	American Electric Power	4.2 Demand Response	Document ID: **Use case # 2.7**
	Title: **Demand Response HAN Device Provisioning**		

Subject Matter Expert:	Author:	Reviewed by:
Margaret Goodrich	BillSchleicher	Tim Simmons / Margaret Goodrich

Demand Response HAN Device Provisioning

"Acknowledgment: This material is based upon work supported by the Department of Energy under Award Number DE-OE0000193."

Version History			
Rev.	Date	Author	Change description
A	03/07/2011	Bill Schleicher	Initial Release
B	3/13/2011	Bill Schleicher	Modification made after review
C	08/08/2011	AEP workshop	Various updates
D	9/15/2011	Tim Simmons	Implement various updates
E	10/11/11	Brian D. Green	Add Narrative, Interface Diagram, Note(s) section and update Actors in sequence
F	10/19/11	Barry Peirce	Changes Tracked

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Summary:

This use case addresses the provisioning of (Home Area Network (HAN)) HAN Devices on the network and the communication of the provisioning from the AMI Head-End system to the Demand Response Application (DR Application) and onto the Customer Information System (CIS) via the MasterDataLinkageConfig message generated by the AMI Head-End.

Narrative:

This use case addresses how the customer, after installing a new ***HAN Device***, gets their ***HAN Device*** recognized by the ***Smart Meter***. The ***Smart Meter*** will then send provisioning confirmation for the new ***HAN Device*** onto the ***DR Application*** via the ***AMI Network*** and the ***AMI Head-End.***.

The customer installs a new ***HAN Device***, e.g. ***Programmable Communicating Thermostat (PCT)*** and or ***Load Control Device***. The ***ESI*** (part of the ***Smart Meter)*** recognizes the device and sends the devices registration information to the ***DR Application***. With coordiantion with the utility, the customer powers on the ***HAN Device*** and it begins the provisioning process with the ***ESI***. Once completed, the ***ESI*** sends the information on through to the ***DR Application*** via ***NIC*** (part of the ***Smart Meter***) and the ***AMI Network***. The ***DR Application*** then sends provisioning confirmation on to the ***Customer Information System (CIS).***

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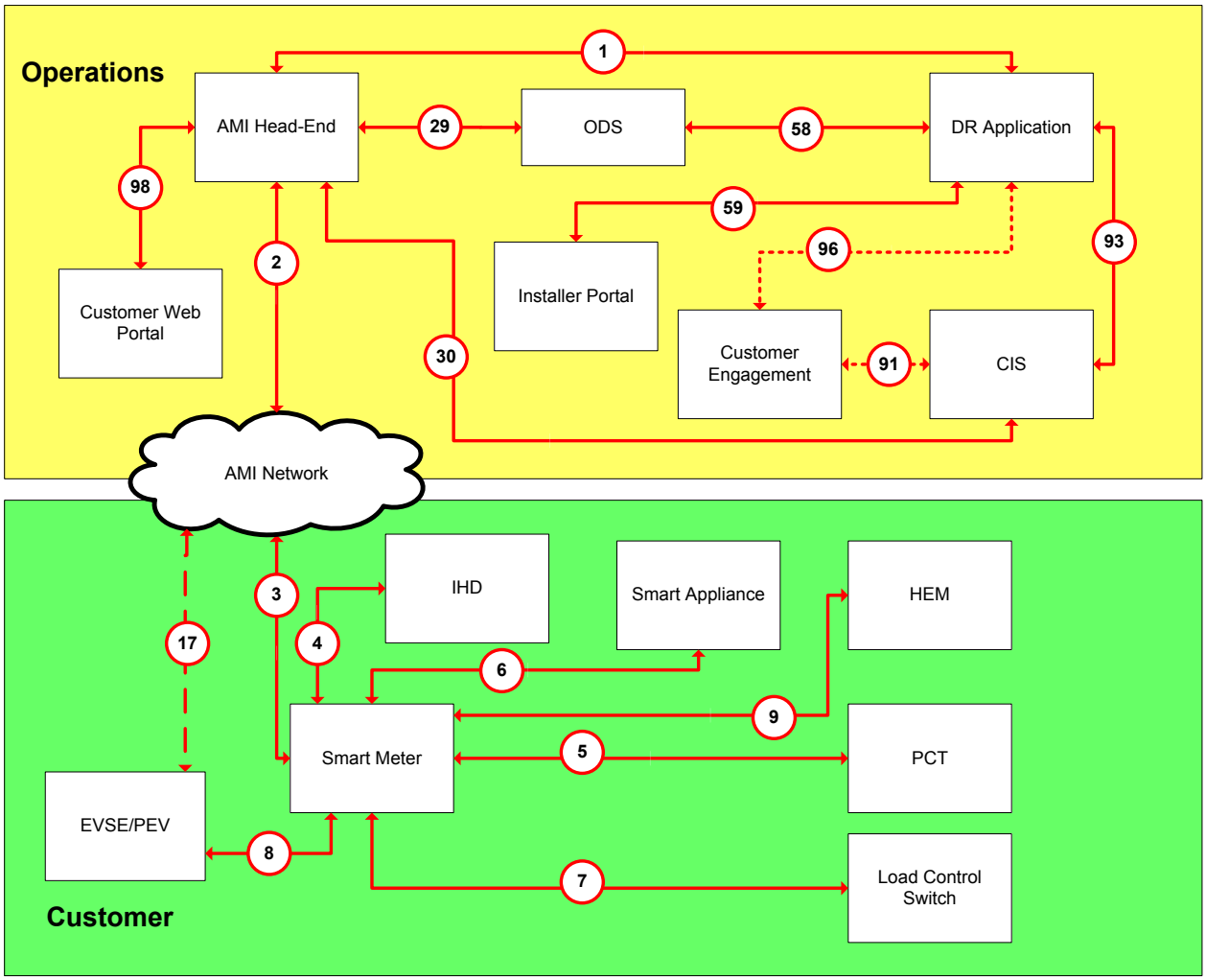
Interface Diagram:



