DAT

FILE_ID: 6100 - Billing Quantity Response - Hourly Energy

Example file name:

ORG11111.ORG22222.**6100.01**.20070214221345.DAT

FILE_ID: 6200 - Billing Quantity Response - Demand

Example file name:

ORG11111.ORG22222.**6200.01**.20070214221345.DAT

Note - With the deployment of *EnergyIP* Release 7.0, Version 00 of the response will be retired and replaced by Version 01 providing a file integrity enhancement using an End Of File record.

File Transfer Services

Billing Services - Data Files and Reports (3 of 4)



§ Reports - Billing Cycle Schedule interface exceptions

FILE_ID: IR03 - Billing Cycle Schedule Exception Report

Example file name: ORG11111.ORG22222.**IR03**.00.200906081342.DAT

§ Reports - Billing Quantity Request interface exceptions

FILE_ID: IR08 - Billing Request Detailed Exception Report

Example file name: ORG11111.ORG22222.**IR08**.00.200906080954

- § Reports IR03 and IR08 are event based - this means that each report is triggered by the completion of processing of the submitted Billing Cycle Schedule file or Billing Quantity Request file.
- § If you are the organization submitting the Billing Cycle Schedule file only your organization will receive Report IR03.
- § The LDC receives Report IR08 for each Billing Quantity Request file submitted.
- § If you as the LDC authorize an agent to submit Billing Quantity request files, you must also authorize the MDM/R to transmit Report IR08 to your agent.

File Transfer Services

Billing Services - Data Files and Reports (4 of 4)

§ Reports - Billing Quantity Process

FILE_ID: BR01 - Billing Delivery Summary Report

Example file name: ORG12345.ORG12345.**BR01.01**.20071106160430.DAT

FILE_ID: BR04 - Billing Delivery Detail Report

Example file name: ORG36912.ORG36912.**BR04.00**.20070912234513.DAT

FILE_ID: BR05 - Billing Validation Sum Check Failure Report

Example file name: ORG21135.ORG21235.**BR05.00**.20100813151429.DAT

FILE_ID: BR06 - Billing No Reads Report

Example file name: ORG24689.ORG46892.**BR06.00**.20070912213011.DAT

FILE_ID: BR03 - Re-Billing Report

Example file name: ORG21135.ORG21235.**BR03.01**.20080213151429.DAT

- § Billing quantity process reports are scheduled for delivery as specified under 'Timing and Delivery' in the *"MDM/R Reports Technical Specifications"*.
- § The LDC receives all billing quantity process reports.
- § If your agent supports your billing process, you must also authorize the MDM/R to transmit those billing quantity process reports that you expect are required to support your agent's activities.

Universal SDP ID Assignment Request/Response



Service Delivery Point (SDP) Defined



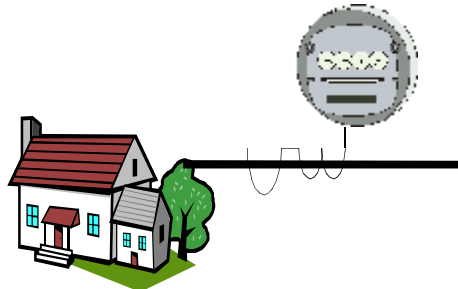
§ A **Service Delivery Point (SDP)** is:

- The point at which energy is deemed to be delivered to the customer.
 - Physical SDPs are metered.
 - Virtual SDPs allow two or more physical SDPs to be aggregated.
- The point at which billing occurs based on input from one or more smart meters.
- The common database element in the MDM/R Master Directory to which attributes, relationships and services are associated using the synchronization processes.

Service Delivery Point (SDP)

LDC and MDM/R Identifiers

Service Delivery Point



LDC

SDP ID

Represents the SDP in the LDC's systems

Using synchronization, you tell the MDMR:

- The SDP's characteristics
- How to process the SDP's meter data
- How to prepare and deliver billing quantity data for the SDP

MDMR

Universal SDP ID

Represents the SDP in the MDM/R

Service Delivery Point (SDP)

LDC and MDM/R Identifiers



§ LDC assigns an SDP ID to each SDP

- The SDP ID identifies the SDP within your systems.
- The SDP ID must be unique to each SDP within the LDC's systems.
- SDP IDs are required for both physical and virtual SDPs.

§ The LDC requests assignment of a Universal SDP ID within the MDM/R for that same SDP

- The Universal SDP ID is a unique-within-Ontario randomly generated number that remains associated with a given LDC and SDP ID.
- A Universal SDP ID is required for each SDP ID in the MDM/R.
- The Universal SDP ID is a key identifier used by the MDM/R synchronization processes.

Universal SDP ID Assignment

Understanding the process



- § LDCs must submit requests for Universal SDP IDs
 - The request file is a list of SDP IDs that require assignment of Universal SDP IDs.

- § LDCs will receive a response file that provides a list of their SDP IDs and the Universal SDP IDs that were assigned and a status of each assignment transaction indicating any exceptions.

- § The successful assignment of a Universal SDP ID does not create an SDP in the MDM/R Master Directory.
 - You must use the synchronization process to create the SDP asset and to assign the necessary attributes to each SDP within the MDM/R Master Directory (MMD).

Universal SDP ID Assignment

Universal SDP ID Assignment Interface



§ The Universal SDP Assignment interface is a Request-Response process involving two FTS file types:

- Universal SDP ID Assignment Request, FILE_ID: 1000
- Universal SDP ID Assignment Response, FILE_ID: 2000

§ The Request File simply:

- Associates the LDC's unique MDM/R Organization Identifier (as assigned to the LDC during the registration process) with the unique identifier assigned by the LDC to each SDP (i.e. the SDP ID).

