PREPAYMENT CLUSTER

Overview :

i. The Prepayment Cluster provides the facility to pass messages relating to the accounting functionality of a meter between devices on the HAN.

ii. It allows for the implementation of a system conforming to the set of standards relating to Payment Electricity Meters (IEC 62055) and also for the case where the accounting function is remote from the meter.

iii. Prepayment is used in situations where the supply of a service may be interrupted or enabled under the control of the meter or system in relation to a payment tariff.

iv. The accounting process may be within the meter or elsewhere in the system. The amount of available credit is decremented as the service is consumed and is incremented through payments made by the consumer. Such a system allows the consumer to better manage their energy consumption and reduces the risk of bad debt owing to the supplier.

Dependencies :

i. Support for ZCL Data Types.

ii. Events carried using this cluster include a timestamp with the assumption that target devices maintain a real time clock. Devices can acquire and synchronize their internal clocks via the ZCL Time server.

iii. Use of the Price cluster is Mandatory when using the Prepayment cluster in Currency mode.

iv. The Calendar cluster shall be used to set up the Friendly Credit period that the prepayment meter shall use.

v. Use of the Metering cluster is Mandatory when using the Prepayment cluster in any mode.

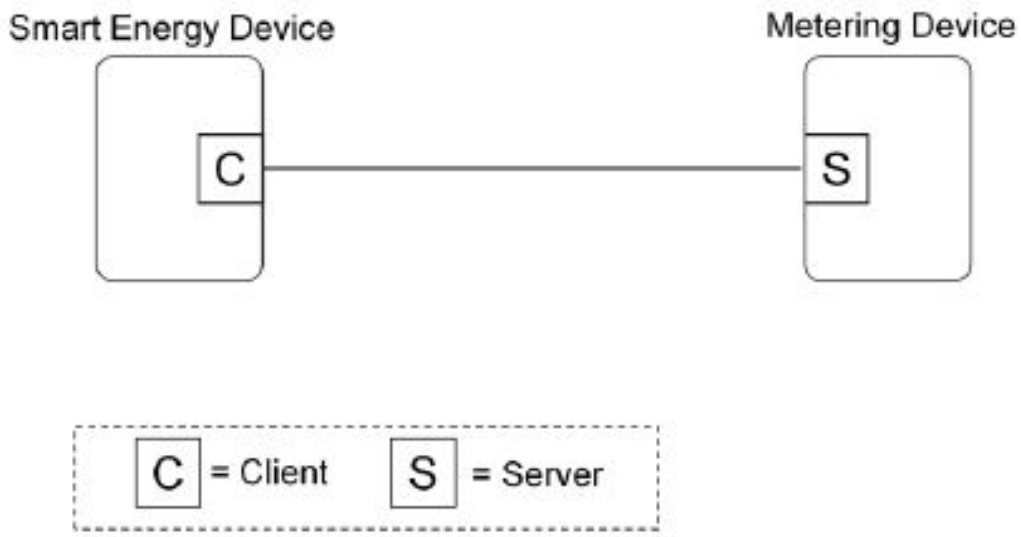
vi. Use of the Device Management cluster is mandatory when using the disconnection function within the Prepayment cluster

Prepayment Attribute Sets :

- The Prepayment clusters have below mentioned attributes sets included in it.

Attribute Set Identifier	Description
0x00	Prepayment Information Set
0x01	Top-up Attribute Set
0x02	Debt Attribute Set
0x03	Reserved
0x04	Alarms Set
0x05	Historical Cost Consumption Information Set
0x06 – 0xFF	Reserved

- For our particular case when prepayment cluster is considered the client/server communication is as shown below :



Credit Time-line over the different period of time :

- The below mentioned figure shows over all different stages of the credit that is changed over a specific duration of time :

