



RECOMMENDATION TO NAESB EXECUTIVE COMMITTEE

For Quadrant: Retail Electric Quadrant

Requesters: Open ADE Task Force

Request No.: R10008

Request Title: Energy Services Provider Interface Standard

1

2 **1. RECOMMENDED ACTION:**

**EFFECT OF EC VOTE TO ACCEPT
RECOMMENDED ACTION:**

3

- Accept as requested
- Accept as modified below
- Decline

- Change to Existing Practice
- Status Quo

4 **2. TYPE OF DEVELOPMENT/MAINTENANCE**

Per Request:

- Initiation
- Modification
- Interpretation
- Withdrawal

- Principle
- Definition
- Business Practice Standard Document
- Data Element
- Code Value
- X12 Implementation Guide
- Business Process Documentation

Per Recommendation:

- Initiation
- Modification
- Interpretation
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- Definition
- Business Practice Standard Document
- Data Element
- Code Value
- X12 Implementation Guide
- Business Process Documentation

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6 **3. RECOMMENDATION**

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8 **SUMMARY:**

9 The UCAlug OpenADE Task Force submitted a request for the initiation of NAESB Model
10 Business Practices on July 29, 2010 (R10008) to standardize the interface which allows for the
11 exchange of energy usage information between designated parties. The UCAlug OpenADE
12 Task Force provided the artifacts on which these Model Business Practices were based.

13 These Model Business Practices will build on the NAESB Energy Usage Information (EUI)
14 Model and, subject to the Governing Documents and Applicable Regulatory Authority, will help
15 enable Retail Customers to share energy usage information with Third Parties who have
16 acquired the right to act in this role. This Energy Services Provider Interface will provide a
17 consistent method for Retail Customers to authorize a Third Party to gain access to energy
18 usage data. Doing so will help enable Retail Customers to choose Third Party products to
19 assist them to better understand their energy usage and to make more economical decisions
20 about their usage. This Energy Services Provider Interface will contribute to the development of



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21 an open and interoperable method for Third Party authorization and machine-to-machine
22 exchange of Retail Customer usage information.

23

24 **RECOMMENDED STANDARDS:**

25

26 **REQ.21 ENERGY SERVICES PROVIDER INTERFACE**

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28 **EXECUTIVE SUMMARY**

29 This document establishes the Model Business Practices for the Energy Services
30 Provider Interface. For Retail Customers to better realize the benefits of the
31 Smart Grid, Retail Customer related data (e.g. usage information, etc.) should be
32 made available in a timely manner to the Retail Customer and to the Authorized
33 Third Parties chosen by the Retail Customer.

34

35 The Energy Services Provider Interface encompasses a variety of interactions
36 between Retail Customers, Distribution Companies, and Third Parties. In a
37 business environment where best practices are voluntary, Model Business
38 Practices should be applied within the context of regulatory requirements and
39 agreements. These Model Business Practices define an Energy Services
40 Provider Interface, but any obligation to use it would be established by Governing
41 Documents and Applicable Regulatory Authority rules and regulations not these
42 Model Business Practices

43

44 **INTRODUCTION**

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46 The North American Energy Standards Board (NAESB) is a voluntary non-profit
47 organization comprised of members from all aspects of the natural gas and
48 electric industries. Within NAESB, the Retail Electric Quadrant (REQ) and the
49 Retail Gas Quadrant (RGQ) focus on issues impacting the retail sale of energy to
50 Retail Customers. REQ / RGQ Model Business Practices are intended to provide
51 guidance to Distribution Companies, and other Market Participants involved in
52 providing energy service to Retail Customers. The focus of these Model
53 Business Practices is the Energy Service Provider Interface.

54

55 These Model Business Practices are voluntary and do not address policy issues
56 that are the subject of state legislation or regulatory decisions. These Model
57 Business Practices have been adopted with the realization that as the industry
58 evolves, additional and amended Model Business Practices may be necessary.



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Any industry participant seeking additional or amended Model Business Practices (including principles, definitions, data elements, process descriptions, and technical implementation instructions) should submit a request to the NAESB office, detailing the change, so that the appropriate process may take place to amend the Model Business Practice.