§ The Response File:

- Assigns a Universal SDP ID to each LDC-unique SDP ID.
- Provides a detailed report of the assignment transaction status and any exceptions encountered during the request-response process.

Universal SDP ID Assignment

Who can submit a request?

- § Either the LDC or its authorized agent can submit a Universal SDP ID assignment request.
 - Submitting organization must be registered with the MDM/R.
 - If an agent, the LDC must authorize configuration of the MDM/R to accept FTS file type 1000: Universal SDP ID Assignment Request on behalf of the LDC.

- § Only the organization submitting a FTS file type 1000: Universal SDP ID Assignment Request will receive the corresponding FTS file type 2000: Universal SDP ID Assignment Response.
 - Detailed exceptions are reported as an integral part of the Universal SDP ID Assignment Response.

Universal SDP ID Assignment Reporting



§ Universal SDP ID Assignment Request Summary Exception Report (IR01):

- Event based - triggered by the completion of processing of the submitted Universal SDP ID Assignment Request file
- Received by the LDC for each request file submitted.
 - The Universal SDP Assignment process runs every 15 minutes, thus multiple requests processed within each 15 minute period you will receive one report containing a summary record for each request file processed.
 - When multiple reports are produced in the same calendar day, each subsequent report that you receive will include all summary records from earlier reports.
- Provides summary information for each request file processed including:
 - Number of requested IDs
 - Number of issued IDs
 - Number of already issued IDs
 - Number of exceptions created by an invalid LDC ORG ID
 - Number of exceptions created by incomplete data

Universal SDP ID Assignment

Some things to think about - for example...



- § Prior to go live, you may want to request Universal SDP IDs for your entire population of SDPs.
 - Since the Universal SDP ID is the key integration point for synchronization with the MDM/R, you cannot provide synchronization data for an SDP without one.
 - Some LDCs have used this approach to migrate the Universal SDP ID to their AMI systems.

- § Prior to transmission of Meter Read data, SDPs must be synchronized to reduce the exceptions reported by the MDM/R data collection processes that will result for all SDPs that have not been synchronized.

- § After go live, you may only want to request a Universal SDP ID when you create a new SDP in your CIS and are ready to communicate with the MDM/R.

Synchronization



Synchronization

Master Data - What is it?

- § Master data is generally described as the attributes for each SDP, Meter, and Communication Module within the MDM/R.
- § The submission of master data in the form of synchronization file sets is used by the MDM/R to:
 - Create new SDP, Meter, or Communication Module assets
 - Update the attributes of an existing SDP and related assets
 - Deactivate date effective attributes of an SDP and related assets
- § Master data is transmitted in synchronization files sets that can be submitted using one of two interfaces:
 - Incremental Synchronization
 - Periodic Audit Synchronization

Synchronization

MDM/R and LDC Synchronization Processes

The MDM/R synchronization processes are the primary means to:

- § Ensure that all SDPs and associated attributes and relationships in the MDM/R are current with the LDC's data source - typically the LDC's Customer Information System (CIS)
- § Provide the MDM/R with the data that is required to:
 - Accept and validate meter read data
 - Generate and deliver billing quantity data
 - Provide data access to the correct organizations

You must establish your own process to synchronize your CIS and AMI systems with the data necessary to support the MDM/R meter read interfaces, including:

- LDC and AMI Operator Organization IDs
- AMCD IDs
- Universal SDP IDs

Synchronization

Two MDM/R Synchronization Interfaces (1 of 3)



- § The MDM/R provides two synchronization processes and related interfaces:
 - Incremental Synchronization, FTS File Type: 4000
 - Periodic Audit Synchronization, FTS File Type: 3000

- § Both the Incremental Synchronization (I-Sync) and the Periodic Audit Synchronization (P-Sync) share a common file and file format structure.
 - Both I-Sync file sets and P-Sync file sets consist of seven files.
 - The file format for each file is common to both I-Sync and P-Sync.

- § I-Sync and P-Sync file sets will be processed in the numeric sequence determined by a 'Sequence Number' contained in the Manifest file for each synchronization file set.
 - The sequence number as processed by the MDM/R makes no distinction between Incremental and Periodic Audit synchronization. The NEXT sequence number is expected whether an I-Sync or P-Sync is the next file set submitted.

Synchronization

Two MDM/R Synchronization Interfaces (2 of 3)



- § Each synchronization is a single file set made up of a set of 7 related files:
 - File Number 00: Manifest File
 - File Number 01: Asset Data Files
 - File Number 02: Premise Data Files
 - File Number 03: Service Agreement Data Files
 - File Number 04: Parameter Data Files
 - File Number 05: Relationship Data Files
 - File Number 07: Component SDP Data Files

- § File Numbers 00, 01, 02, 03, 04, and 05 are Mandatory for both I-Sync and P-Sync file sets.
 - File Number 07 is only required if you are using the MDM/R Virtual SDP functionality.