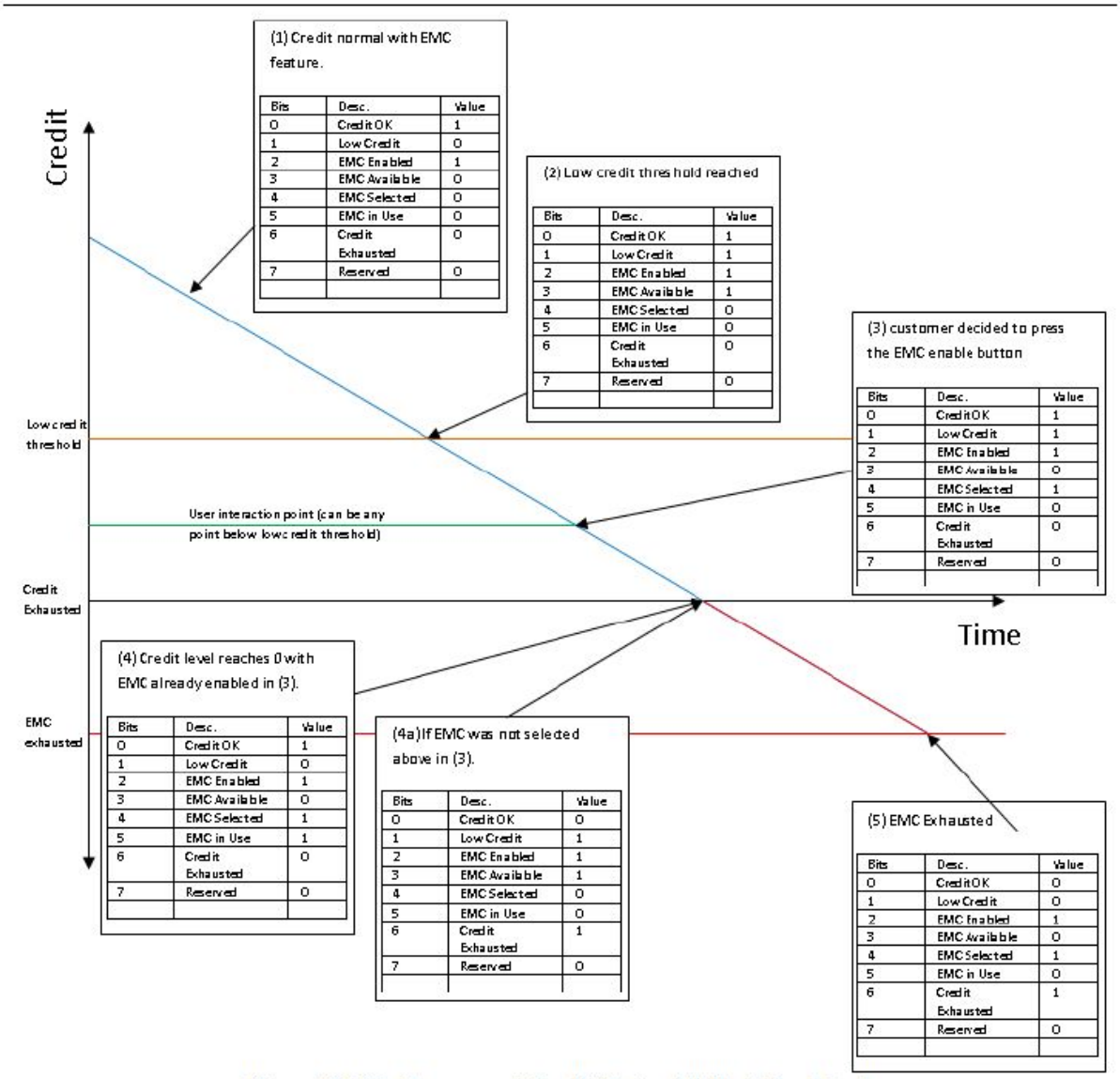


Figure D-135– Prepayment Credit Status Attribute Explained

- Detailed information of above figure will be obtained from ZSE doc (page no : 517).

Prepayment Commands Set:

Commands that are received by the server are as shown in the table:-

Command Identifier FieldValue	Description	Mandatory/ Optional
0x00	*Select Available Emergency Credit*	O
0x01	Reserved	
0x02	*Change Debt*	O
0x03	*Emergency Credit Setup*	O
0x04	*Consumer Top Up*	O
0x05	*CreditAdjustment*	O
0x06	*Change Payment Mode*	O
0x07	*Get Prepay Snapshot*	O
0x08	*Get Top Up Log*	O
0x09	*Set Low Credit Warning Level*	O
0x0A	*Get Debt Repayment Log*	O
0x0B	*Set Maximum Credit Limit*	O
0x0C	*Set Overall Debt Cap*	O

Commands that are generated by the server are as shown in the table:-

Table D-150– Cluster -specific Commands Sent by the Server

Command Identifier Field Value	Description	Mandatory/ Optional
0x00	*Reserved*	O
0x01	*Publish Prepay Snapshot*	O
0x02	*Change Payment Mode Response*	O
0x03	*Consumer Top Up Response*	O
0x04	*Reserved*	O
0x05	*Publish Top Up Log*	O
0x06	*Publish Debt Log*	O

- Description of different commands that are generated or received by server are mentioned below along with its frame formats.

