

# **AMI Network (Moving Data Elements from the AMI Head-End to Smart Meter & from the Smart Meter to the AMI Head-End)**

**Version 3.0**

**April 22nd, 2010**

## **1 Descriptions of Function**

This use case describes how data will travel through the AMI Network. One scenario describes how the data will move from the AMI Head-End to the Smart Meter. The second scenario describes how the data moves from the Smart Meter to the AMI Head-End

### **1.1 Function Name**

AMI Network – AMI Head-End to the Smart Meter and Smart Meter to the AMI Head-End

### **1.2 Function ID**

*Identification number of the function*

### **1.3 Brief Description**

Advanced Metering Infrastructure (AMI) is a transforming technology that has broad impact on the energy market and its consumers. AMI allows utilities to balance supply, demand, and capacity making a smarter, more efficient, grid by pushing aspects of grid monitoring and control out to the endpoints of delivery. Stakeholders are implementing the systems and technologies required to deploy AMI today.

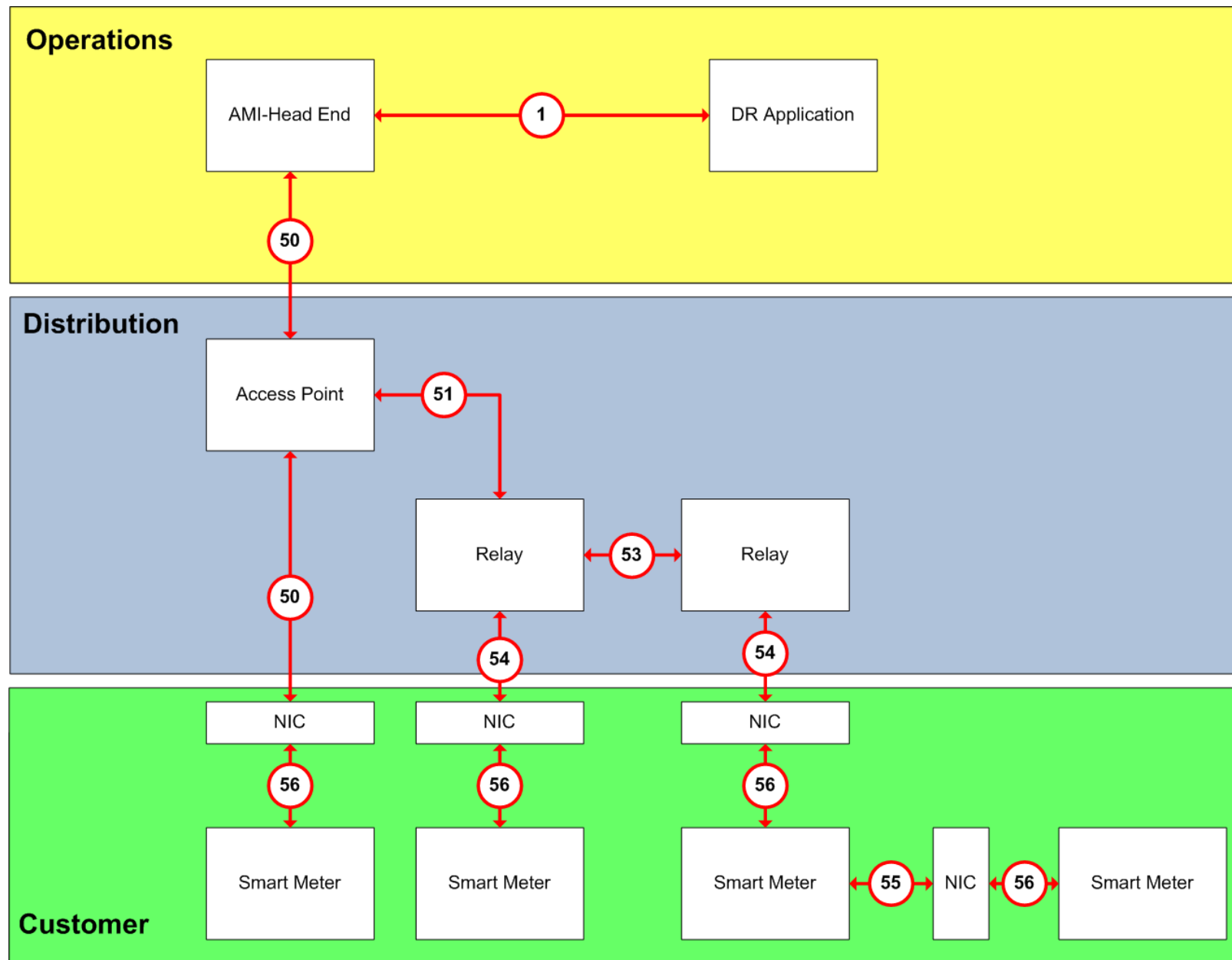
Advanced Metering Infrastructure (AMI) is a two-way communication system that can reach every device in the distribution space. The industry focus in embracing AMI as opposed to Automatic Meter Reading (AMR) is that the communication system is not dedicated to a single application. Instead, AMI is a flexible, general-purpose communication system that can be used for many applications – including meter reading, distribution automation, connect/disconnect, and others.