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BUSINESS PROCESSES AND PRACTICES

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Overview

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REQ.21.1 Principles

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REQ.21.1.1 The processes for ESPI should minimize the complexity associated with authorizing Third Parties to access Retail Customers energy usage data.

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REQ.21.1.2 The processes associated with the ESPI should be consistent with any related requirements established by the Governing Documents and Applicable Regulatory Authority.

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REQ.21.2 Definitions

81

REQ.21.2.A Business Definitions [Definitions identified with an asterisk are works in process to be modified based on the actors identified in the use cases]

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TASK FORCE NOTE: The REQ working glossary can be found through the following link: http://www.naesb.org/pdf3/req_rqg_glossary_defined_terms.xls

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Terms used from the glossary

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Applicable Regulatory Authority: The state regulatory agency or other local governing body that provides oversight, policy guidance, and direction to any parties involved in the process of providing energy to Retail Customers through regulations and orders.

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Distribution Company: A regulated Entity which provides distribution services and may provide energy and/or transmission/transportation services in a given area.

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Entity: A person or organization with sufficient legal standing to enter into a contract or arrangement with another such person or organization (as such legal standing may be determined by those parties) for the purpose of conducting and/or coordinating energy transactions.

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Governing Documents: Documents that determine the interactions among parties, including but not limited to: applicable law, regulatory documents (e.g., tariffs, rules,



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103 regulations), contractual agreements, Distribution Company Operational Manuals, and
104 other relevant models and operational procedures.

105
106 **Retail Customer:** Any Entity that takes gas and/or electric service for its own
107 consumption.

108

109 **REQ.21.2.B Technical Definitions**

110 *[Definitions identified with an asterisk are works in process to be modified based on the actors*
111 *identified in the use cases]*

112

113 **REQ.21.2.B.x Authorizing Entity:** An Entity (e.g. PUC, Distribution Company,
114 bonding agent, etc.) who approves a Third Party to utilize the
115 Energy Services Provider Interface. (return to this and add
116 specifics)

117

118 **REQ.21.2.B.x Third Party:** An Entity which provides some service to a Retail
119 Customer based on information it does not have direct access to
120 or direct authority over. A Third Party relies on a Data Custodian
121 to provide access to Retail Customer information.

122

123 **REQ.21.2.B.x Authorized Third Party:** A Third Party that has been approved
124 by the Authorizing Entity to utilize the Energy Services Provider
125 Interface. Third Party must provide proof that they meet the
126 governing documents' requirements for data security and data
127 privacy protection in order to become an Authorized Third Party..

128

129 ***REQ.21.2.B.x Energy Service Provider Interface:** A standardized machine-to
130 machine interface that permits a Data Custodian to share, at the
131 Retail Customer's request and under the Retail Customer's
132 direction, a broad set of that Retail Customer's Data Custodian
133 data with Authorized Third Parties.

134

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136 **REQ.21.2.B.x Personally Identifiable Information:** any information about an
137 individual maintained by an agency, including (1) any information
138 that can be used to distinguish or trace an individual's identity,
139 such as name, social security number, date and place of birth,
140 mother's maiden name, or biometric records; and (2) any other
141 information that is linked or linkable to an individual, such as
142 medical, educational, financial, and employment information¹.

¹ NIST Special Publication 800-122, Guide to Protecting the Confidentiality of Personally Identifiable Information (PII) April 2010, page 2-1.



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REQ.21.2.B.x

Data Custodian: A Data Custodian holds Retail Customer resource information and will share this information with Third Parties only in accordance with the Governing Documents, Applicable Regulatory Authority and the direction of the Retail Customer. A Data Custodian typically has direct access to the pertinent information (e.g., by directly acquiring electricity usage data from a meter). A Data Custodian may be a Distribution Company.

***REQ.21.2.B.x**

Energy Usage Information: Any information concerning a Retail Customer’s use of energy.

