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Use of This Document

This document describes how to use the MultiSpeak Version 4.1 Specification to implement interfaces for Pre-Paid Metering (PPM) systems. The document is informative, that is to say that the contents of this document are provided for information only and do not establish requirements for the MultiSpeak Specification. Should there be conflicts between this document and the Specification, the specification shall take precedence.

Status of This Document

The provisions of this document apply to Version 4.1.x of the MultiSpeak Specification. All sequence diagrams in this document have been approved as of December 31, 2011. Complete support for these use cases is included in Version 4.1.5 of the Specification. No further PPM use cases were under development as of December 31, 2011.
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</table>
Introduction

Use Cases and Sequence Diagrams – Generic Definition

*Use cases* are a way of defining functional requirements of an information system. They can be used to define the *business processes* required for all activities in a utility and represent interactions between *actors*, that is to say system components or individuals that affect a business process. There is a wide variety in the content, detail and approach taken to use case development within various standards pertaining to the utility industry and within individual utilities. The development of use cases provides considerable benefit as will be discussed further below.

The MultiSpeak® Initiative has recently focused on developing a library of use cases, each of which are documented using *sequence diagrams* and supporting narrative materials as the best means to document how common utility business processes are supported using MultiSpeak-defined web services. A sequence diagram is one of many interaction diagrams defined in the Unified Modeling Language (UML), a standard of the Object Management Group (OMG) that can be used to design and document the functionality of information systems. The sequence diagram shows how applications and other actors interact with one another and the time order in which those interactions occur in order to achieve a particular functionality. The MultiSpeak sequence diagrams contain such features as: actors, MultiSpeak web service *methods*, data payloads (*objects* and *elements*) and accompanying annotations about the underlying business processes described.

Scope of This Report

The purpose of this report is to detail the use case library that has been produced to date (through December 31, 2011) for Pre-Paid Metering (PPM) business processes in utilities. The report includes a listing of all approved PPM use cases and a copy of each approved sequence diagram. There are no further PPM use cases in development at this time as this is considered to describe a full set of PPM functionality.

MultiSpeak is an extremely content-rich specification. Explicit definition of use cases defines the specific functionality in MultiSpeak that supports a particular utility business process. MultiSpeak use cases define the actors, interface requirements, assumed preconditions, the data exchanges to achieve a specific business process and the assumed ending state after a particular step in the business process is completed.

The MultiSpeak use case sequence diagrams are built using Enterprise Architect (EA) software. The most current Enterprise Architect project file containing a compilation of all MultiSpeak use cases is available to MultiSpeak members at (https://groups.cooperative.com/multispeak/default.aspx). Available on the MultiSpeak members SharePoint site are the following:

- The Enterprise Architect project file containing all of the current MultiSpeak use cases on all topics, including those approved and under development. The specific use cases can be opened to observe the use case narrative and the sequence diagrams can be used to view the underlying data payloads. Use
cases from other standards-setting organizations such as IEC 61968 CIM, OpenSG, and ZigBee® SEP V2.0 are being added to the MultiSpeak SharePoint site as they become available.

- An index to all use cases including a cross-standard listing of how the MultiSpeak use cases relate to those of other standards work including the AMI-Enterprise subgroup of the Open Smart Grid User’s Group (AMI-ENT) and others as they become available.
- Minutes from Technical Committee meetings and teleconferences detailing the most current status of approved and draft use cases and sequence diagrams.

Development of MultiSpeak Use Cases

The MultiSpeak Specification itself has been under continuous development since 2002 utilizing contributions by the MultiSpeak Technical Committee. The Technical Committee has historically consisted primarily of vendors serving the utility market. They included in the specification, from its beginnings, capabilities which reflected the needs of utility customers. Thus, the capability to address specific utility business processes has always been inherent in MultiSpeak. However, explicit documentation of how MultiSpeak meets specific utility business processes, through use cases, has only been included starting with Version 4.1.

Note that unless otherwise indicated, all methods listed on a MultiSpeak use case are required in order to be in compliance with the MultiSpeak Specification. Two exceptions to this requirement are for information flows documented in the use cases in a box labeled “alt” or “opt”. Both are discussed below, however, briefly, in the case of alternative methods (alt), one of a series of actions is required, but only one among the alternatives. Methods or a set of methods in a box marked (opt) are optional, not required. The boxes labeled opt or alt are referred to as fragments in UML.

The complete functionality necessary for any interface can be defined by the sum of all of the use cases that are required to meet the utility’s business processes. An example would be the interface between the customer billing function of a customer information system and the pre-paid metering function of a prepayment metering application.

Importance and Benefits of Use Cases

The development of MultiSpeak use cases is critical to all of the stakeholders interested in the MultiSpeak effort for a number of reasons.

For improving communication between vendors and utility software users. Use cases help improve communications between utilities and vendors by providing a checklist of capabilities that users may wish to specify in future software acquisition. They should also help users ensure that products received from vendors meet the needs outlined in requests for proposals.

For software development. At the most fundamental level, explicit definition of use cases is an aid to vendor or utility software developers in developing MultiSpeak-compliant interfaces and data flows. Use cases help ensure agreement on what basic
services mean within the MultiSpeak specification and hence more uniform and consistent implementations of software interfaces.