AMI systems promise to provide advanced energy monitoring and recording, sophisticated tariff/rate program data collection, and load management command and control capabilities. Additionally, these powerful mechanisms will enable consumers to better manage their energy

usage, and allowing the grid to be run more efficiently from both a cost and energy delivery perspective. These advanced capabilities will also allow utilities to provision and configure the advanced meters in the field, offering new rate programs, and energy monitoring and control.

## **1.4 Narrative**

This Use Case handles the transfer of any data element from the AMI Head-End to the Smart Meter. It is intended to be an intermediary Use Case, called and reused by many other Use Cases. The Use Case provides for scenarios such as meter to meter, relay to meter, and relay to relay to meter communications paths. It hides the complexity of the *Access Point* sending messages directly to a Smart Meter *NIC* and to a *Smart Meter* through a combination of *Relays* and *Smart Meters*.



**Figure 1-1**  
**Context Diagram for AMI Network**

### 1.5 Actor (Stakeholder) Roles

<i>Grouping (Community)</i>		<i>Group Description</i>
<i>Actor Name</i>	<i>Actor Type (person, organization, device, system, or subsystem)</i>	<i>Actor Description</i>
AMI Head-End	Device	The AMI Head-End is the back office system than controls the Advanced Metering Infrastructure.
Firewall/DMZ	Device	A piece of computer software or hardware intended to prevent unauthorized access to system software or data
Backhaul Router	Device	The access point in the mesh router communicates with the mobile users in the area.
Backhaul Network	Device	The high capacity line from a wireless mesh network to the LAN. The backhaul side of the device relays the traffic from router to router wireless until it reaches a gateway that connects to the Internet or other private network via a wired or wireless connection.
Backhaul Gateway	Device	
Access Point	Device	The Access Point is a sub-system within the AMI system that performs high volume data transport capabilities.
Relay (AMI)	Device	A sub-system of the AMI system that typically relays the data using radio signals between the meters and the access points.

<i>Grouping (Community)'</i>		<i>Group Description</i>
<i>Actor Name</i>	<i>Actor Type (person, organization, device, system, or subsystem)</i>	<i>Actor Description</i>
NIC-ESP	Device	AMI side of the network interface card within the Smart Meter.

*Replicate this table for each logic group.*

## **1.6 Information exchanged**

*Describe any information exchanged in this template.*

<i>Information Object Name</i>	<i>Information Object Description</i>
Data Elements that need to be sent to the Smart Meter	In the context of this Use Case, a Data Elements may represent any generic piece of data or information that needs to be sent over the AMI Network.

## **1.7 Activities/Services**

*Describe or list the activities and services involved in this Function (in the context of this Function).*

<i>Activity/Service Name</i>	<i>Activities/Services Provided</i>

## 1.8 Contracts/Regulations

Identify any overall (human-initiated) contracts, regulations, policies, financial considerations, engineering constraints, pollution constraints, and other environmental quality issues that affect the design and requirements of the Function.