REQ.21.2.C Acronyms

Abbreviation / Acronym	Meaning
ADE	Automatic Data Exchange
ESPI	Energy Services Provider Interface
EUI	Energy Usage Information
NISTIR	National Institute of Standards and Technology Interagency Report
PII	Personally Identifiable Information

REQ.21.3 Model Business Practices

REQ.21.3.1 General Practices for Energy Services Provider Interface (ESPI)

REQ.21.3.1.1

To the extent required by the Applicable Regulatory Authority, Authorized Third Parties and Data Custodians should exchange Retail Customer’s EUI at the Retail Customer’s request pursuant to the requirements as set forth in NAESB REQ.21, subject to the Governing Documents.

REQ.21.3.1.2

The ESPI relationship requires a set of agreements between Retail Customer-Authorized Third Party, Retail Customer-Data Custodian, and Authorized Third Party-Data Custodian to ensure that the appropriate information is provided as needed and other information access is restricted.



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- REQ.21.3.1.3** A Third Party cannot access PII from a Data Custodian. PII may only be provided to a Third Party by the Retail Customer.
- REQ.21.3.1.4** Subject to the Governing Documents and Applicable Regulatory Authority, the ESPI should enable a Retail Customer to share EUI for such Retail Customer with Authorized Third Parties who have acquired the right to act in this role.
- REQ.21.3.1.5** The ESPI should allow exchange of usage information without requiring access to PII.
- REQ.21.3.1.6** All information exchanged by the ESPI should be secure in accordance with the security requirements stated herein. These may be further constrained by Governing Documents and Applicable Regulatory Authority.
- REQ.21.3.1.7** A Retail Customer should have the ability to authorize the Data Custodian to release EUI for such Retail Customer to an Authorized Third Party who has acquired the right to act in this role, subject to the Governing Documents and Applicable Regulatory Authority.
- REQ.21.3.1.8** Subject to the Governing Documents and Applicable Regulatory Authority, a Retail Customer should have the ability to authorize multiple Authorized Third Parties to have limited time based access to specified EUI or other types of information for such Retail Customer, with any default expiration for such access established by such Governing Documents or Applicable Regulatory Authority.
- REQ.21.3.1.9** Subject to the Governing Documents and Applicable Regulatory Authority, a Retail Customer should have the ability to designate a specific expiration date, extend any specific expiration date, or indicate an open-ended access timeframe other than the default access period.
- REQ.21.3.1.10** The ESPI should have the capability to support the Retail Customers' ability to select / revoke which Authorized Third Parties are authorized for access to EUI.
- REQ.21.3.1.11** The ESPI should have the capability to notify the relevant Authorized Third Parties, Data Custodian and Retail Customers



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- 217 when access has been granted, access has been changed, or
218 access has been revoked for a UsagePoint.
219
- 220 **REQ.21.3.1.12** Subject to the Governing Documents and Applicable Regulatory
221 Authority, the ESPI should be consistent with the applicable
222 guidelines around security and authorization for Third Party data
223 access as set forth in the NISTIR 7628.
224
- 225 **REQ.21.3.1.13** The ESPI should provide the ability for any party to terminate any
226 information sharing relationship in which that party is involved.
227
- 228 **REQ.21.3.1.14** Future versions of the ESPI should be backwards compatible,
229 including provisions for exchanging versioning information and
230 negotiating interface capabilities.
231
- 232 **REQ.21.3.1.15** Any Third Party wishing to access EUI via the ESPI must establish
233 and maintain a trusted relationship with each Data Custodian who
234 provides a ESPI. Subject to the Governing Documents and
235 Applicable Regulatory Authority, both the Data Custodian and the
236 Authorized Third Party should disallow requests from Entities who
237 are not Authorized Third Parties.
238
- 239 **REQ.21.3.1.16** Subject to the Governing Documents and Applicable Regulatory
240 Authority during communications of any information confidentiality
241 will be maintained.
242
- 243 **REQ.21.3.1.17** Subject to the Governing Documents and Applicable Regulatory
244 Authority, Third Parties must be authorized by the Authorizing
245 Entity and/or the Data Custodian to be an Authorized Third Party
246 and utilize the ESPI and must maintain their status as an
247 Authorized Third Party.
248
- 249 **REQ.21.3.1.18** If an Authorizing Entity exists within a jurisdiction, Retail
250 Customers should be able to view a list of Third Parties who have
251 been authorized to use the ESPI.
252
- 253 **REQ.21.3.1.19** Subject to the Governing Documents and Applicable Regulatory
254 Authority, EUI should be made available to Authorized Third
255 Parties (as directed by the Retail Customer) in a reasonable and
256 timely fashion.
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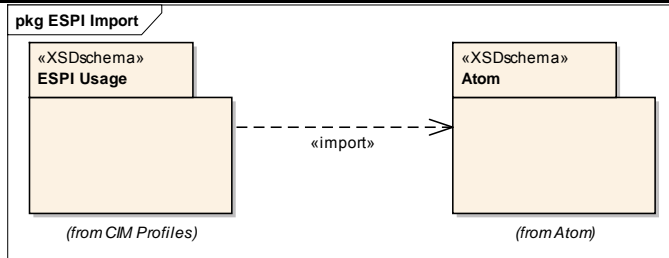