**For improving interoperability.** True interoperability of utility software application continues to be a high priority among all stakeholders. Tighter specification requirements and clearly defined compliance through use cases will move this effort forward.

**For improving security.** Use cases may play a valuable role in identifying and specifying security requirements on an interface.

**For improved testing for compliance and interoperability.** A key aspect of achieving interoperability is developing testing procedures, test profiles and test data to exercise, as fully as possible, the limits of interoperability of various software products. Use cases need to be defined in order to develop profiles; testing to the use cases will improve the test process.

**For improving product offerings.** Use cases can help vendors identify potential additional features for their product offerings. They can also help vendors who provide products in more than one standards-space.

**For improving communication between the MultiSpeak specification and its users.** Developing use cases makes it easier for vendors new to the MultiSpeak specification as well as new utility users to identify specific MultiSpeak capabilities.

**For the continued development and refinement of the MultiSpeak specification.** As noted above, MultiSpeak inherently contains solutions to many utility business process needs. However, by defining use cases contained in current content the MultiSpeak Initiative can identify needed additional development. It also serves as a quality assurance measure to ensure that the current specification content is adequate for the intended purpose.

**For improving harmonization with other standards.** A significant goal of the national smart grid effort is to harmonize standards-efforts among the various standards-setting organizations. A complete set of use cases will be a valuable tool in relating MultiSpeak content to other standards groups and will significantly ease harmonization with those standards such as when they build new functionality.
MultiSpeak® Use Case Examples and Conventions

MultiSpeak Use Case Conventions

Figures 1 and 2 show two illustrative examples of MultiSpeak use cases. These two particular use cases are for aspects of meter reading, but the features illustrated are applicable to all MultiSpeak use cases including those described later in this document. Figure 1 is the use case MSP.MR:20.147 “Initiate a disconnect action on an RCD switch.” Figure 2 is the use case “MSP.MR:20.100 “Utility disconnects customer for non-payment using RCD switch” which illustrates the features of a composite use case. This section describes in detail the interpretation of the information provided by MultiSpeak use cases. The numbers on the figures correspond to the descriptions below.

Figure 1. Example of a MultiSpeak use case. Numbers in callouts correspond to descriptions in the text of these generic features of all MultiSpeak use cases.
MultiSpeak® Use Cases for Pre-Paid Metering (PPM)

Figure 2. Example of a MultiSpeak composite use case.

**MultiSpeak Use Case Number.** In Figure 1 the MultiSpeak use case number is MSP.MR:20.147. The interpretation of identifying numbers is as follows:

MSP.MR:20.147

Identifies a MultiSpeak use case

- Category
- Subcategory
- Specific identifier

The first identifier is MSP which distinguishes a MultiSpeak use case from those produced by other organizations.

The second identifier is the category designation. Category designations that have been defined for MultiSpeak use cases to date are shown in Table 1.
Table 1
MultiSpeak Use Case Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM</td>
<td>Asset Management</td>
</tr>
<tr>
<td>CAM</td>
<td>Customer Account Management</td>
</tr>
<tr>
<td>DER</td>
<td>Distributed Energy Resources</td>
</tr>
<tr>
<td>DGN</td>
<td>Field Design</td>
</tr>
<tr>
<td>DR</td>
<td>Demand Response and HAN</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information Systems</td>
</tr>
<tr>
<td>INSP</td>
<td>Inspection and Assessment</td>
</tr>
<tr>
<td>MM</td>
<td>Market Management</td>
</tr>
<tr>
<td>MR</td>
<td>Meter Reading and Control</td>
</tr>
<tr>
<td>NO</td>
<td>Network Operations</td>
</tr>
<tr>
<td>OM</td>
<td>Outage Management</td>
</tr>
<tr>
<td>PS</td>
<td>Power System Modeling</td>
</tr>
<tr>
<td>WM</td>
<td>Work Management</td>
</tr>
<tr>
<td>DISC</td>
<td>Discovery and Network Management</td>
</tr>
<tr>
<td>SUB</td>
<td>Subscription Management</td>
</tr>
<tr>
<td>INF</td>
<td>Informative Use Cases</td>
</tr>
</tbody>
</table>

The DISC and SUB categories contain use cases that have to do with management of messaging for all interfaces in MultiSpeak. The MSP.INF use cases are of two types: (i) ones that are included for information only and which will never be considered to be a required portion of the specification and (ii) use cases that are under development for future versions of the specification.