<i>Contract/Regulation</i>	<i>Impact of Contract/Regulation on Function</i>

<i>Policy</i>	<i>From Actor</i>	<i>May</i>	<i>Shall Not</i>	<i>Shall</i>	<i>Description (verb)</i>	<i>To Actor</i>

<i>Constraint</i>	<i>Type</i>	<i>Description</i>	<i>Applies to</i>

## 2 Step by Step Analysis of Function

Describe steps that implement the function. If there is more than one set of steps that are relevant, make a copy of the following section grouping (Steps to implement function, Preconditions and Assumptions, Steps normal sequence, Post-conditions) and provide each copy with its own sequence name.

### 2.1 Steps to implement function – Name of Sequence

AMI Head-End to Smart Meter

#### 2.1.1 Preconditions and Assumptions

Describe conditions that must exist prior to the initiation of the Function, such as prior state of the actors and activities

<i>Actor/System/Information/Contract</i>	<i>Preconditions or Assumptions</i>
AMI Head-End	All elements of the SilverSpring AMI network are proprietary in nature and are part of a whole; thus cannot work in isolation of each other.
Backhaul Network	Telecom links are required between AMI network elements and these links are implemented differently depending on geography, availability, coverage and throughput (private, public, land-line, wireless).

## 2.1.2 Steps – Name of Sequence

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environment
#	<i>Triggering event? Identify the name of the event.<sup>1</sup></i>	<i>What other actors are primarily responsible for the Process/Activity? Actors are defined in section0.</i>	<i>Label that would appear in a process diagram. Use action verbs when naming activity.</i>	<i>Describe the actions that take place in active and present tense. The step should be a descriptive noun/verb phrase that portrays an outline summary of the step. “If ...Then...Else” scenarios can be captured as multiple Actions or as separate steps.</i>	<i>What other actors are primarily responsible for Producing the information? Actors are defined in section0.</i>	<i>What other actors are primarily responsible for Receiving the information? Actors are defined in section0.  (Note – May leave blank if same as Primary Actor)</i>	<i>Name of the information object. Information objects are defined in section 1.6</i>	<i>Elaborate architectural issues using attached spreadsheet. Use this column to elaborate details that aren’t captured in the spreadsheet.</i>	<i>Reference the applicable IECSA Environment containing this data exchange. Only one environment per step.</i>
1.1	Data needs to be sent from AMI Head-End to Smart Meter	AMI Head-End	Data Elements to the LAN	AMI Head-End sends Data Elements to the LAN	AMI Head-End	LAN	Data Elements that need to be sent to the Smart Meter		

<sup>1</sup> Note – A triggering event is not necessary if the completion of the prior step – leads to the transition of the following step.

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environment
1.2		AMI Head-End	Data Elements to the Firewall/DMZ	LAN sends Data Elements to the Firewall/DMZ	LAN	Firewall/DMZ	Data Elements that need to be sent to the Smart Meter		
1.3		Firewall/DMZ	Data Elements to the Backhaul Router	Firewall/DMZ sends Data Elements to the Backhaul Router	Firewall/DMZ	Backhaul Router	Data elements that need to be sent to the Smart Meter		
1.4		Backhaul Router	Data Elements to the Backhaul Network	Backhaul Router sends Data Elements to the Backhaul Network	Backhaul Router	Backhaul Network	Data elements that need to be sent to the Smart Meter		
1.5		Backhaul Network	Data Elements to the Backhaul Gateway	Backhaul Network sends Data Elements to the Backhaul Gateway	Backhaul Network	Backhaul Gateway	Data elements that need to be sent to the Smart Meter		
1.6		Backhaul Gateway	Data Elements to the Access Point	Backhaul Gateway sends Data Elements to the Access Point	Backhaul Gateway	Access Point	Data elements that need to be sent to the Smart Meter		
1.7 A.1		Access Point	Data Elements to NIC-ESP	Access Point sends Data Elements to NIC-ESP	Access Point	NIC-ESP	Data elements that need to be sent to the Smart Meter		