Synchronization

Two MDM/R Synchronization Interfaces (3 of 3)



- § File Numbers 01, 02, 03, 04, 05, and 07 may each be segmented to break down large files into smaller files using the file Segment Number.
 - File Segment Numbers must always start with the value “01”.
 - File Segment Numbers may have gaps and need not be sequential.
 - Each File Number and File Segment Number must be listed in the Manifest File.
 - File segmentation can only occur between complete records.
- § Files sent as one segment must have the Segment Number set to “01”.
- § The ‘Extracted Date Time’ contained in the header record for each File Number must be the date and time that the data was extracted from your CIS for each synchronization file set.
 - The ‘Extracted Data Time’ in the header record of each file in a synchronization file set must be the same for the entire file set.

Synchronization

Who can submit synchronization file sets?



- § Either the LDC or its authorized agent can submit I-Sync file sets and/or P-Sync file sets.
- Submitting organization must be registered with the MDM/R
 - If an agent, the LDC must authorize configuration of the MDM/R to accept:
 - FTS file type 4000 if the agent organization is to submit I-Sync file sets on the LDC's behalf, and/or
 - FTS file type 3000 if the agent organization is to submit P-Sync file sets on the LDC's behalf.

Incremental Synchronization

Understanding the I-Sync process (1 of 3)

- § You should use the Incremental Synchronization process as the main vehicle for maintaining SDP attribute updates required to support your day-to-day business processes.
- § I-Sync file sets may contain updates for any number of attributes for any number of SDPs.
- § The I-Sync process provides support for date effective attribute changes including:
 - Prior state value and effective date changes
 - Current state value and effective date changes
 - Future state value and effective date changes
- § Any number of I-Sync file sets may be submitted each day and will be processed upon receipt in the sequence determined by the Manifest File 'Sequence Number'.

Incremental Synchronization

Understanding the I-Sync process (2 of 3)

- § Use the I-Sync process to support various business scenarios
- Meter change
 - Meter removal
 - Add a new meter
 - Service cut at pole
 - Booting a meter
 - Framing Structure change
 - Billing Cycle ID change
 - VEE Service change
 - CT/PT Multiplier change
 - Account change
 - Billing Agent or AMI Operator change
 - Retailer (Energy Service Provider) change
 - Create a new SDP and all attributes

Incremental Synchronization

Understanding the I-Sync process (3 of 3)

- § The minimum data elements required in an I-Sync file set to support each business scenario are defined in the “*MDM/R Technical Interface Specifications*”, Version 3.0, Section 2.3.10
 - An I-Sync file set may contain all SDP attributes including attributes not required to support a specific business scenario.
 - The data elements required for multiple scenarios may be combined and submitted in a single I-Sync file set.
- § Minimum data requirements for each business scenario have been updated in “*MDM/R Technical Interface Specifications*”, Version 3.0.
 - Minimum data requirements have been reduced for most scenarios.
 - Minimum data requirements for the “Meter Change” and “Meter Removal” business scenarios have been expanded to require Communication Module Asset and Meter to Communication Module Relationship data.

Periodic Audit Synchronization

Understanding the P-Sync process (1 of 2)

- § You should use the Periodic Audit Synchronization process to ensure that all SDPs and associated attributes in the MDM/R are current with the LDC's data source (e.g. your CIS).
- § P-Sync requires that all SDPs that have already been created in the MDM/R (or are to be created) and their current attribute values must be included in the P-Sync file set.
 - Date effective attributes of SDPs omitted in a P-Sync file set will be deactivated (i.e. end-dated) by the P-Sync process.
- § The P-Sync process provides support for date effective attribute changes limited to:
 - Current state value and effective date changes
 - Future state value and effective date changes
- § You must use the I-Sync process for prior state changes.

Periodic Audit Synchronization

Understanding the P-Sync process (2 of 2)



- § The submission of a P-Sync file set may be required to be scheduled based on the size of a LDC in terms of the total number of SDPs.

- § While submission of P-Sync file sets may be scheduled, they will be processed in the sequence of P-Sync and I-Sync file sets determined by the Manifest File 'Sequence Number'.

Synchronization

Sync Data Files - Master Data Parity (1 of 2)



- § The master data elements that are synchronized for each SDP consist of data contained in each of the synchronization data files.
- § Specific data elements for both I-Sync and P-Sync are defined in the “*MDM/R Technical Interface Specifications*”, Version 3.0, Section 2.2.8.
- § Again, the requirements for both I-Sync and P-Sync files sets are the same:
 - The Manifest File Number 00 is mandatory.
 - File Numbers 01, 02, 03, 04, 05 are always mandatory.
 - I-Sync detail record minimum data requirement for each business scenario must be present.
 - P-Sync detail records must be fully populated for all active SDPs.
 - File Number 07 is only required if you are using the MDM/R Virtual SDP functionality.
- § The following slide provides a summary of the synchronization data file to master data parity.

Synchronization

Synch Data Files - Master Data Parity (2 of 2)



§ Parity Summary of synchronization data files and master data:

- File Number 01: Asset data, including:
 - SDP asset data
 - Meter asset data
 - Communication Module asset data
- File Number 02: Premise data
- File Number 03: Service Agreement Data, including:
 - Framing Structure
 - Commodity Type
- File Number 04: Parameter data, including:
 - SDP parameters
 - Meter parameters
- File number 05: Relationship data, including:
 - SDP to Meter relationships
 - SDP to Account relationships (Optional)
 - Meter to Communication Module relationships
 - SDP to Billing Agent relationships
 - SDP to AMI Operator relationships
 - SDP to Energy Service Provider relationships (Optional)
 - SDP to CCA Service Provider relationships (Optional)
- File number 07: Channel to Channel and Channel to Formula Relationship data

Synchronization

Reporting (1 of 7)