The PPM use cases described in this report are a subset of Customer Account Management (CAM) use cases and therefore will have a use case number in the MSP.CAM:40.XXX series. The subcategories for Customer Account Management that have been defined to date include:

Table 2
MultiSpeak Customer Account Management Use Case Subcategories

<table>
<thead>
<tr>
<th>Customer Account Management Subcategory</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAM:10</td>
<td>Customer Management</td>
</tr>
<tr>
<td>CAM:20</td>
<td>Account Management</td>
</tr>
<tr>
<td>CAM:30</td>
<td>Service Location Management</td>
</tr>
<tr>
<td>CAM:40</td>
<td><strong>Customer Prepayment</strong></td>
</tr>
<tr>
<td>CAM:50</td>
<td>Call Handling</td>
</tr>
</tbody>
</table>

**Use Case Title.** This is a narrative description of the use case. The intention was to make the individual use cases as close to a utility business process or a portion of a utility business process as possible.
Use Case Annotation. There are a number of features, typically narratives and annotations, contained in the use cases which do not display in the Figures shown in this document. However, these annotations can be read by clicking on the feature (for example, a specific method) of the use case in the Enterprise Architect file located in the MultiSpeak Members SharePoint Site. Each use case also typically has an overall narrative indicating in more detail the purpose of the use case. For the use case shown in Figure 1, the following narrative will be found in the Enterprise Architect file:

“In this use case, the CIS:CB initiates a disconnect action by issuing one or more connectDisconnectEvent objects to the AMI Head-End:CD. The communication can occur directly between the CIS:CB or can be relayed through an MDM system.”

Time Flow of the Sequence Diagram. Feature number 4 in Figure 1 is just a reminder that on the sequence diagram for a use case, whatever happens on left side (upper left corner) typically is the initiating event, and the sequence of subsequent events typically works down and to the right through time. This allows the specification of simple runtime scenarios in a graphical manner.

Actors. The square boxes at the top of the sequence diagrams are actors. Actors represent the role that is played by a person or portion of an information system during the execution of a use case or business process. In MultiSpeak, human actors are represented using “stick figures” and these model humans acting in their roles as users, customers, dispatchers, field workers, etc.

Because MultiSpeak is an interface specification, the actors in MultiSpeak use cases typically will be portions of information systems that expose interfaces with other systems, described in terms of MultiSpeak functions. The box labeled “Customer Billing (CIS:CB)”, identified as #5 in Figure 1, is an example of one such actor. The MultiSpeak convention is that information system actors in the sequence diagrams are labeled with the physical system designation and then the logical function name with the two separated by a colon. In this case, the Customer Information System (CIS) is the physical system and Customer Billing (CB) is the MultiSpeak logical function of that physical system involved in this use case.

Clicking on the actor in any use case in the Enterprise Architect use case library file will provide additional information about that actor. For example, in Figure 1, clicking on the Customer Billing (CIS:CB) actor provides the following annotation:

“This is the Customer Billing function of a Customer Information System (CIS).”

Clicking on the Meter Data Management box in the Enterprise Architect file of this example Figure provides the following annotation:

“This is the function of the Meter Data Management (MDM) system that acts as a proxy for the Connect Disconnect (CD) function, such as that in an AMI Head End system.”
It should be noted that actors may be in different locations on different sequence diagrams. For example, a mobile worker could be an initiator of a sequence of steps and therefore in the upper left of one sequence diagram, but could be the receiver of information and would therefore be located further right on a different sequence diagram.

**Grouping of Actors.** When there are multiple actors belonging to a single physical system then a shaded box (boundary) is drawn around all of those actors and their vertical lanes (termed *lifelines* and defined below). Typically these groupings will represent the set of interfaces from a single application that is active in the use case being documented. Typically such groupings that are used in MultiSpeak use cases are shown in Table 3 along with the MultiSpeak Functions that might be included.

### Table 3
**Example Groupings of Functions in an Application Actor**

<table>
<thead>
<tr>
<th>Name of Group (Application)</th>
<th>Examples of Individual Actors (Functional Interfaces) That Might Be Contained in Such a Grouping</th>
</tr>
</thead>
</table>
| Meter Data Management (MDM) | MDM:AM (Asset Management proxy)  
MDM:CB (Customer Billing proxy)  
MDM:CD (Connect/Disconnect proxy)  
MDM:EA (Engineering Analysis proxy)  
MDM:HAN (HAN Communications proxy)  
MDM:MR (Meter Reading proxy)  
MDM:OA (Outage Analysis proxy)  
MDM:PPM (Pre-Paid Metering proxy) |
| AMI Head End                | AMI Head End:OD (Outage Detection interface)  
AMI Head End: CD (Connect Disconnect interface)  
AMI Head End:MR (Meter Reading interface) |
| Customer Information System | CIS:CB (Customer Billing interface)  
CIS:EDTR (End Device Testing and Receiving interface) |
| Outage Management System   | OMS:OA (Outage Analysis interface)  
OMS:GV (GIS Viewer interface) |
| Interactive Voice Response  | IVR:CH (Call Handling interface)  
IVR:OD (Outage Detection interface) |

Note that even though the customer information system could contain multiple actors, in Figure 1 there is only a single actor “CIS:CB” shown. This is because other potential capabilities are not needed to conduct this business process and thus are not shown in this use case to improve clarity. This practice applies to all other applications as well.