Note(s):

For this example, a HAN Device can be a Programmable Communicating Thermostat (PCT) or a Load Control Switch.

The NIC and ESI are parts of the Smart Meter.

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Actor(s):

The list of the actors and the roles that are participating in this use case described in the table below.

Name	Role description
AMI Head-End	The AMI Head-End is the back office system that: 1) controls the Advanced Metering Infrastructure; 2) serves as a temporary repository for data extracted from the Smart Meters; 3) manages routing and schedules for the AMI network.
AMI Network	The AMI Network provides the communications between the AMI Head-End and the Smart Meters.
CIS	Customer Information System is the system of record for customer data and billing.
DR Application	Demand Response Application. This is the system for managing Demand Response and devices for load control, pricing, and messages.
ESI	HAN network interface component with NIC within the Smart Meter
HAN Device	A HAN Device is a device used for a variety of purposes within a customer premise. Examples of HAN devices include Load Control Switch(s) and Programmable Communicating Thermostats (PCTs).
NIC	AMI network interface component with Meter Metrology Board within the Smart Meter.

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Participating Business Functions:

The participating business function, its acronym and what they provide in this use case are detailed in the table below.

Acronym	Business Function/Abstract Component	Services or Information Provided
CIS	Customer Information System for customer data and billing system	Publishes changes to customer accounts, customer agreements, pricing, and service location to Metering System (MS). CIS also issues End Device Control messages such as the On Demand Request.
AMI	Advanced Metering Infrastructure for energy monitoring and recording, load control capability, tariff/rate data collection.	Energy monitoring and control, configuration of advanced meters, offers new rate programs, distribution automation, Meter Readings, Meter Events and Alarms.
DR Application	Demand Response Application	The DR Application provides Demand Response services and management such as Pricing including issuing both scheduled and unscheduled pricing signals, Rate/Tariff Plans, and Device Management including dispatching Load Control commands. Enrollment and HAN Device Management is also provided through this system.

Assumptions / Design Considerations:

- Standard International Electrotechnical Commission (IEC) 61968 Message Definition format will be followed to provide the Header, Request, Reply, and payload used when defining the messages for the design specifications. For the purpose of the use cases identified in this document these have been omitted as they are to be provided in the design specification for the DR HAN Device Provisioning use case.
- This use case is premised on SEP 1.0 messages
- This use case correlates to section 4.2.3 of the AEP IOP document. (Section 4.2.3 refers to DR Signal over the AMI and emphasises load control signals. Pricing, messages and HAN Device Management are also functions served over this interface.)
- This use case only applies to ZigBee technology.
- Customer has enrolled in a DR Program and enrollment has been documented within CIS
- Customer is not enrolled in RTP concurrently with DR

- HAN Device Information and Customer Information has been successfully imported into DR Application.
- User initiates a provision request to a targeted Smart Meter ESI within the DR Application.
- PCT and Load Control Switch HAN Devices support the metering application cluster; otherwise there is no communication that takes place during provisioning between the HAN Devices and the ESI.