Figure 1: ESPI Import

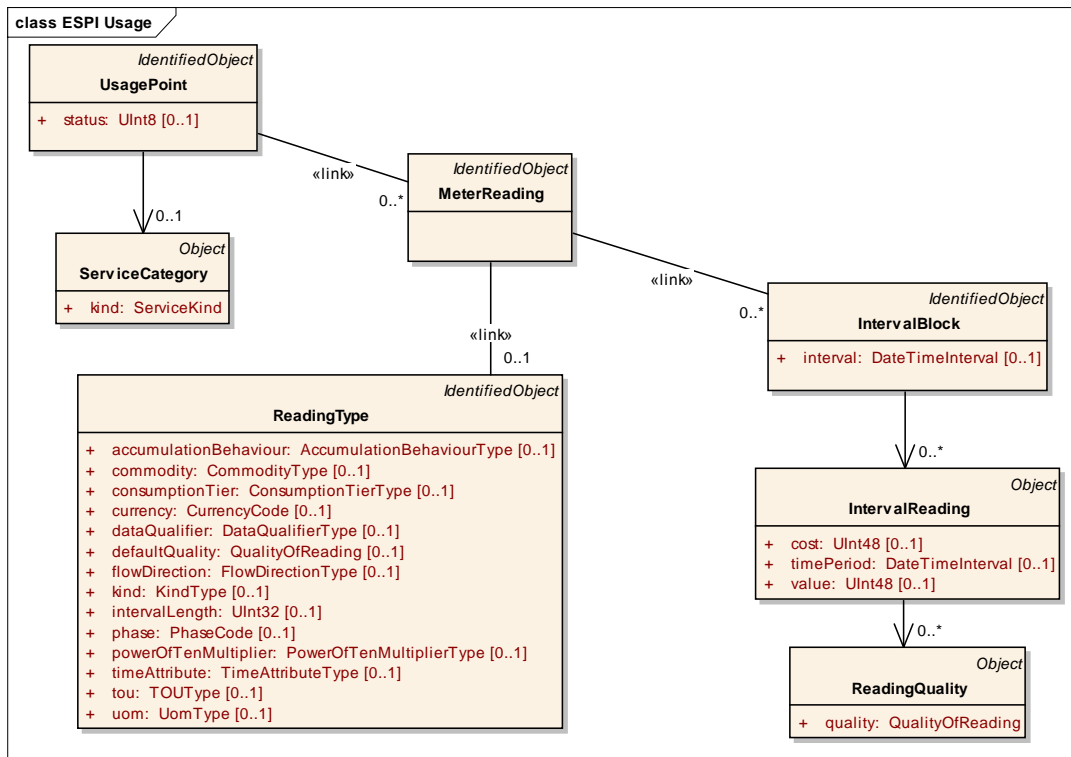


Figure 2: ESPI Usage

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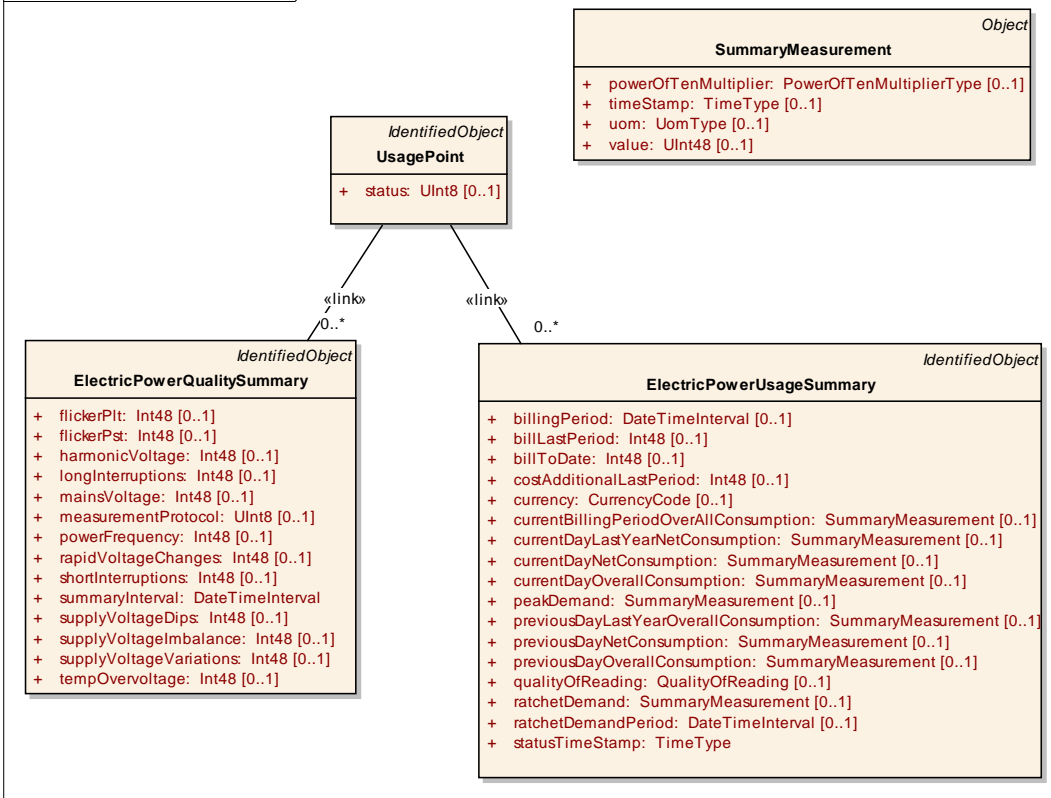
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class ESPI Usage Summary Classes



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Figure 3: ESPI Usage Summary Classes