For the pre-paid metering use cases, it is particularly important to note that although a Meter Data Management system is shown in nearly all the use cases, such a system is not required to execute the use case and thus to be in compliance with the MultiSpeak specification. For utilities without Meter Data Management systems, the MDM box can be removed and the information flow will be identical. In Figure 1, for example, the Customer Billing (CIS:CB) actor is sending a method call “InitiateConnectDisconnect” to an AMI Head End:Connect/Disconnect actor. If the utility has an MDM, that call goes first to the MDM:CD (connect/disconnect proxy contained within the MDM system) and then the MDM issues the call through from its MDM:CB (customer billing proxy) to the AMI Head End:CD (connect/disconnect function). Thus
the CIS:CB only “sees” a connect disconnect function (and isn’t affected by whether it is contained within an MDM application or within an AMI application) and the eventual receiving system (here the AMI) isn’t affected by whether the customer billing (CB) request originated within a CIS application or within the MDM proxy. If the utility does not have an MDM system, the call will go directly from CIS:CB to the AMI Head End:CD. The functional performance of the information flow is identical in both cases.

**Lifeline.** The vertical lines extending from the actor boxes downward are termed lifelines. The lifeline is a graphic device used in a sequence diagram to show the periods of time that a specific actor is potentially active. Typically, in MultiSpeak, actors are persistent and can “live” for the entire scope of a use case, hence the lifeline stretches from the top to the bottom of the sequence diagram. In the more general case it is possible for an actor to become inactive part way through a sequence diagram; in that case, its lifeline ends at the point that the actor becomes inactive.

**Methods.** The horizontal arrows between the lifelines of actors are messages exchanged between the two actors. In MultiSpeak Versions 3 and 4, these messages are web service methods, identified by the method name (for example in Figure 1, the first method called is InitiateConnectDisconnect. Note that the methods are shown vertically in the time sequence order in which they occur for a specific use case.

MultiSpeak use cases document both synchronous and asynchronous message exchange patterns, along with self-messages. Following the conventions of Unified Modeling Language Version 2.0, solid arrows with solid heads are synchronous calls, solid arrows with open (“stick”) heads are asynchronous calls and dashed arrows with open heads are return messages.

Note that since MultiSpeak is an interface specification, it only pertains to the flows of information between separate applications or systems. Thus, as illustrated in Figure 1, the flow of information between a Customer Information System and an MDM is shown with the InitiateConnectDisconnect method. Similarly, the flow between the MDM and the AMI Head End (passing along the call InitiateConnectDisconnect) is also shown. However, the internal flow from the MDM:CD proxy to the MDM:CB proxy is not shown. **MultiSpeak does not typically show the information flows which are internal to a particular application. Those flows certainly may be handed by using MultiSpeak method calls and returns, but that decision is left to the vendor of the particular application and is outside the scope of MultiSpeak.** In reviewing use cases on the MultiSpeak SharePoint site, the user may find an occasional case where an internal flow is shown to clarify a particular issue however these flows are not within the scope of MultiSpeak. The convention is to show these internal-to-an-application flows in purple color to clearly identify them as such.

There is significantly more information contained in each method call than is displayed in the Figures of this report. Again, that information can be accessed in the Enterprise Architect use case library file by clicking on the specific method in each use case.

That information typically includes: (i) descriptive text (annotation), (ii) a list of parameters sent including the appropriate MultiSpeak objects and (iii) where important to
the specific use case, information about the specific elements on those objects that are required for this use cases.

For example, by clicking on InitiateConnectDisconnect method in the use case shown in Figure 1 one would obtain the following detailed information:

“CIS:CB initiates a disconnect action by issuing one or more connectDisconnectEvent objects to the AMI Head-End:CD. CD returns information about failed transactions by returning an array of errorObjects. The Connect/Disconnect function returns information about this action using the CDStatesChangedNotification to the URL specified in the responseURL calling parameter and references the transactionID specified to link the transaction to this Initiate request.

Calling Parameters:

1) connectDisconnectEvent [ ] - An array of connectDisconnectEvents. The loadActionCode element SHALL be set to be "Disconnect". The CDReasonCode MAY be set to be any of the appropriate values, such as "NonPayment", "ServiceInactive", "PPMBalanceNegative", or "Other".

2) responseURL - The URL to which the CD function should send subsequent CDStatesChangedNotification in response to this Initiate call.

3) transactionID - the link between this Initiate call and subsequent CDStatesChangedNotification messages sent in response to this call.

4) expTime - The expiration time parameter indicates the amount of time for which the publisher should try to obtain and publish the data; if the publisher has been unsuccessful in publishing the data after the expiration time, then the publisher will discard the request and the requestor should not expect a response.”

Return. The MultiSpeak convention is to show all returns to a request and to include a list of parameters contained in the return in the annotation to the return message. Although including all the returns creates a somewhat more complex diagram it provides complete documentation of the information flows required by MultiSpeak.

As an example, the following annotation would be obtained by clicking on the return arrow for InitiateConnectDisconnect in this use case in the Enterprise Architect file on the SharePoint site:

“This is the synchronous return to the InitiateConnectDisconnect call.

Return Parameters:

1) errorObject [ ] - optional array to return error information if necessary. No errorObjects should be returned if no error was detected.”
**Self-message.** In some use cases, there will be an event that needs to occur within a system before the sequence can continue, such as the “AMI head-end disconnects RCD switch” shown in Figure 1. These events are termed *self-messages*. Such self messages are not a part of the MultiSpeak specification, but are shown in the sequence diagrams to help clarify the business process.