- **Select Available Emergency Credit Command**

Payload Format

Octets	4	1
Data Type	UTCTime	8 bits Enumeration
Field Name	Command Issue Date/ Time (M)	Originating Device (M)

Figure D-115– *Select Available Emergency Credit* Command Payload

Below mention table shows the originating Device field enumerations:-

Table D-146– Originating Device Field Enumerations

Enumerated Value	Device
0x00	Energy Service Interface
0x01	Meter
0x02	In-Home Display Device
0x03 – 0xFF	Reserved

- **Change Debt Command:**

- The Change Debt command is sent to the Metering Device to change the debt values

D.7.2.3.3.1 Payload Format

Octets	4	1-13	4	1	1	4	2
Data Type	Unsigned 32-bit Integer	Octet String	Signed 32-bit Integer	8-bit Enumeration	8-bit Enumeration	UTCTime	Unsigned 16-bit Integer
Field Name	Issuer Event ID (M)	Debt Label (M)	Debt Amount (M)	Debt Recovery Method (M)	Debt Amount Type (M)	Debt Recovery Start Time (M)	Debt Recovery Collection Time (M)

1	4	2
8-bit Enumeration	Signed 32-bit Integer	Unsigned 16-bit Integer
Debt Recovery Frequency (M)	Debt Recovery Amount (M)	Debt Recovery Balance Percentage (M)

Figure D-116– Change Debt Command Payload

- **Emergency Credit Setup Command**
- This command provides a method to set up the parameters for the Emergency Credit.

D.7.2.3.4.1 Payload Format

Octets	4	4	4	4
Data Type	Unsigned 32-bit Integer	UTC Time	Unsigned 32-bit Integer	Unsigned 32-bit Integer
Field Name	Issuer Event ID (M)	Start Time (M)	Emergency Credit Limit (M)	Emergency Credit Threshold (M)

Figure D-117– Emergency Credit Setup Command Payload

D.7.2.3.4.2 Payload Details

- **Consumer Top Up Command**
- The Consumer Top Up command is used by the IHD and the ESI as a method to apply credit top up values to a prepayment meter.

D.7.2.3.5.1 Payload Format

Octets	1	1-26
Data Type	8 bit Enumeration	Octet String
Field Name	Originating Device (M)	TopUp Code (M)

Figure D-118– Consumer Top Up Command Payload

- **Consumer Top Up Response Command**

D.7.2.4.4.1 Payload Format

Octets	1	4	1	4
Data Type	8-bit Enumeration	Signed 32- bit Integer	8-bit Enumeration	Signed 32-bit Integer
Field Name	Result Type (M)	Top Up Value (M)	Source of Top up (M)	Credit Remaining (M)

Figure D-130– Consumer Top Up Response Command Payload

- **Credit Adjustment Command**

- The Credit Adjustment command is sent to update the Credit Remaining attribute on a Prepayment meter. It shall only be sent from an ESI to the Meter.

D.7.2.3.6.1 Payload Format

Octets	**4**	**4**	**1**	**4**
Data Type	Unsigned 32-bit Integer	UTC Time	8 bits Enumeration	Signed 32-bit Integer
Field Name	Issuer Event ID (M)	Start Time (M)	Credit Adjustment Type (M)	Credit Adjustment Value (M)

Figure D-119– Credit Adjustment Command Payload

- **Change Payment Mode Command**

- This command is sent to a Metering Device to instruct it to change its mode of operation, e.g. from Credit to Prepayment.

D.7.2.3.7.1 Payload Format

Octets	**4**	**4**	**4**	**2**	**4**
Data Type	Unsigned 32 bit Integer	Unsigned 32 bit Integer	UTC Time	16 bit BitMap	Signed 32-bit Integer
Field Name	Provider ID (M)	Issuer Event ID (M)	Implementation Date/Time (M)	Proposed Payment Control Configuration (M)	Cut Off Value (M)

Figure D-120– Change Payment Mode Command Payload

- **Get Prepay Snapshot Command**

- This command is used to request the cluster server for snapshot data.

D.7.2.3.8.1 Payload Format

Octets	**4**	**4**	**1**	**4**
Data Type	UTC Time	UTC Time	Unsigned 8-bit Integer	32-bit BitMap
Field Name	Earliest Start Time (M)	Latest End Time (M)	Snapshot Offset (M)	Snapshot Cause (M)

Figure D-121– Get Prepay Snapshot Command Payload

- **Publish Prepay Snapshot Command**

- This command is generated in response to a GetPrepaySnapshot command or when a new snapshot is created. It is used to return a single snapshot to the client.