#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environment
1.7 B.1		Access Point	Data Elements to Relay (AMI)	Access Point sends Data Elements to Relay (AMI)	Access Point	Relay (AMI)	Data elements that need to be sent to the Smart Meter		
1.7 B.2		Relay (AMI)	Data Elements to Relay (AMI)	Relay (AMI) sends Data Elements to Relay (AMI)	Relay (AMI)	Relay (AMI)	Data elements that need to be sent to the Smart Meter	As needed	
1.7 B.3		Relay (AMI)	Data Elements to NIC-ESP	Relay (AMI) sends Data Elements to NIC-ESP	Relay (AMI)	NIC-ESP	Data elements that need to be sent to the Smart Meter		
1.7 C.1		Access Point	Data Elements to NIC-ESP	Access Point sends Data Elements to NIC-ESP	Access Point	NIC-ESP	Data elements that need to be sent to the Smart Meter	As needed	
1.7. C.2		NIC-ESP	Data Elements to NIC-ESP	NIC-ESP sends Data Elements to NIC-ESP	NIC-ESP	NIC-ESP	Data elements that need to be sent to the Smart Meter		

### 2.1.3 Post-conditions and Significant Results

*Describe conditions that must exist at the conclusion of the Function. Identify significant items similar to that in the preconditions section.*

<i>Actor/Activity</i>	<i>Post-conditions Description and Results</i>

### 3 Step by Step Analysis of Function

*Describe steps that implement the function. If there is more than one set of steps that are relevant, make a copy of the following section grouping (Steps to implement function, Preconditions and Assumptions, Steps normal sequence, Post-conditions) and provide each copy with its own sequence name.*

#### 3.1 Steps to implement function – Name of Sequence

Smart Meter to AMI Head-End

##### 3.1.1 Preconditions and Assumptions

*Describe conditions that must exist prior to the initiation of the Function, such as prior state of the actors and activities*

<i>Actor/System/Information/Contract</i>	<i>Preconditions or Assumptions</i>
AMI Head-End	All elements of the SilverSpring AMI network are proprietary in nature and are part of a whole; thus cannot work in isolation of each other.
Backhaul Network	Telecom links are required between AMI network elements and these links are implemented differently depending on geography, availability, coverage and throughput (private, public, land-line, wireless).

##### 3.1.2 Steps – Name of Sequence

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environment
#	<i>Triggering event? Identify the name of the event.<sup>2</sup></i>	<i>What other actors are primarily responsible for the Process/Activity? Actors are defined in section0.</i>	<i>Label that would appear in a process diagram. Use action verbs when naming activity.</i>	<i>Describe the actions that take place in active and present tense. The step should be a descriptive noun/verb phrase that portrays an outline summary of the step. "If ...Then...Else" scenarios can be captured as multiple Actions or as separate steps.</i>	<i>What other actors are primarily responsible for Producing the information? Actors are defined in section0.</i>	<i>What other actors are primarily responsible for Receiving the information? Actors are defined in section0.  (Note – May leave blank if same as Primary Actor)</i>	<i>Name of the information object. Information objects are defined in section 1.6</i>	<i>Elaborate architectural issues using attached spreadsheet. Use this column to elaborate details that aren't captured in the spreadsheet.</i>	<i>Reference the applicable IECSA Environment containing this data exchange. Only one environment per step.</i>
2.1 A.1	Elements of AMI System deliver data elements that need to be sent to the AMI Head-End	NIC-ESP	Data Elements to the Access Point	NIC-ESP sends Data Elements to the Access Point	NIC-ESP	Access Point	Data Elements that need to be sent to the AMI Head		
2.1 B.1		NIC-ESP	Data Elements to the NIC-ESP	NIC-ESP sends Data Elements to the NIC-ESP	NIC-ESP	NIC-ESP	Data Elements that need to be sent to the AMI Head	As necessary	
2.1 B.2		NIC-ESP	Data Elements to the Relay (AMI)	NIC-ESP sends Data Elements to the Relay (AMI)	NIC-ESP	Relay (AMI)	Data Elements that need to be sent to the AMI Head	As necessary	

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<sup>2</sup> Note – A triggering event is not necessary if the completion of the prior step – leads to the transition of the following step.