**Alternative fragment.** In many cases, MultiSpeak contains multiple, equally valid methods for accomplishing a particular action. These alternative methods may be indicated on a sequence diagram with a note to the annotation (of either the overall use case or to a particular method). Alternatives may also be noted using an “alt” *fragment*, an example of which is shown in Figure 1. As noted above, “alt” indicates that one of a series of actions is *required*, but only one of the options needs to be implemented to meet the requirements of the MultiSpeak specification.

**Status Note.** For all use cases there is a “status” note to indicate that the use case is a “Draft for Consideration” or “Approved”, the date of last action on the use case, and any revision numbers.

**Composite Use Cases.** MultiSpeak uses simple use cases (termed *modular use cases* although they are complete and can stand alone on their own as use cases) to build *composite* use cases that illustrate more detailed or comprehensive business processes. Figure 2 shows an illustration of one such composite use case.

In a composite sequence diagram such as Figure 2, the fragments should be executed in the order presented just as with a simple sequence diagram. All constituent modular use cases are required in order to meet the MultiSpeak specification, unless specifically indicated otherwise (such as for those marked “opt”).

**Optional fragment.** An “Opt” label on a fragment indicates that *all* of the actions contained within the box are optional. Figure 2 shows an example. Here, the use case MSP.MR:20.160 “Verify state of RCD switch” is not required, but may be executed in this use case. If it is executed, it is typically executed in the order shown in the sequence diagram.

**Other MultiSpeak Use Case Conventions**

The following are additional conventions that the user may encounter when reviewing the use cases contained in this report or in the Enterprise Architect files.

**Loops.** A use case fragment may be labeled “loop”. This indicates that support for the messages contained in the loop fragment is required unless specifically identified as being optional, and that all of the messages contained in the loop fragment may be executed as many times as necessary to complete the desired action.

**Red method arrows.** During the development process, red colored arrows are used for methods that are not currently in the MultiSpeak specification but would be required to
have a consistent approach to a particular use case. As the use cases are approved by the Technical Committee or a subcommittee, the method is added to the appropriate MultiSpeak Version and the color is changed to black in the sequence diagram. All of the use cases presented in this report have been approved and there are no such methods listed, however, in the Enterprise Architect file the user may encounter some arrows using this convention as the Specification continues to evolve.
MultiSpeak PPM Use Cases

Table 4 provides a summary of PPM Use Cases that have been developed and have been approved by the MultiSpeak Initiative’s Technical Committee through December 31, 2011.

Table 5 provides a summary of two outage management use cases that are referenced in one or more PPM use cases. Similarly, Table 6 provides a summary of the two meter reading use cases that are referenced in one or more PPM use cases.

All use cases listed in the Tables have been approved for use with MultiSpeak Version 4.1.

A copy of the sequence diagram for all approved use cases is contained in this report in the Figure numbers shown in the Table.
## Table 4
### MultiSpeak PPM Use Cases:
*Customer Prepayment (MSP.CAM:40.XXX)*

<table>
<thead>
<tr>
<th>MultiSpeak Use Case Number</th>
<th>Use Case Name/Narrative</th>
<th>Figure (this report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSP.CAM:40</td>
<td><em>Customer Prepayment</em></td>
<td></td>
</tr>
<tr>
<td>MSP.CAM:40.100</td>
<td>CIS enrolls a customer in prepayment service</td>
<td>3</td>
</tr>
<tr>
<td>MSP.CAM:40.105</td>
<td>PPM commissions new PPM service</td>
<td>4</td>
</tr>
<tr>
<td>MSP.CAM:40.108</td>
<td>AMI head-end system notifies prepayment system of threshold event.</td>
<td>5</td>
</tr>
<tr>
<td>MSP.CAM:40.109</td>
<td>AMI head-end monitors meters for threshold events on behalf of prepayment system.</td>
<td>6</td>
</tr>
<tr>
<td>MSP.CAM:40.110</td>
<td>Prepayment system requests information about a prepayment customer.</td>
<td>7</td>
</tr>
<tr>
<td>MSP.CAM:40.115</td>
<td>Prepayment system obtains information about prepayment customers.</td>
<td>8</td>
</tr>
<tr>
<td>MSP.CAM:40.120</td>
<td>Prepay customer makes payment on account.</td>
<td>9</td>
</tr>
<tr>
<td>MSP.CAM:40.125</td>
<td>Prepayment system obtains meter readings.</td>
<td>10</td>
</tr>
<tr>
<td>MSP.CAM:40.130</td>
<td>Prepaid metering system disconnects service when account balance falls below allowable minimum.</td>
<td>11</td>
</tr>
<tr>
<td>MSP.CAM:40.135</td>
<td>Prepaid metering system initiates power limitation condition when account falls below allowable minimum.</td>
<td>12</td>
</tr>
<tr>
<td>MSP.CAM:40.140</td>
<td>Customer prepays for electric service</td>
<td>13</td>
</tr>
<tr>
<td>MSP.CAM:40.150</td>
<td>CIS makes required adjustments to customer account balance in prepaid metering system.</td>
<td>14</td>
</tr>
<tr>
<td>MSP.CAM:40.160</td>
<td>CIS synchronizes records with the prepaid metering system.</td>
<td>15</td>
</tr>
<tr>
<td>MSP.CAM:40.165</td>
<td>Monthly reconciliation of prepayment billing information.</td>
<td>16</td>
</tr>
<tr>
<td>MSP.CAM:40.170</td>
<td>Prepayment system reconnects service previously disconnected for non-payment.</td>
<td>17</td>
</tr>
<tr>
<td>MSP.CAM:40.171</td>
<td>Prepayment system connects service using RCD switch.</td>
<td>18</td>
</tr>
<tr>
<td>MSP.CAM:40.172</td>
<td>Prepayment system connects service using RCD switch, without arming.</td>
<td>19</td>
</tr>
<tr>
<td>MSP.CAM:40.173</td>
<td>Arm an RCD switch for PPM.</td>
<td>20</td>
</tr>
<tr>
<td>MSP.CAM:40.174</td>
<td>Prepayment system connects service using RCD switch, with arming.</td>
<td>21</td>
</tr>
</tbody>
</table>
Table 4
MultiSpeak PPM Use Cases:
Customer Prepayment (MSP.CAM:40.XXX)
(continued)