Normal Sequence:

The sequences of events, showing the order in which they ocurr during the typical progression of this use case are provided in the table below. The Sequence Diagram that graphically depicts the events is presented immediately following the table.

Use Case Step	Triggering Event	Description Of Process	Information To Be Exchanged	Producer	Receiver	Message Type
1	DR Application has initiated the provisionin g action	DR Application sends a time-based provisioning window that allows for newly authorized HAN Devices to begin the process of provisioning to the ESI via AMI Network.	HAN Device MAC Address, HAN Device – Device Type, pre-configured security key, and a command to allow for the ESI to enable provisioning.	DR Applicati on	AMI Head-End	
2		AMI Head-End forwards provisioning window message to AMI Network	HAN Device MAC Address, HAN Device – Device Type, pre-configured security key, and a command to allow for the ESI to enable provisioning.	AMI Head-End	AMI Network	Proprietary

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Use Case Step	Triggering Event	Description Of Process	Information To Be Exchanged	Producer	Receiver	Message Type
3		AMI Network routes provisioning window message to ESI	HAN Device MAC Address, HAN Device – Device Type, pre-configured security key, and a command to allow for the ESI to enable provisioning.	AMI Network	NIC	Proprietary
4		NIC sends provisioning window message to ESI	HAN Device MAC Address, HAN Device – Device Type, pre-configured security key, and a command to allow for the ESI to enable provisioning.	NIC	ESI	Proprietary
5	HAN Device discovery initiated	Customer installs HAN Device(s) while the provisioning window is active on the NIC-ESI. HAN joining is initiated automatically or through a button push on the HAN Device.	MAC Address of HAN Device	HAN Device	ESI	Zigbee, SEP 1.0
6		ESI verifies that the HAN Device is authorized to provision to the HAN and responds with network and commissioning information. Upon completion, HAN Device is joined to the HAN.	Network Key, 16-bit short address, and PAN ID.	ESI	HAN Device	Zigbee, SEP 1.0

Use Case Step	Triggering Event	Description Of Process	Information To Be Exchanged	Producer	Receiver	Message Type
7		HAN Device identifies and requests attributes and cluster information, as well as, negotiates message size with ESI. ESI identifies attributes and cluster information and responds to HAN Device requests accordingly. Upon completion, HAN Device has been commissioned and all application binding has been completed.	For each end point, Payload or message size, attributes and clusters that are supported by each interface are exchanged and agreed too. The exchange of information involves many transactions that includes time and time status.	HAN Device	ESI	Zigbee, SEP 1.0
8		HAN Device initiates and completes security registration with the NIC-ESI and receives its new application key via a secure transaction. Upon completion, HAN Device has been provisioned to the ESI.	New Application key	HAN Device	ESI	Zigbee, SEP 1.0
9		HAN Device requests and receives current and pending application information from the ESI.	Any messages or attributes that are both supported by the HAN Device and ESI are requested by the HAN Device i.e. active text messages, prices, load control events, and or metering reads.	HAN Device	ESI	ZigBee, SEP 1.0

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Use Case Step	Triggering Event	Description Of Process	Information To Be Exchanged	Producer	Receiver	Message Type
10	HAN Device Provisioned to ESI	ESI sends the HAN Device Provisioning state to NIC.	Provisioned State, HAN Device – MAC Address	ESI	NIC	Proprietary
11		NIC sends the HAN Device Provisioning state to AMI Network.	Provisioned State, HAN Device – MAC Address	NIC	AMI Network	Proprietary
12		AMI Network routes the HAN Device Provisioning state to AMI Head-End.	Provisioned State, HAN Device – MAC Address	AMI Network	AMI Head-End	Proprietary
13		AMI Head-End sends the HAN Device Provisioning state to DR Application	Provisioned State, HAN Device – MAC Address	AMI Head-End	DR Application	Create /MasterDataLinkageConfig
14		DR Application sends HAN Device Status, Premise ID(?) to CIS i.e. Premise ID: 123456789, Joined,.	Premise-HAN Device DR join-registration message	DR Application	CIS	Create /MasterDataLinkageConfig