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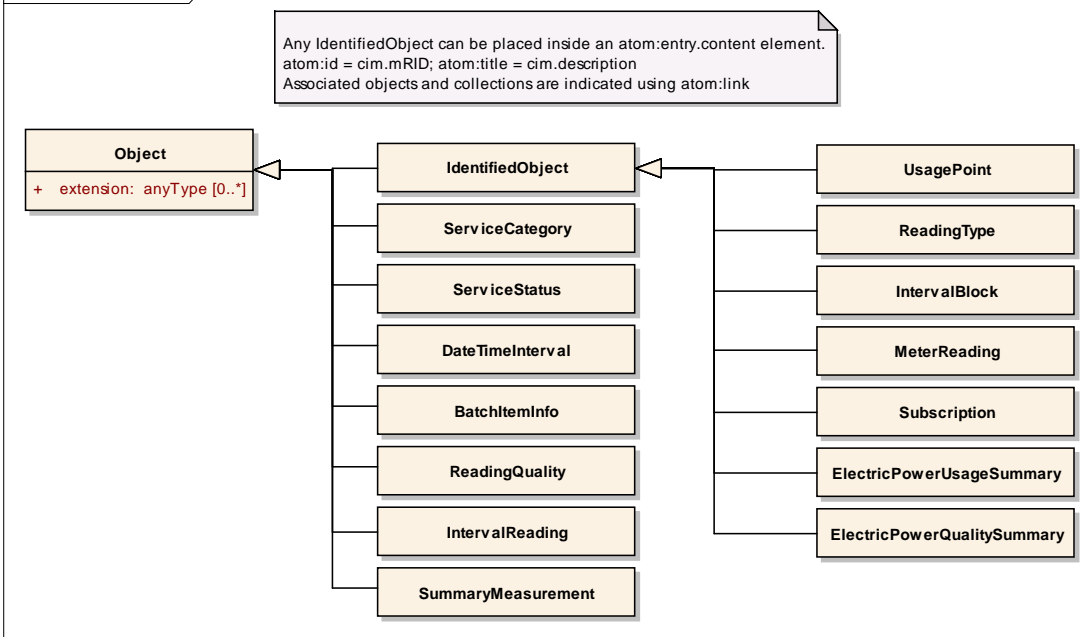
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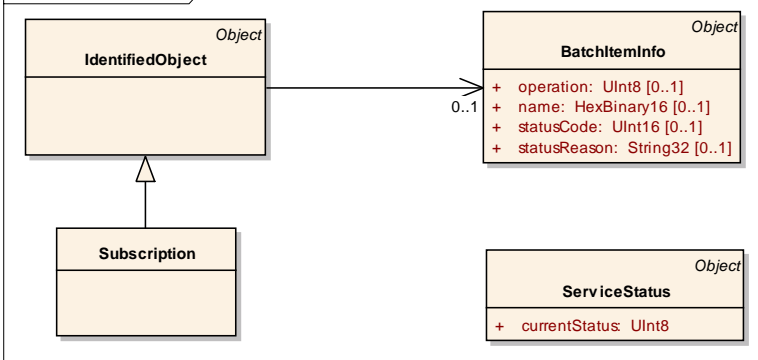
class ESPI Inheritance



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Figure 4: ESPI Inheritance

class ESPI Publication



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Figure 5: ESPI Publication



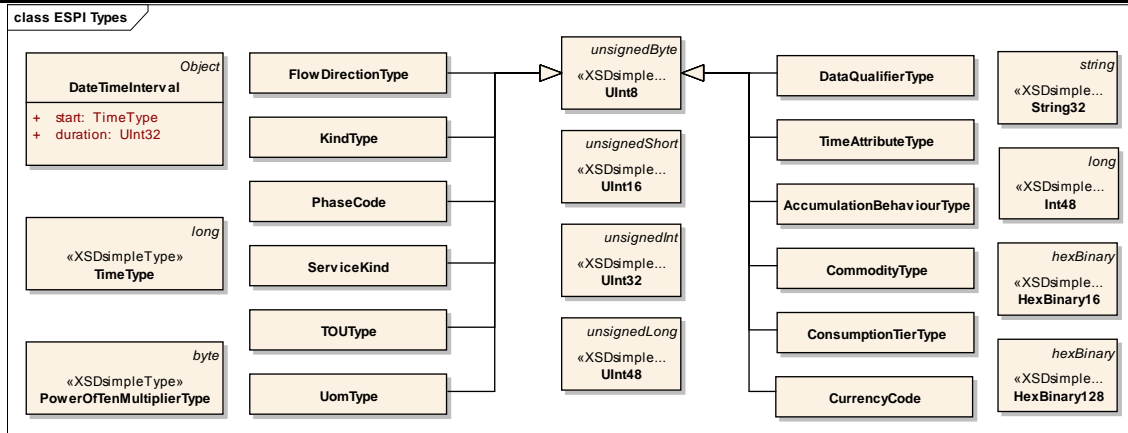
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310
311 **Figure 6: ESPI Types**
312