<table>
<thead>
<tr>
<th>MultiSpeak Use Case Number</th>
<th>Use Case Name/Narrative</th>
<th>Figure (this report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSP.CAM:40</td>
<td>Customer Prepayment</td>
<td></td>
</tr>
<tr>
<td>MSP.CAM:40.175</td>
<td>Prepaid metering system cancels power limitation condition when account balance is brought back above the allowable minimum.</td>
<td>22</td>
</tr>
<tr>
<td>MSP.CAM:40.180</td>
<td>CIS sends prepayment rate updates.</td>
<td>23</td>
</tr>
<tr>
<td>MSP.CAM:40.190</td>
<td>CIS unenrolls a customer from prepayment service.</td>
<td>24</td>
</tr>
<tr>
<td>MSP.CAM:40.200</td>
<td>AMI Meter enters credit/load limitation mode.</td>
<td>25</td>
</tr>
<tr>
<td>MSP.CAM:40.210</td>
<td>Prepayment metering system obtains information about potentially outaged meters.</td>
<td>26</td>
</tr>
<tr>
<td>MSP.CAM:40.220</td>
<td>PPM initiates threshold monitoring requests.</td>
<td>27</td>
</tr>
<tr>
<td>MSP.CAM:40.230</td>
<td>PPM adjusts threshold monitoring requests.</td>
<td>28</td>
</tr>
<tr>
<td>MSP.CAM:40.240</td>
<td>PPM cancels a threshold monitoring request.</td>
<td>29</td>
</tr>
</tbody>
</table>

Table 5
MultiSpeak Outage Management Use Cases Referenced in PPM Use Cases
Outage Reporting (MSP.OM:10.XXX)

<table>
<thead>
<tr>
<th>MultiSpeak Use Case Number</th>
<th>Use Case Name/Narrative</th>
<th>Figure (this report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSP.OM:10</td>
<td>Outage Reporting</td>
<td></td>
</tr>
<tr>
<td>MSP.OM:10.175</td>
<td>Prepayment metering notifies OMS of services disconnected for low balance.</td>
<td>30</td>
</tr>
<tr>
<td>MSP.OM:10.185</td>
<td>Prepayment metering notifies OMS of services reconnected after disconnection for low balance.</td>
<td>31</td>
</tr>
</tbody>
</table>
### Table 6
MultiSpeak Meter Reading Use Cases Referenced in PPM Use Cases

**Meter Readings (MSP.MR:10.XXX)**

<table>
<thead>
<tr>
<th>MultiSpeak Use Case Number</th>
<th>Use Case Name/Narrative</th>
<th>Figure (this report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSP.MR:10</td>
<td>Meter Readings</td>
<td></td>
</tr>
<tr>
<td>MSP.MR:10.50</td>
<td>Meter readings are published to MDM and CIS</td>
<td>32</td>
</tr>
<tr>
<td>MSP.MR:10.110</td>
<td>AMI meter completes an on-demand meter reading for CIS</td>
<td>33</td>
</tr>
</tbody>
</table>
MSP.CAM:40 Series Use Cases – Customer Prepayment

The approved use cases for the Customer Prepayment series are contained in Figures 3 through 29.

![Diagram of Meter Data Management with EnrollPPMCustomer actions between CIS, MDM, and Customer Billing]

**Figure 3.** MSP.CAM:40.100 – CIS Enrolls A Customer In Prepayment Service.
Figure 4. MSP.CAM:40.105 – PPM Commissions New PPM Service.
Figure 5. MSP.CAM:40.108 – AMI Head-End System Notifies Prepayment System Of Threshold Event.
Figure 6. MSP.CAM:40.109 – AMI Head-End Monitors Meters For Threshold Events On Behalf Of Prepayment System.
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Figure 7. MSP.CAM:40.110 – Prepayment System Requests Information About A Prepayment Customer.