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environment
2.1 B.3		Relay (AMI)	Data Elements to the Access Points	Relay (AMI) sends Data Elements to the Access Points	Relay (AMI)	Access Points	Data Elements that need to be sent to the AMI Head		
2.1 C.1		NIC-ESP	Data Elements to the Relay (AMI)	NIC-ESP sends Data Elements to the Relay (AMI)	NIC-ESP	Relay (AMI)	Data Elements that need to be sent to the AMI Head		
2.1 C.2		Relay (AMI)	Data Elements to another Relay (AMI)	Relay (AMI) sends Data Elements to another Relay (AMI)	Relay (AMI)	Relay (AMI)	Data Elements that need to be sent to the AMI Head	As necessary	
2.1 C.3		Relay (AMI)	Data Elements to the Access Points	Relay (AMI) sends Data Elements to the Access Points	Relay (AMI)	Access Points	Data Elements that need to be sent to the AMI Head		
2.2		Access Point	Data Elements to the Backhaul Gateway	Access Point sends Data Elements to the Backhaul Gateway	Access Point	Backhaul Gateway	Data Elements that need to be sent to the AMI Head		
2.3		Backhaul Gateway	Data Elements to the Backhaul Network	Backhaul Gateway sends Data Elements to the Backhaul Network	Backhaul Gateway	Backhaul Network	Data Elements that need to be sent to the AMI Head		

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environment
2.4		Backhaul Network	Data Elements to the Backhaul Router	Backhaul Network sends Data Elements to the Backhaul Router	Backhaul Network	Backhaul Router	Data Elements that need to be sent to the AMI Head		
2.5		Backhaul Network	Data Elements to the Firewall/DMZ	Backhaul Router sends Data Elements to the Firewall/DMZ	Backhaul Router	Firewall/DMZ	Data Elements that need to be sent to the AMI Head-End		
2.6		Firewall/DMZ	Data Elements to the LAN	Firewall/DMZ sends Data Elements to the LAN	Firewall/DMZ	LAN	Data Elements that need to be sent to the AMI Head-End		
2.7		LAN	Data Elements to the AMI Head-End	LAN sends Data Elements to the AMI Head-End	LAN	AMI Head-End	Data Elements that need to be sent to the AMI Head-End		