Staging Table Loader (STL) interface exception reports

- § The synchronization STL performs file sequence, syntax, and logical validation checks against the synchronization files and file contents. Two reports are produced as the result of STL processing of each I-Sync or P-Sync file set:
- Incomplete Synchronization File Set Report (IR10), and
 - Synchronization Staging Table Loader Exception Report (IR14)
- § Only the organization submitting a synchronization file set as designated by the ORG_ID_2 as specified in the file name of each synchronization file set will receive Reports IR10 and IR14.
- Report IR10 is event based - this report is triggered only if a sync file set is incomplete or submitted out of order and is rejected after a configured wait-time.
 - This wait-time has been set to 1 hour to better support LDC operational requirements based on initial MDM/R production operations.
 - Report IR14 is event based - triggered after the synchronization staging table loading process is completed (successfully or unsuccessfully) for each sync file set.

Synchronization

Reporting (2 of 7)



§ Incomplete Synchronization File Set (IR10)

- Report IR10 informs the submitting organization that a synchronization file set (including I-Sync and P-Sync file sets) has been rejected by the MDM/R. The following conditions will cause a synchronization file set to be rejected:
 - All files for a particular synchronization file set have not been received after the configured wait-time and the file set has been rejected, or
 - The synchronization file set was received out of sequence and is being held, awaiting for the prior synchronization file set(s) to be submitted, and
 - The synchronization file set was received out of sequence, the missing synchronization file set(s) have not been received after the configured wait-time, and the file set has been rejected.
- Report IR10 will only be produced when a synchronization file set has been rejected.

Synchronization

Reporting (3 of 7)



§ Synchronization Staging Table Loader Exception Report (IR14)

- Report IR14 informs the submitting organization of the status of the synchronization staging table loading process (for I-Sync and P-Sync file sets) and reports errors and warnings encountered during the staging table loading process for each synchronization file set.
- Any records causing ERROR exception codes will cause the synchronization file set to fail to load.
- WARNING exception codes will allow the synchronization staging table loading process to complete successfully.
- Report IR14 will always be produced whether the synchronization staging table loading process is successful (no exceptions or Warnings only), or not successful (one or more errors encountered).
- All errors and/or warnings will be reported whether the synchronization staging table loading process is successful or not successful.

Synchronization

Reporting (4 of 7)



Synchronization processing reports

- § Upon successful loading of the synchronization staging tables and completion of the synchronization process a complete listing of attributes that were updated by the synchronization process and a listing of exceptions for attributes that were to be updated but failed to update are reported.
- § Two reports are produced for each I-Sync or P-Sync file set:
 - Synchronization Updates Report (IR06), and
 - Synchronization Exception Report (IR07)
- § Both Report IR06 and Report IR07 are event based - these reports are triggered after the synchronization process has completed (successfully or unsuccessfully).
 - Reports IR06 and IR07 provide a “Synchronization Status” indicating the point at which the synchronization stopped. The Synchronization Status Record will be identical for the IR06 and IR07 Reports produced for the same synchronization file set.

Synchronization

Reporting (5 of 7)



Synchronization processing reports (continued)

- § Two additional synchronization reports were developed as part of the deployment of EnergyIP Release 6.3.
 - ORG Sync Updates Report (IR04), and ORG Sync Exception Report (IR05)
 - The Organization Synchronization process was intended to attach the AMI Operator service provider organization, and/or the Billing Agent service provider organization to assets for the purpose of establishing organizational access rights to asset data via the *EnergyIP* GUI.

- § Reports IR04 and IR05 have been withdrawn and the Organization Synchronization process will not be deployed.

- § Service organization users providing AMI Operator services or Billing Agent services to LDCs must be established as LDC users for the purpose of establishing access rights to asset data via the *EnergyIP* GUI.

Synchronization

Reporting (6 of 7)



§ Synchronization Updates Report (IR06)

- The Synchronization Updates Report provides the status of synchronization processing for each file set and a complete listing of the records that were updated in the MMD via either the I-Sync or P-Sync processes.
 - Only attributes that require update of the MMD master data will be reported.
 - All other attributes submitted in the Synchronization file set that do not represent a change to master data will not be included in this report.
- Specific data values as submitted in the synchronization files may be transformed when returned as the master data update provided in Report IR06. These data transformations are specified in detail in the *“MDM/R Reports Technical Specifications”* for Report IR06.
- With the deployment of EnergyIP Release 7.0, Version 01 of Report IR06 will be replaced by a Version 02 providing a file integrity enhancement using an End Of File (EOF) record.
 - If you intend to “machine read” the IR06 Report your systems must be able to process the new EOF record.

Synchronization

Reporting (7 of 7)



§ Synchronization Exception Report (IR07)

- The Synchronization Exception Report provides the status of synchronization processing for each file set and a complete listing of the records that failed to update when submitted via either the I-Sync or P-Sync processes due to a synchronization processing error.
 - Only attributes that require update of the MMD master data but failed to complete processing will be reported in this report.
- Report IR07 will be produced for every I-Sync or P-Sync file set whether or not exceptions are encountered.
 - Under this condition the IR07 Report will consist of Column Heading Records with no Detail Records.
- With the deployment of EnergyIP Release 7.0, Version 01 of Report IR07 will be replaced by a Version 02 providing a file integrity enhancement using an End Of File record.
 - If you intend to “machine read” the IR07 Report your systems must be able to process the new EOF record.