D.7.2.4.2.1 Payload Format

Octets	4	4	1	1	1	4	1	Variable
Data Type	Unsigned 32-bit Integer	UTC Time	Unsigned 8-bit Integer	Unsigned 8-bit Integer	Unsigned 8-bit Integer	32-bit BitMap	8-bit Enumeration	
Field Name	Snapshot ID (M)	Snapshot Time (M)	Total Snapshots Found (M)	Command Index (M)	Total Number of Commands (M)	Snapshot Cause (M)	Snapshot Payload Type (M)	Snapshot Payload (M)

Figure D-127– Publish Prepay Snapshot Command Payload

- **Get Top Up Log**

- This command is sent to the Metering Device to retrieve the log of Top Up codes received by the meter.

D.7.2.3.9.1 Payload Format

Octets	4	1
Data Type	UTC Time	Unsigned 8-bit Integer
Field Name	Latest EndTime (M)	Number of Records(M)

Figure D-122– Get Top Up Code Log Command Payload

- **Publish Top Up Log Command**

- This command is used to send the Top Up Code Log entries to the Prepayment client. The command shall be sent in response to a Get Top Up Log command and MAY be sent unsolicited whenever a new Top Up code is received and successfully processed[19]. When the command is being sent a the result of a Top Up, the Top Up Payload shall contain details for that Top Up only. Where the Top Up Payload contains details for more than one log entry, they are sent most recent entry first.

D.7.2.4.5.1 Payload Format

Octets	1	1	xx
Data Type	Unsigned 8 –bit Integer	Unsigned 8 –bit Integer	
Field Name	Command Index (M)	Total Number of Commands (M)	Top Up Payload

Figure D-131– Publish Top Up Log Command Payload

- **Set Low Credit Warning Level**
- This command is sent from client to a Prepayment server to set the warning level for low credit.

D.7.2.3.10.1 Payload Format

Octets	4
Data Type	Unsigned 32-bit Integer
Field Name	Low Credit Warning Level (M)

Figure D-123– Set Low Credit Warning Level Command Payload

- **Get Debt Repayment Log Command**
- This command is used to request the contents of the Repayment log.

D.7.2.3.11.1 Payload Format

Octets	4	1	1
Data Type	UTC Time	Unsigned 8-bit Integer	Unsigned 8 bit Integer
Field Name	Latest EndTime (M)	Number of Debts (M)	Debt Type

Figure D-124– GetDebtRepaymentLog Command Payload

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- **Publish Debt Log Command**
- This command is used to send the contents of the Repayment Log.

D.7.2.4.6.1 Payload Format

Octets	1	1	xx
Data Type	Unsigned 8 –bit Integer	Unsigned 8 –bit Integer	
Field Name	Command Index (M)	Total Number of Commands (M)	Debt Payload (M)

Figure D-133– Publish Debt Log Command Payload

- **Set Maximum Credit Limit**
- This command is sent from a client to the Prepayment server to set the maximum credit level allowed in the meter.

D.7.2.3.12.1 Payload Format

Octets	4	4	4	4	4
Data Type	Unsigned 32 bit Integer	Unsigned 32 bit Integer	UTC Time	Unsigned 32-bit Integer	Unsigned 32-bit Integer
Field Name	Provider ID (M)	Issuer Event ID (M)	Implementation Date/Time (M)	Maximum Credit Level (M)	Maximum Credit Per Top Up (M)

Figure D-125– Set Maximum Credit Level Command Payload

- **Set Overall Debt Cap**

- This command is sent from a client to the Prepayment server to set the overall debt cap allowed in the meter.

D.7.2.3.13.1 Payload Format

Octets	4	4	4	4
Data Type	Unsigned 32 bit Integer	Unsigned 32 bit Integer	UTC Time	Signed 32-bit Integer
Field Name	Provider ID (M)	Issuer Event ID (M)	Implementation Date/Time (M)	Overall Debt Cap

Figure D-126– Set Overall Debt cap Command Payload

- **Change Payment Mode Response Command**

- This command is sent in response to the ChangePaymentMode command. The ChangePaymentModeResponse command shall only inform the ESI of the current default setting that would affect the meter when entering into Prepayment/PAYG or Credit mode. Should these values require changing then other commands within the Prepayment & Price cluster should be used.

D.7.2.4.3.1 Payload Format

Octets	1	4	4	4
Data Type	8 Bit Bitmap	Unsigned 32-bit Integer	Unsigned 32-bit Integer	Unsigned 32-bit Integer
Field Name	Friendly Credit (M)	Friendly Credit Calendar ID (M)	Emergency Credit Limit (M)	Emergency Credit Threshold (M)

Figure D-129– Change Payment Mode Response Command Payload