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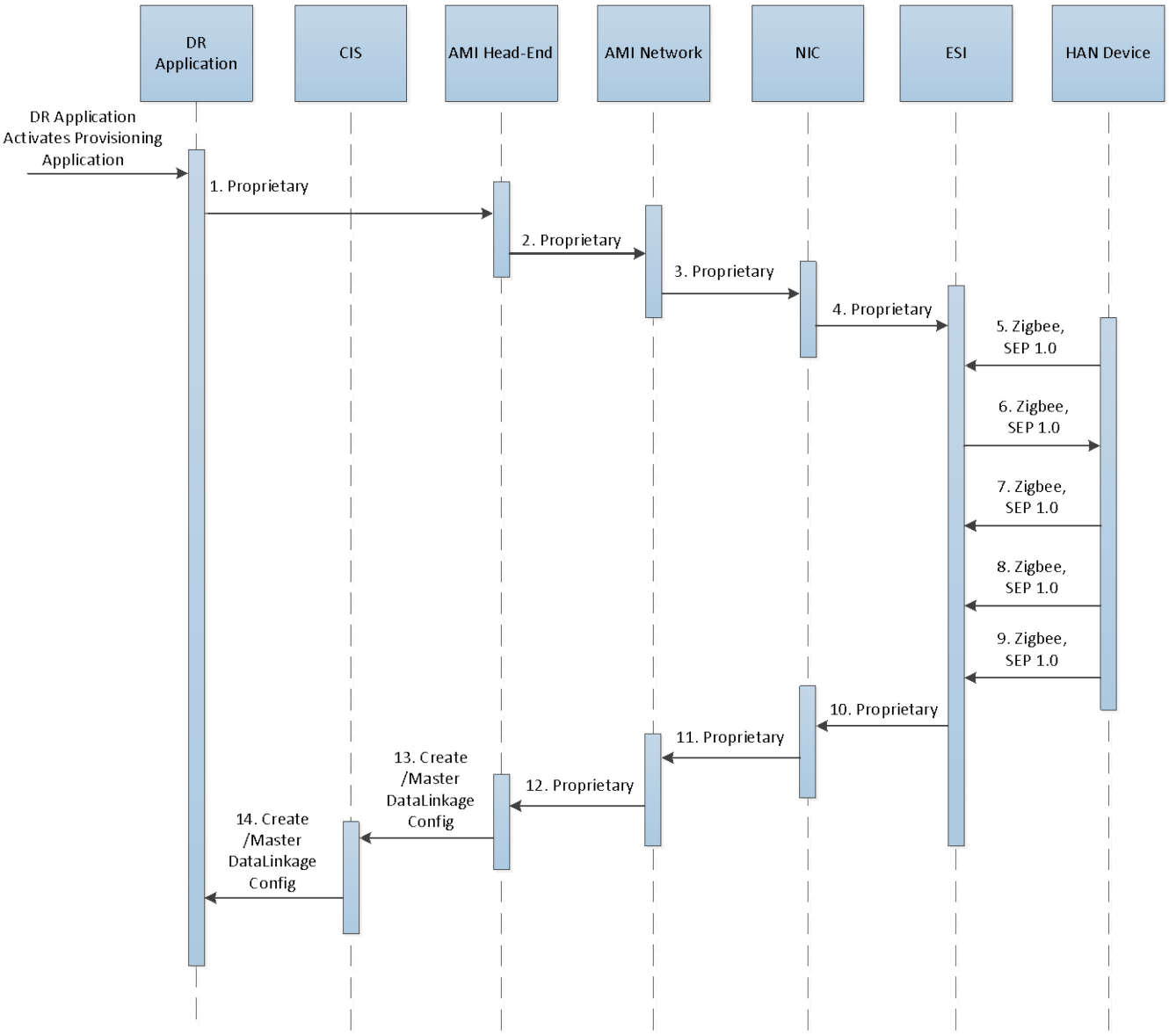


Integration Scenarios

Adapters will use the Common Information Model (CIM) in Extensible Markup Language (XML) to send and receive messages and events.

The following are the points of integration that must be tested for this use case. Other non-CIM message interfaces may be testable in this use case.

Actor	Interface Points
CIS	• AMI Head-End
AMI Head-End	• AMI Network • CIS • DR Application • ODS

Pre-conditions:

The following conditions that MUST be met before this use case can occur.