Synchronization

Some other important items for your review

- § The preceding slides have highlighted some important technical items that, although included in the technical specifications for the MDM/R, you might miss on your first review of the synchronization interface and reports specifications.
- § You must carefully review the specifications for both I-Sync and P-Sync and the specifications for Report IR06, with particular attention to the sections addressing:
 - **Integration**, most particularly:
 - Characteristics, and
 - Synchronization File Set Sequencing
 - **Business Rules**, most particularly:
 - Rules pertaining to de-activation (P-Sync only)
 - Threshold checks
 - Rules affecting future and retroactive dating
 - **Data Transformations**, specified in the IR06 Report
- § The characteristics and business rules differ in important ways for I-Sync and P-Sync and you must be thoroughly familiar with these requirements for both synchronization processes.

Delivery of Billing Quantities



Billing Quantity Data

What is it? (1 of 3)

- § Billing Quantity data are energy consumption quantities, and demand quantities prepared from valid interval data by the MDM/R for delivery to the LDC or its authorized agent.
 - Valid interval data - or more specifically interval data that is eligible for billing - includes all intervals for which each interval validation status is either 'Valid' (VAL), 'Estimated' (EST), or 'Not Validated' (NV).
 - Interval data for which the interval validation status is 'Needs Verification or Edit' (NVE) is not eligible for billing.
 - **(Future)** As part of the Measurement Canada register read requirements, start and end register readings for each billing period will be included as part of the delivered Billing Quantity Data.
- § Billing Quantity data in the form of a Billing Quantity response for each SDP will be delivered when all data for a requested billing period is eligible for billing.
- § Billing Quantity data is prepared for delivery based on the Energy Purchase Service (i.e. Framing Structure) assigned to each SDP using the synchronization processes.

Billing Quantity Data

What is it? (2 of 3)



Framing Structures for preparing Billing Quantity data include:

§ For Energy (kWh) Consumption

- TOU/CPP (EST): providing Time of Use and Critical Peak Pricing consumption for SDPs located in the Eastern time zone
- TOU/CPP (CST): providing Time of Use and Critical Peak Pricing consumption for SDPs located in the Central time zone
- Hourly: providing consumption for each hour in a billing period to support billing at hourly spot market pricing
- Periodic: providing an interval data sum equivalent for register read billing

§ For kW and kVA Demand - (24) different framing structures are available to produce combinations of each energy framing structure and demand framing including

- 15 Minute or 60 Minute Block demand in the Eastern or Central Time zones
- 15 Minute or 60 Minute Rolling demand in the Eastern or Central Time zones

Billing Quantity Data

What is it? (3 of 3)

- § Billing Quantities for SDPs framed as TOU/CPP or Periodic are the sum of all daily billing quantity values (also called daily framed usage within the *EnergyIP* system) for each bucket for every day of a requested billing period.
 - For TOU/CPP or Periodic framed SDPs, every day of the requested billing period must have daily framed usage based on valid or estimated interval data.
- § Billing Quantities for SDPs framed as Hourly are (24) hourly consumption values for each day of a requested billing period.
 - For Hourly framed SDPs, all intervals within the requested billing period must be present and not require verification or editing (i.e. must be valid or estimated).
- § **(Future)** As part of the Measurement Canada register read requirements TOU/CPP, Periodic, and Hourly data based on interval data will be adjusted if the sum of the interval based usage does not equal the register read difference.
- § Billing Quantity data delivered by the MDM/R is not adjusted for losses.
 - Any necessary loss adjustments must be applied by your billing processes.

Billing Services

'Push' and 'Pull' Interfaces (1 of 3)

- § LDCs and/or their authorized agents as controlled by FTS can request Billing Quantity data using two different MDM/R Billing Services:
- **Scheduled Billing Service ('Push')**: You can provide a billing cycle schedule that indicates the dates of billing cycles. Any SDP that has a 'Billing Cycle ID' assigned via synchronization will have Billing Quantities automatically produced according to the billing cycle schedule.
 - **Request-Response Billing Service ('Pull')**: You can request Billing Quantities via the billing quantity request-response interface. You can use this interface to request billing quantities for normal billing purposes (called "on cycle") or for ad-hoc billing quantity requests (called "off cycle").
- § If you use the Scheduled 'Push' billing service for normal billing purposes, you can also use the Request-Response 'Pull' billing service for ad-hoc billing purposes.

Billing Services

'Push' and 'Pull' Interfaces (2 of 3)

- § To support the use of the Scheduled 'Push' Billing Service you must establish and submit a billing cycle schedule using the Billing Cycle Schedule Interface.
 - Your billing cycle schedule is submitted using FTS file type 8000.
 - You or your authorized agent generally provide a billing cycle schedule once a year.
 - Schedule updates may be submitted throughout the year a number of days in advance of the first billing cycle date to be updated (currently configured to 3 days) to prevent changes to a billing cycle during an open billing window.

- § The Request-Response 'Pull' Billing Service is an on demand method for obtaining Billing Quantity data.
 - You submit on-cycle or off-cycle Billing Quantity requests using FTS file type 5000.

Billing Services

'Push' and 'Pull' Interfaces (3 of 3)



- § The MDM/R transmits Billing Quantities for each SDP either to the LDC or to your agent as determined by the organization assigned to the 'SDP to Billing Agent' relationship for each SDP using the synchronization processes.
- § Billing Quantity response files for either 'Push' or 'Pull' billing services are the same.
 - Energy Billing Quantity responses for SDPs framed as TOU/CPP (EST), TOU/CPP (CST) or Periodic are delivered using FTS file type 6000.
 - Energy Billing Quantity responses for SDPs framed as Hourly are delivered using FTS file type 6100.
 - Demand Billing Quantity responses for all demand framing structures are delivered using FTS file type 6200.