### 3.1.3 Post-conditions and Significant Results

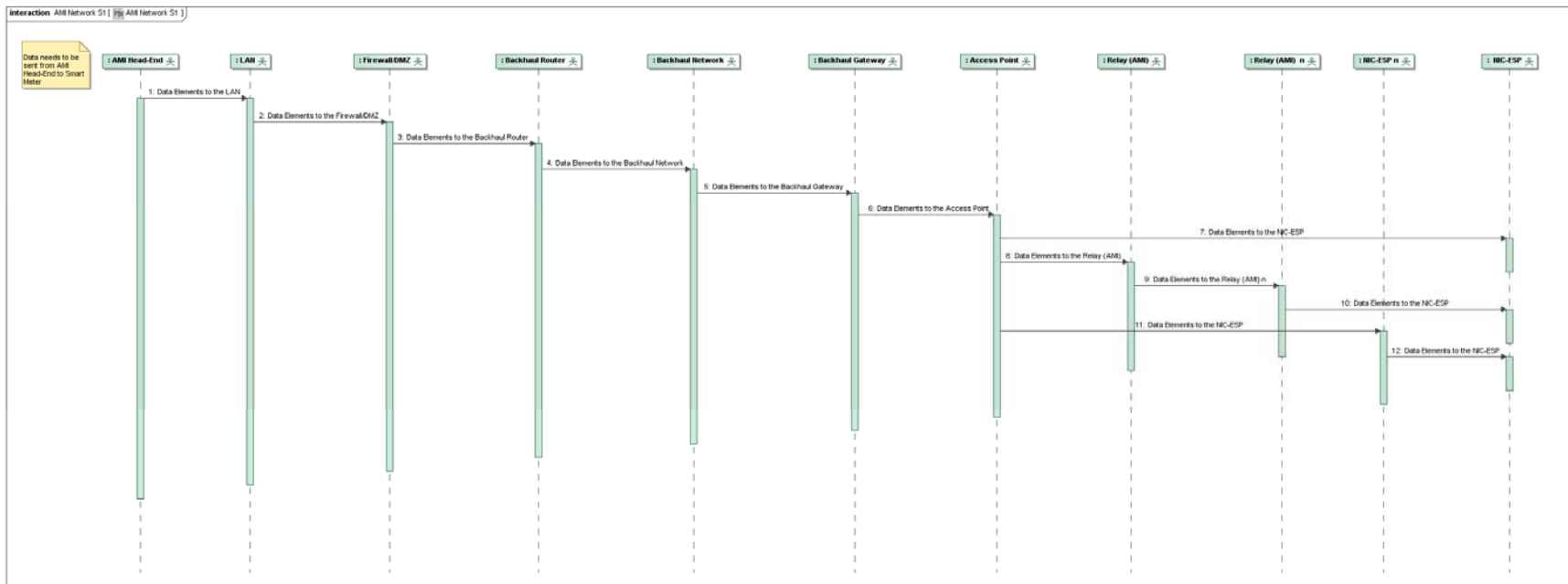
*Describe conditions that must exist at the conclusion of the Function. Identify significant items similar to that in the preconditions section.*

<i>Actor/Activity</i>	<i>Post-conditions Description and Results</i>

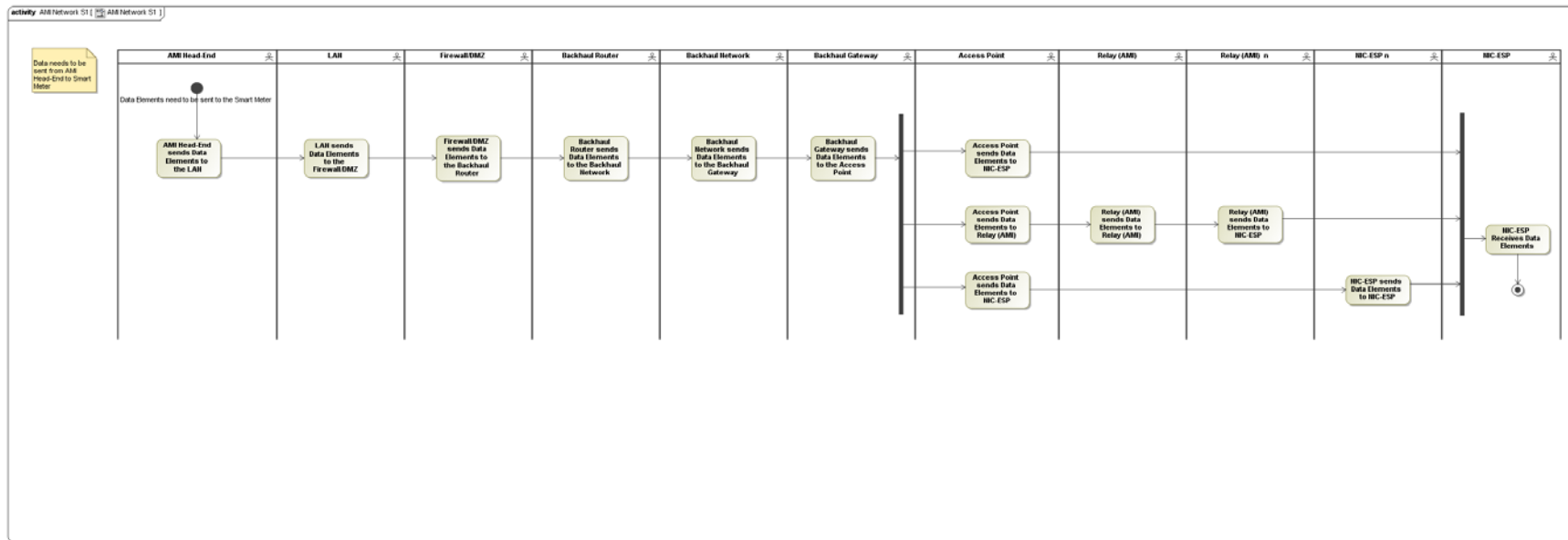
## 3.2 Architectural Issues in Interactions