- Customer's Smart Meter must be registered with the AMI Head-End systems functioning fully on the AMI network.
- The Smart Meter record must be created in CIS
- HAN Device must be imported and linked to customer and or rate programs within the DR Application

Post-conditions:

The following events or actions that may happen after or be caused by the completion of the normal use case events, as well as the exceptions or alternative sequences are:

The following systems must be updated once the HAN Device binding is complete and the MasterDataLinkageConfig message (Need SME to verify) is sent by the AMI Head-End system.

- HAN Device Configuration data is sent to the CIS System ?
- HAN Device provisioning state information is sent to the DRMS System i.e. joined.
- Active enrollment is passed from the DRMS to CIS and or ODS?

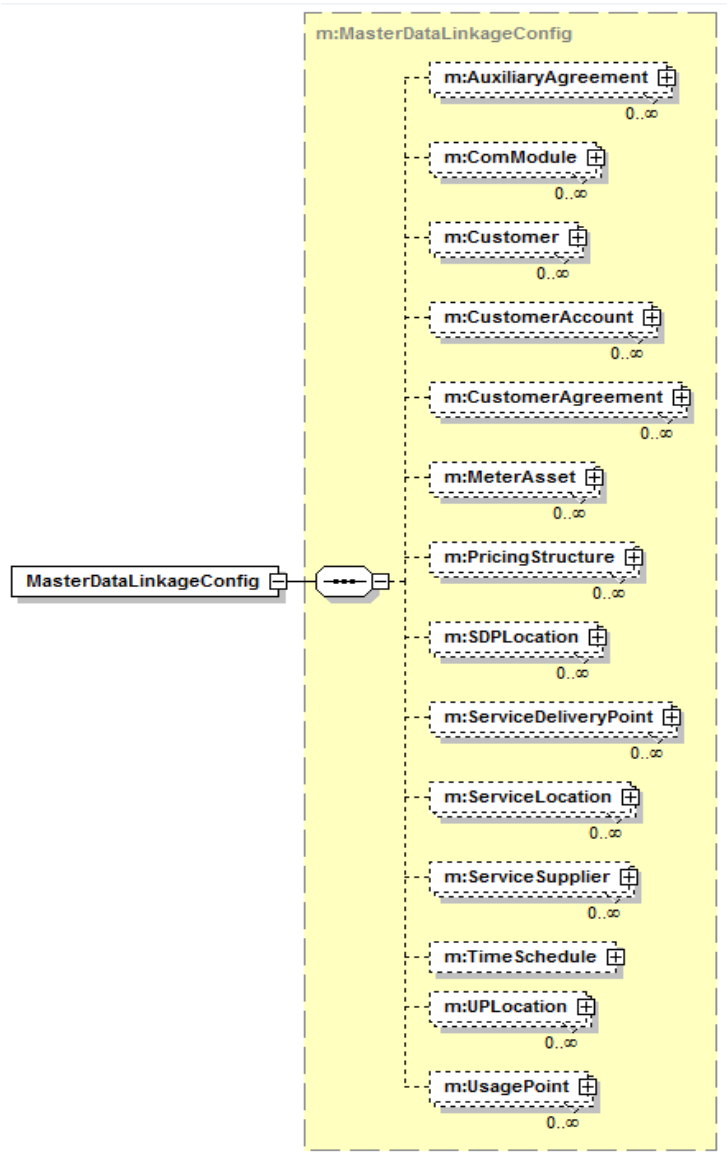
Exceptions / Alternate Sequences: None

There are no exceptions, unusual events or alternate sequences defined for this use case.

Use Case Step	Triggering Event	Description Of Process	Information To Be Exchanged	Producer	Receiver	Message Type

Message Type(s) Diagram:

The following XML Schema Definition (XSD) diagram shows the normative and informative parts of the message. Not all of the International Electrotechnical Commission's (IEC) – CIM message optional elements must or will be used in the use of IEC – CIM for this specific use case.



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References:

Use Cases or other documentation referenced by this use case include:

- **61968_9_MeterReadingAndControl_2ed-working-draft-20110215.docx:** Section 5.2 (End Device Management); Annex H.6 (XML Schemas for MeterReadings)

Issues: None

ID	Description	Status

Miscellaneous Notes:

Configuration of HAN devices has recently moved under the MasterDataLinkageConfig message format. Although not yet fully documented in the 61968-9 Meter Reading and Control document, the HAN device ID messaging will be consistent with the diagram below.