Figure 8. MSP.CAM:40.115 – Prepayment System Obtains Information About Prepayment Customers.
Figure 9. MSP.CAM:40.120 – Prepay Customer Makes Payment On Account.
Figure 10. MSP.CAM:40.125 – Prepayment System Obtains Meter Readings.
Figure 11. MSP.CAM:40.130 – Prepaid Metering System Disconnects Service When Account Balance Falls Below Allowable Minimum.
Figure 12. MSP.CAM:40.135 – Prepaid Metering System Initiates Power Limitation Condition When Account Balance Falls Below Allowable Minimum.
Figure 13. MSP.CAM:40.140 – Customer Prepays For Electric Service.
Figure 14. MSP.CAM:40.150 – CIS Makes Required Adjustments To Customer Account Balance in Prepaid Metering System.
Figure 15. MSP.CAM:40.160 – CIS Synchronizes Records With The Prepaid Metering System.
Figure 16. MSP.CAM:40.165 – Monthly Reconciliation Of Prepayment Billing Information.
Figure 17. MSP.CAM:40.170 – Prepayment System Reconnects Service Previously Disconnected For Non-Payment.
Figure 18. MSP.CAM:40.171 – Prepayment System Connects Service Using RCD Switch.
Figure 19. MSP.CAM:40.172 – Prepayment System Connects Service Using RCD Switch, Without Arming.
Figure 20. MSP.CAM:40.173 – Arm An RCD Switch For PPM.
Figure 21. MSP.CAM:40.174 – Prepayment System Connects Service Using RCD Switch, With Arming.
Figure 22. MSP.CAM:40.175 – Prepaid Metering System Cancels Power Limitation Condition When Account Balance Is Brought Back Above The Allowable Minimum.
Figure 23. MSP.CAM:40.180 – CIS Sends Prepayment Rate Updates.
Figure 24. MSP.CAM:40.190 – CIS Unrolls A Customer From Prepayment Service.
Figure 25. MSP.CAM:40.200 – AMI Meter Enters Credit/Load Limitation Mode.
Figure 26. MSP.CAM:40.210 – Prepayment Metering System Obtains Information About Potentially Outaged Meters.
Figure 27. MSP.CAM:40.220 – PPM Initiates Threshold Monitoring Requests.
Figure 28. MSP.CAM:40.230 – PPM Adjusts Threshold Monitoring Requests.
Figure 29. MSP.CAM:40.240 – PPM Cancels A Threshold Monitoring Request.
MSP.OM:10 Series Use Cases – Outage Reporting

Two use cases in the Outage Management series are used as fragments within approved Pre-Paid Metering use cases and therefore are included here as Figures 30 and 31.

Figure 30. MSP.OM:10.175 – Prepayment Metering Notifies OMS Of Services Disconnected For Low Balance.
Figure 31. MSP.OM:10.185 – Prepayment Metering Notifies OMS Of Services Reconnected After Disconnection For Low Balance.
MSP.MR:10 Series Use Case – Meter Reading

Two use cases in the Meter Reading series are used as fragments within the approved Pre-Paid Metering use cases and therefore are included here as Figures 32 and 33.

Figure 32. MSP.MR:10.50 – Meter Readings Are Published To MDM And CIS.
Figure 33. MSP.MR:10.110 – AMI Meter Completes An On-Demand Meter Reading For CIS.
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Resources

MultiSpeak Web Site – www.MultiSpeak.org

MultiSpeak Members SharePoint Site. The Members SharePoint site can be accessed through www.groups.cooperative.com/multispeak/default.aspx with appropriate credentials.

Enterprise Architect is a semantic modeling tool that has been used by the MultiSpeak Initiative to document use cases and the MultiSpeak UML class model. Users that do not have access to a licensed copy of the Enterprise Architect program can obtain an Enterprise Architect viewer program, EALite.exe, at no cost from the Sparx Systems web site. The viewer program currently is available from: http://www.sparxsystems.com/products/ea/downloads.html

OMG Unified Modeling Language (OMG UML) UML Version 2.1.2
A collection of UML documents are available at no charge from the Object Management Group at the following website:
http://www.omg.org/technology/documents/modeling_spec_catalog.htm#UML


IEC 61968-9, Application integration at electric utilities – System interfaces for distribution management – Part 9: Interface for meter reading and control. IEC 61968-9 is a standard in the IEC Common Information Model (CIM) family of standards that covers much of the same area as the PPM portion of MultiSpeak. The standard is maintained by IEC Technical Committee 57, Working Group 14. More information about IEC 61968-9 and TC57 may be found at: http://ieetc57.ucaiug.org/default.aspx

Open Smart Grid User’s Group (OpenSG). The mission of the OSGug Technical Subcommittee is to foster enhanced functionality, lower costs and speed market adoption of Advanced Metering networks and Demand Response solutions through the development of an open standards-based information/data model, reference design & interoperability guidelines. More information about the OpenSG user’s group can be found at: http://osgug.ucaiug.org/default.aspx

AMI-Enterprise (AMI-ENT) is a subgroup of OpenSG that is focused on enterprise integration of AMI systems. More information about AMI-Enterprise may be found at http://osgug.ucaiug.org/sgsystems/OpenAMIEnt/default.aspx

ZigBee® Smart Energy Profile (SEP). SEP is a profile of messages and data definitions that may be used to communicate with equipment and devices on a ZigBee® network. For more information on ZigBee® or SEP see www.zigbee.org.
Glossary

The following glossary provides a list of some of the key terms used in this document. Many are based on the following reference, which can be consulted for more information:


**actor** – A role that is played by a person or portion of an information system during the execution of a use case. In MultiSpeak, human actors are represented using “stick figures” and model humans acting in their roles as users, customers, dispatchers, field workers, etc. In MultiSpeak, portions of IT systems that expose interface capabilities are represented as actors that serve the roles of the MultiSpeak abstract functions.