Elaborate on all architectural issues in each of the steps outlined in each of the sequences above. Reference the Step by number.

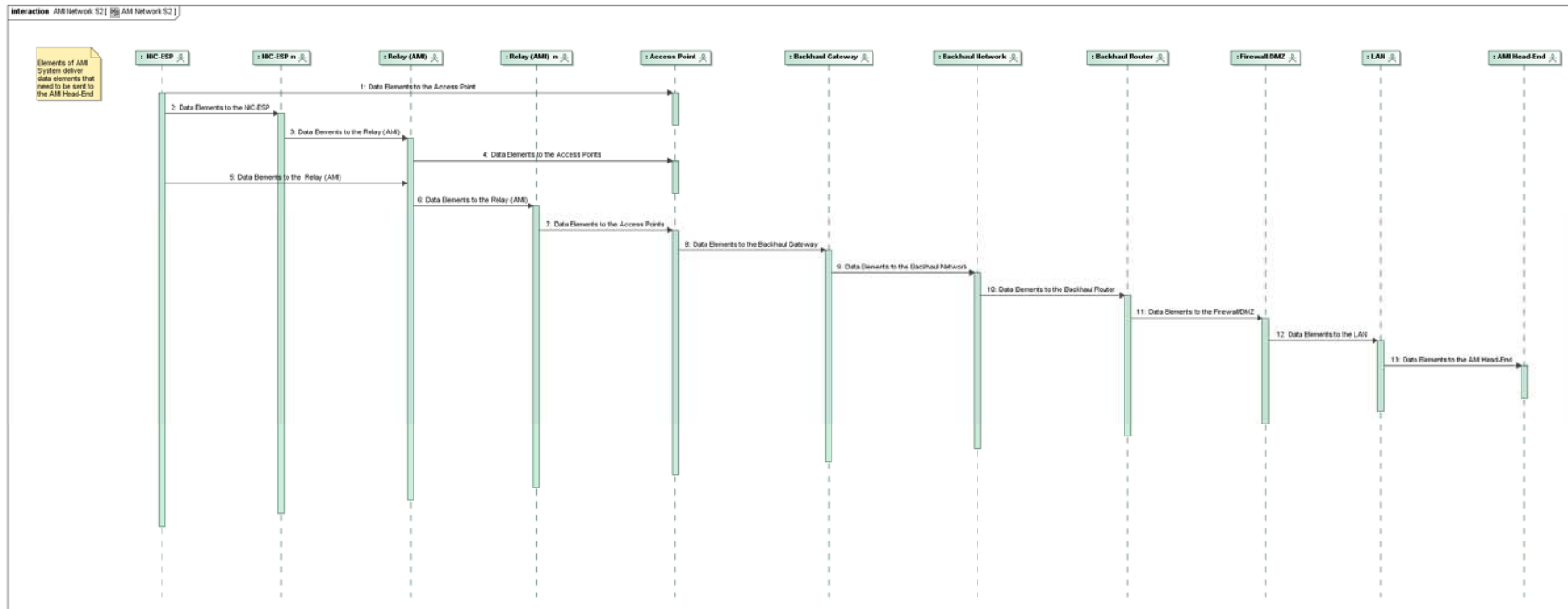
## 3.3 Diagram



AMI Network Scenario 1 Sequence Diagram

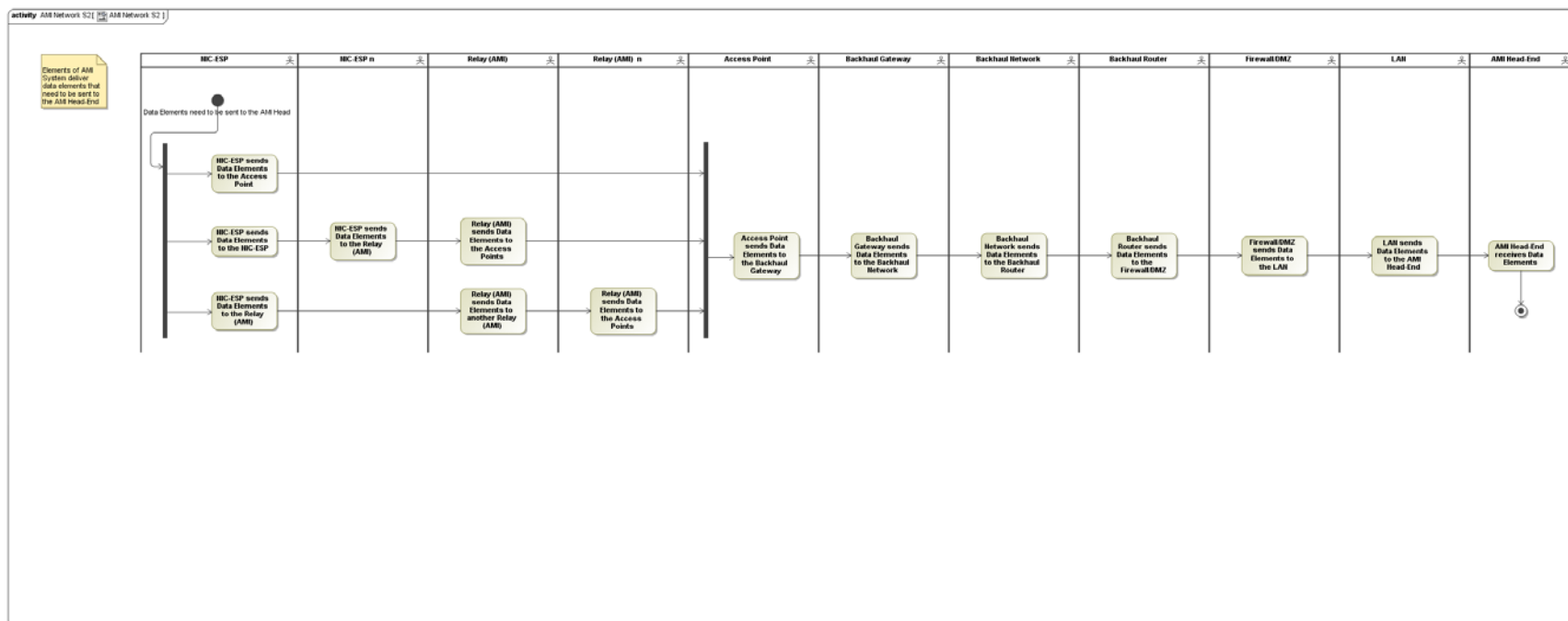


*AMI Network Scenario 1 Activity Diagram*



*AMI Network Scenario 2 Sequence Diagram*





AMI Network Scenario 2 Activity Diagram

## 4 Auxiliary Issues

### 4.1 References and contacts

ID	Title or contact	Reference or contact information
[1]		Silver Springs Representative

## 4.2 Action Item List

ID	Description	Status
[1]		

## 4.3 Revision History

No	Date	Author	Description
1.1	3-27-2010	Brian D. Green	Original Use Case
1.2	3-28-2010	J.R. Cote	Update Actors
1.3	3-30-2010	Brian D. Green	Update Sequence
1.4	3-31-2010	John Simmins	Update Sequence
1.5	4-5-2010	Brian D. Green	Clean-Up
1.6	4-6-2010	Brian D. Green	Clean-Up
2.0	4-10-2010	John Simmins	Fill in blanks and narrative and description
3.0	4-22-2010	Brian D. Green	Add Utility comments and diagrams