Each of the (24) demand framing structures provides for both Energy and Demand billing quantity responses, thus each demand Billing Quantity response delivered in FTS file type 6200 supplements a corresponding energy Billing Quantity response delivered in either FTS file type 6000 or FTS file type 6100.

Billing Services

Who can submit billing interface files?

- § Either the LDC or its authorized agent can submit Billing Cycle Schedules or Billing Quantity Requests to the MDM/R.
 - Submitting organization must be registered with the MDM/R.
 - If an agent, the LDC must authorize configuration of the MDM/R to accept FTS file type 8000 (Billing Cycle Schedule) or to accept FTS file type 5000 (Billing Quantity Request) if the agent is to submit either file type on behalf of the LDC.
 - If a Billing Quantity Request is to be submitted by the either the LDC or the LDC's authorized agent, only the organization specified in the 'SDP to Billing Agent' relationship associated with each SDP will receive Billing Quantity values in the response file.

§ If you are not the Billing Agent associated with an SDP, the response file returned to you will not contain Billing Quantity values.

§ Such responses will include a Transaction Status = "08" indicating that you are not the active Billing Agent for each SDP for which your organization is not assigned the 'SDP to Billing Agent' relationship.

Understanding the Timing

The Billing Window

- § Both ‘Push’ and ‘Pull’ billing service processes are controlled by global billing service properties that establish a billing window.
 - During this billing window billing quantity requests (‘Push’ or ‘Pull’, ‘on-cycle’ or ‘off cycle’) remain active if complete framed usage data or interval data for any day are not available or are not eligible for billing when a billing request for an SDP is initially processed.

- § The MDM/R is configured for a billing window of three business days based on consultation with the SMSIP Working Group who established that for each request (i.e. for each SDP):
 - A requested billing period should not be foreshortened, that is, all days requested in a billing period must be included in each Billing Quantity response.
 - A period of three business days after the last day of a requested billing period should be provided to allow sufficient time for the LDC or its authorized agent to provide the necessary valid interval data to process any billing quantity requests that remain active.

Global billing service properties are documented in the
“MDM/R VEE Standard for the Ontario Smart Metering System”

Understanding the Timing

Other Billing Response Process parameters

- § Other key billing response process parameters establish billing quantity delivery timing as follows:
- For scheduled billing service (‘Push’) the schedule for loading SDPs scheduled for a billing quantity response for the current day based on each LDC’s Billing Cycle Schedule is currently set at 07:30 EST.
 - The billing quantity response process used to process all active ‘Push’ and ‘Pull’ billing quantity requests is currently set to run every (3) hours between 08:00 EST and 23:00 EST every day.
 - For request-response ‘Pull’ billing service:
 - Off-cycle requests are processed when initially received.
 - On-cycle requests and pending off-cycle requests are processed every (3) hours.
 - All ‘Push’ and ‘Pull’ billing quantity requests remain active for all three business days of the billing window if a complete set of eligible data is not available.
 - A ‘no data available’ response is returned for all unfulfilled billing quantity requests at 08:00 EST on the calendar day after each billing window expires - once this happens a new request is required.

Billing Quantity Response

Billing Period Events (1 of 2)



§ The MDM/R will automatically provide a segmented Billing Quantity response for a single Billing Quantity request (either ‘Pull’ or ‘Push’) divided into multiple sub-periods if any of the following three conditions occur:

1. **Change to the Energy Purchase Service Assigned to an SDP** - resulting from a Framing Structure ID change made via the synchronization processes sometime during the requested billing period.
 - The billing service looks for Energy Purchase Service changes that fall within the billing period and delivers Billing Quantities for each sub-period defined by one or more Energy Purchase Service change events.

2. **Change to the SDP to Account Relationship** - resulting from one or more account changes made via the synchronization processes during the requested billing period.
 - The billing service looks for SDP to Account Relationship changes that fall within the billing period and delivers Billing Quantities for each sub-period defined by one or more account change events.

Billing Quantity Response

Billing Period Events (2 of 2)



3. **Seasonal Price Change** - resulting from a global RPP price change made by the OEB during the requested billing period.
 - For any SDP for which the Energy Purchase Service is TOU/CPP or Periodic the billing service looks for global price change events that fall within the billing period and delivers Billing Quantities for each sub-period defined by one or more global price change events as defined in the TOU Schedules and Energy Purchase Service Calendars.
 - The TOU Schedules and Energy Purchase Calendars are specified in the *“MDM/R TOU Schedule and Calendar Manual”*.

(Future) Meter Change and CT/PT Multiplier Change Event - resulting from Meter Change and/or a CT/PT Multiplier changes within the requested billing period.

- This event change functionality will be enabled as part of the MDM/R Universal Solution supporting the Measurement Canada register read requirements.
- Please see the initial specification for the New Billing Service Standard Interface Reply for business rules - Reference *MDM/R Technical Interface Specifications* Version 3.0, Section 2.5.