**annotation** – Additional textual information that is provided to describe objects or methods. Annotation may be either informative or normative.

**application** – A physical piece of software that provides real-world capabilities.

**asynchronous action** – A message set in which the originating actor does not pause to wait for successive messages, which potentially will be sent in response to the initial message.

**boundary** – A graphical device used in UML diagrams to group like entities. For instance, it is common in MultiSpeak sequence diagrams to group the lifelines for the abstract functions that are implemented in one physical application together with a box indicating the system boundary.

**business process** – A group of steps that are carried out to achieve a business objective.

**class** – An abstract definition of a set of entities that share the same attributes, operations, relationships and semantics.

**class, abstract** – A class that is used as part of an object-oriented data model, but which is never intended to be instantiated with data.

**class, concrete** – A class that, when implemented, is intended to be directly instantiated with data.

**compliance** – The conformance of a system or application to the requirements and restrictions of a specific standard.

**composite use case** – A comprehensive use case composed of potentially many modular use cases and/or individual messages.

**element** – A piece of information about an object. In XML, an element is a constituent part of the object, which is separated by a set of XML tags that describe the data contained in the element.
fragment – A portion of a sequence diagram that includes one or more steps or messages that is called out for special consideration. Fragments are graphically noted by a box around the affected portion of the sequence diagram along with a bar that contains one of a number of abbreviations, including the following that are commonly used in MultiSpeak: opt, alt, or, loop. The opt fragment indicates that execution of the steps or messages in the fragment is optional at that point in the process. That is to say, execution of the steps in the fragment is acceptable, but is not required for compliance with the use case. The alt fragment gives potential, mutually exclusive alternatives groups of steps or messages that could be executed at that point in the use case. Support for one of the alternatives is required for compliance, but support for all of the alternatives is not required. The loop fragment implies that the steps or messages included in the fragment could be repeated many times. Sometimes loop fragments include information on when the loop is to be exited, but sometimes the loop fragment is used to indicate that that set of functionality could be done an indeterminate number of times until the business process is completed.

function – An abstract set of capabilities of an application. In MultiSpeak, functions are the web service endpoint definitions that consist of a set of web service methods to support the set of application capabilities.

harmonization – The process of achieving technical equivalency and enabling interchangeability between different standards with overlapping functionality. Harmonization requires an architecture that documents key points of interoperability and associated interfaces.

informative – Descriptive material that is provided as suggestion or expansion on the required (normative) material.

interoperability – The ability for two applications or systems to interact in pre-defined manners. In the context of the MultiSpeak standard, interoperability is the ability for two applications or systems to interoperate using the defined interface contracts and other requirements of the MultiSpeak Specification. In general, interoperability does not ensure compliance with a standard, however, for the purposes of MultiSpeak interoperability testing, both compliance of the applications and interoperability between them is tested. Thus tested MultiSpeak interoperability implies both compliance and interoperability as defined in the scope of the test performed. Unless the tests performed have tested the full range of the desired use cases (business processes), the degree of practical interoperability achieved might not meet all the needs of a particular utility.

lifeline – A graphical device used in a sequence diagram to show the periods of time that a specific actor is potentially active. Typically, in MultiSpeak actors are persistent and can “live” for the entire scope of a use case, hence the lifeline stretches from the top to the bottom of the sequence diagram.

message – The implementation of an operation or web service method, usually consisting of message header and message payload.

method – An operation or procedure that is supported on a web service. Short for web service method.
multi-Speak® Use Cases for Pre-Paid Metering (PPM)

modular use case (or module) – A use case that can be reused as a small portion of a more comprehensive composite use case.

normative – Material that is considered to be a requirement for compliance with a specification. Contrast this with informative, which is material that is provided as a suggestion or description, but which is not required for compliance.

object – A concrete implementation of an abstraction. In XML, an object is a concrete implementation of an abstract UML class.

profile – A set of methods on an interface between two applications along with all of the necessary information, requirements, and restrictions detailing the payload of each message. The intention of defining a profile is to limit the possible ways in which an interface could be implemented so that applications are likely to interoperate in the desired manner.

self-message – A graphical device used in a sequence diagram to indicate that an action is to be executed at this step in the sequence and that further execution of the business process cannot occur until the action shown in the self-message is completed. The action shown is internal to one system (or actor) and does not require messages between actors in order to be completed.

sequence diagram – A diagram that is intended to clarify the interactions between actors in a system, emphasizing the order of messages in time sequence.

synchronous action – A message in which the sending actor pauses to wait for the result of the message before continuing processing.

Unified Modeling Language (UML) – A language for visualizing, specifying, constructing and documenting the artifacts of a software-intensive system. UML is a standard of the Object Management Group (www.omg.org).

use case – A description of a set of sequences of actions, including variants, that a system performs in order to accomplish a desired goal.