Billing Quantity Response

Transaction Status and Exception Conditions

- § The MDM/R automatically provides a Transaction Status for each billing quantity response as an integral part of each Billing Quantity response file.
- SDPs for which a Billing Quantity response can be processed successfully without exception are delivered with a Transaction Status = “00”.
 - SDPs for which a complete set of data eligible for billing is not available when the billing window closes are delivered with a Transaction Status = “02”.
 - Billing Quantity responses may also be returned before the billing window closes, with or without quantity data, with exceptions. These Transaction Codes are defined in the *“MDM/R Technical Interface Specifications”*, Version 3.0, Table 2.7.4.
- § Transaction Status codes for each SDP are also reported in the Billing Delivery Detail Report BR04 twice each day at 12:00 EST and 23:30 EST for every active billing quantity request.

Billing Quantity Response

Validation and Estimation Services (1 of 3)

- § The MDM/R automatically performs certain validation and estimation services for each Billing Quantity response as determined by the VEE Service assigned to each SDP using the synchronization processes.
- § Two services are available:
- **Billing Validation Sum Check** - This billing validation service is provided by all VEE Services with the exception the ‘No Validation’ and ‘No Estimation’ VEE Services 01 and 02.
 - **Interval Data Extrapolation** provided by the On Demand Estimation (ODEST) exception handling process.
 - The ODEST process is enabled for a set of VEE Services that parallel VEE Services for which ODEST is disabled.

All VEE Services and the availability of Billing Validation Sum Check and ODEST services as configured for each VEE Service are specified in the *“MDM/R VEE Standard for the Ontario Smart Metering System”*

Billing Quantity Response

Validation and Estimation Services (2 of 3)

§ Billing Validation Sum Check

- Billing Validation Sum Check is performed for TOU/CPP, Periodic, and Hourly billing quantities when each billing quantity response is ready for delivery.
- Checks total of interval data quantities between register reads against the difference between register reads nearest to the start and end points of the billing period.
- This validation check may fail for one of two reasons:
 - The threshold value for the calculated sum check is exceeded - this mode of failure is reported as Transaction Status = “06”.
 - Register readings were not found within the maximum register range - this mode of failure is reported as Transaction Status = “07”.
- When the Billing Validation Sum Check fails on either of the above conditions, all VEE Services have been configured to report the Billing Quantities in the response with the appropriate failure code.

You must establish the processes for addressing the use of the delivered Billing Quantities and potential investigation of failure as indicated by the Transaction Status codes “06” and “07”.

- Using the new Billing Validation Sum Check Failure Report BR05 will be valuable in supporting your processes.

Billing Quantity Response

Validation and Estimation Services (3 of 3)

§ ODEST Exception Handling

- The ODEST process provides interval data extrapolation when interval data is not available for the last days of a billing period.
- The use of ODEST is optional and determined by the VEE Service assigned to each SDP using the synchronization processes.
- Interval data extrapolation is performed for missing intervals beyond the end time of the most recently received interval data to the end date of a requested billing period.
 - Utilizes Historic or Class Load Profile estimation as determined by the configuration of the VEE service assigned to the SDP.
 - Estimations will be unscaled since an end register reading is not available for estimation requests initiated by the ODEST process.
- For VEE Services providing ODEST, this service has been configured for initiation two business days after the opening of the billing window for all billing quantity requests that remain active.
- If the ODEST estimation is not successful, one business day will remain in the billing window before a 'no data available' response is produced with Transaction Status = "02".

Billing Quantity Process

Reporting (1 of 7)



§ Reporting provided by the MDM/R in support of the Billing Quantity process can be considered in three groups:

- **Interface Exception Reports**
 - Billing Cycle Schedule Exception Report (IR03)
 - Billing Quantity Request Exception Report (IR08)
- **Billing Quantity Process Reports for Active Requests**
 - Billing Delivery Summary Report (BR01)
 - Billing Delivery Detail Report (BR04)
 - Billing Validation Sum Check Failure Report (BR05)
 - Billing No Reads Report (BR06)
- **Post-Process Billing Quantity Reports**
 - Re-Billing Report (BR03)

Billing Quantity Process Reporting (2 of 7)



Interface Exception Reports:

§ **Billing Cycle Schedule Exception Report (IR03)**

- The Billing Cycle Schedule Exception Report provides the status of the loading of each billing cycle schedule file into the MDM/R and any exceptions encountered during this manual process performed by the OSP.
- Exceptions including the possible failure to load the billing cycle schedule are addressed by the SME and LDC using the incident and problem management process.

§ **Billing Quantity Request Detailed Exception Report (IR08)**

- The Billing Quantity Request Detailed Exception Report provides automatic notification of all exceptions encountered during the validation of each Billing Quantity Request file.
- Report IR08 is an event-based report triggered by processing of each Billing Quantity Request file and the scheduled run of the Billing Reads Processor (a process that is configured to run every 10 minutes).
 - You may receive one report for multiple request files if exceptions are encountered for multiple files received in a single 10 minute period.

Billing Quantity Process Reporting (3 of 7)



Billing Quantity Process Reports for Active Requests

§ Billing Delivery Summary Report (BR01)

- The Billing Delivery Summary Report provides a summary of the billing requests in the billing staging table at the time that the report is run.
 - Report BR01 is run twice daily at 12:00 EST and 23:30 EST corresponding to Report BR04.
- This report provides a summary count of the detailed records provided by Report BR04 - Billing Delivery Detail Report. The following information is provided for each open billing window per billing period end date:
 - Total number of SDPs to be processed
 - Number of pending SDPs not yet processed
 - Number of SDPs in-process
 - Number of SDPs in-process in a no-data condition
 - For Transaction Status code “00”
 - Numbers for: Data Found, Found and Sent, Found and Delivery Failed
 - For all other Transaction Status Codes
 - Numbers for: Request Failed, Failed and Sent, Failed and Delivery Failed

Billing Quantity Process Reporting (4 of 7)



Billing Quantity Process Reports for Active Requests

§ **Billing Delivery Detail Report (BR04)**

- The Billing Delivery Detail Report provides details on active billing requests in the billing staging table for a given date.
 - Report BR04 is run twice daily at 12:00 EST and 23:30 EST.
- Detailed information is provided for each active billing request by SDP including:
 - Request Detail Identifier specified in the Billing Quantity Request
 - Read Status
 - Transaction Status
 - Insert time for the billing request
 - Export status
 - Billing period start date
 - Billing period end date
 - Billing window end date
 - Billing request processing complete date time

Billing Quantity Process Reporting (5 of 7)



Billing Quantity Process Reports for Active Requests

§ **Billing Validation Sum Check Failure Report (BR05)**

- The Billing Validation Sum Check Failure Report lists all Billing Quantity responses for SDPs that failed the Billing Validation Sum Check for the current day.
- Information is provided for each billing quantity response by SDP to aid in the determination of the extent of the Billing Validation Sum Check failure.
 - For failures exceeding threshold (Transaction Code “06”) the ‘Total Variant’ or value of the sum check failure is reported.
 - Detailed information is provided to identify the interval data and register read data used by the Billing Validation Sum Check failure algorithm including register date/time and values and total interval consumption.
- Report BR05 is run daily for delivery by 23:30 EST.
- Report BR05 is planned to be deployed as part of *EnergyIP* Release 7.0.

Billing Quantity Process Reporting (6 of 7)



Billing Quantity Process Reports for Active Requests

§ **Billing No Reads Report (BR06)**

- This report lists all Billing Quantity requests for SDPs where Billing Quantities could not be delivered for the current day.
- Detailed information is provided for each SDP for each billing period ending in the current day where billing quantity data was not available providing:
 - Billing Period End Date
 - Transaction Status for exceptions not returning quantity data
- Report BR06 is run daily for delivery by 21:30 EST.

You should establish the processes required to investigate and fix problems that caused the Billing Quantity requests to be closed without returning Billing Quantity data for requests listed on Report BR06.

- Consider this report to be a to-do list where you must re-submit the each identified Billing Quantity request after the problems have been corrected.

Billing Quantity Process Reporting (7 of 7)



Post-Process Billing Quantity Reports

§ Re-Billing Report (BR03)

- The Re-Billing Report lists SDPs where quantity changes to interval data and associated daily framed usage data has occurred as the result of updated interval data quantities received after Billing Quantities have been delivered.
- The report includes an Event Period record for each SDP and affected billing period for either Interval data changes or Usage data changes according to the Framing Structure for the affected SDP.
- Changes are reported at an event level for each SDP and billing period.
 - Each event represents quantity changes to interval data that may result in a change in Billing Quantity data.
 - The original Billing Quantity value, potential new Billing Quantity value, difference of original and new quantities and percent change are reported.

You should establish the processes required to assess the potential quantity changes identified in Report BR03 to determine if a Billing Quantity request is need for re-billing of prior billing periods.

Billing Quantity Process

Some other important items for your review

The preceding slides have highlighted some important technical items that you might miss on your first review of the interface and reports specifications pertaining to billing quantity delivery.

You must carefully review the specifications for the Billing Quantity Request/Response Interface and for Report BR04 whether you use the Scheduled Billing Service or the Request-Response Billing Service with particular attention to the sections addressing:

- **Billing Quantity Request**, most particularly:
 - The specifications for an inclusive Request Daily Read Period Start Date and an exclusive Request Daily Read Period End Date - these fields specify the billing period of each of your requests
 - Request Version Date Time - used to recover a previously delivered billing quantity response
- **Billing Quantity Response**, most particularly:
 - Business Rules pertaining to both Energy responses and Demand responses
 - Frequency and Timing
 - File Format for TOU/CPP & Periodic, Hourly, and Demand response files
 - Transaction Status Code descriptions and how you will use Reports BR03 and BR04

Billing Quantity Process

Future MDM/R Billing Service Standard Interface

- § As part of the MDM/R Universal Solution required to address the Measurement Canada register read requirements, a new Billing Service Standard Interface will be deployed.
 - The new Request and Reply files for this interface will replace the existing MDM/R Request and Response files.
 - This new interface will utilize the standard *EnergyIP* Request Message and Reply Message files transmitted in an .xml file format.
- § The initial specifications for the Billing Service Standard Interface have been published in the *MDM/R Technical Interface Specifications, Version 3.0* dated September 24, 2010.
 - See Section 2.4 for the Billing Service Standard Interface - Request
 - See Section 2.5 for the Billing Service Standard Interface - Reply

For more information regarding the Measurement Canada requirements and the high level design for the MDM/R Universal Solution, please see our presentation of the *New MDM/R Billing Service Standard Interface* delivered at the Toronto Congress Centre on October 5, 2010 and available on our web-site.

Further Information: SMSIP Website



Smart Metering Entity



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 [MDM/R Incident Management](#)

In this section, you will find detailed information about the Meter Data Management and Repository (MDM/R), including its various user interfaces and the types of reports it generates. This section also includes MDM/R design and standards documents as well as updates about its production, quality assurance and sandbox environments.

SMSIP Website URL: www.smi-ieso.ca