313 **BatchItemInfo**

314 Includes elements that make it possible to include multiple transactions in a single (batch)
315 request.

Name	Type	Description
operation	<i>UInt8</i>	Specifies the operation requested of this item. 0=Create 1=Read 2=Update 3=Delete
name	<i>HexBinary16</i>	An identifier for this object that is only unique within the containing collection.
statusCode	<i>UInt16</i>	Indicates the status code of the associated transaction. 200 - Ok 201 - Created 204 - No Content 301 - Moved Permanently 302 - Redirect 304 - Not Modified 400 - Bad Request 401 - Unauthorized 403 - Forbidden 404 - Not Found 405 - Method Not Allowed 410 - Gone 500 - Internal Server Error



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statusReason	<i>String32</i>	Indicates the reason for the indicated status code.
---------------------	-----------------	---

316 **Object**

317 Superclass of all object classes to allow extensions.

Name	Type	Description
extension	<i>anyType</i>	Contains an extension.

318 **ServiceStatus**

319 Contains the current status of the service.

Name	Type	Description
currentStatus	<i>UInt8</i>	The current status of the service. 0 = Unavailable 1 = Normal, operational

320 **Subscription**

321 Defines the parameters of a subscription between third party and data custodian

322 **IdentifiedObject**

323 This is a root class to provide common naming attributes for all classes needing naming
324 attributes

325 **ElectricPowerQualitySummary**

326 A summary of power quality events. This information represents a summary of power
327 quality information typically required by customer facility energy management systems.
328 It is not intended to satisfy the detailed requirements of power quality monitoring. All
329 values are as defined by measurementProtocol during the period. The standards typically
330 also give ranges of allowed values; the information attributes are the raw measurements,
331 not the "yes/no" determination by the various standards. See referenced standards for
332 definition, measurement protocol and period.

Name	Type	Description
flickerPlt	<i>Int48</i>	A measurement of long term Rapid Voltage Change in hundredths. flickerPlt is derived from 2 hours of Pst values (12 values combined in cubic relationship).
flickerPst	<i>Int48</i>	flickerPst is a value measured over 10 minutes that characterizes the likelihood that the voltage fluctuations would result in perceptible light flicker. A value of 1.0 is designed to represent the level that 50% of



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		people would perceive flicker in a 60 watt incandescent bulb. The value reported is represented as an integer in hundredths.
harmonicVoltage	<i>Int48</i>	A measurement of the Harmonic Voltage during the period. For DC, distortion is with respect to a signal of zero Hz.
longInterruptions	<i>Int48</i>	A count of Long Interruption events (as defined by measurementProtocol) during the summary interval period.
mainsVoltage	<i>Int48</i>	A measurement of the Mains [Signaling] Voltage during the summary interval period in uV.
measurementProtocol	<i>UInt8</i>	A reference to the source standard used as the measurement protocol definition. Examples are: 0 = "IEEE1519-2009" 1 = "EN50160"
powerFrequency	<i>Int48</i>	A measurement of the power frequency during the summary interval period in uHz.
rapidVoltageChanges	<i>Int48</i>	A count of Rapid Voltage Change events during the summary interval period
shortInterruptions	<i>Int48</i>	A count of Short Interruption events during the summary interval period
summaryInterval	<i>DateTimeInterval</i>	Interval of summary period
supplyVoltageDips	<i>Int48</i>	A count of Supply Voltage Dip events during the summary interval period
supplyVoltageImbalance	<i>Int48</i>	A count of Supply Voltage Imbalance events during the summary interval period
supplyVoltageVariations	<i>Int48</i>	A count of Supply Voltage Variations during the summary interval period
tempOvervoltage	<i>Int48</i>	A count of Temporary Overvoltage events (as defined by measurementProtocol) during the summary interval period

333 **ElectricPowerUsageSummary**

334 Summary of usage for a billing period

Name	Type	Description
billingPeriod	<i>DateTimeInterval</i>	The billing period to which the included measurements apply
billLastPeriod	<i>Int48</i>	The amount of the bill for the previous



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		period , in millionths of the currency specified in the ReadingType for this reading (e.g. 840 = USD, US dollar).
billToDate	<i>Int48</i>	The bill amount related to the billing period as of the date received, in millionths of the currency specified in the ReadingType for this reading. (e.g. 840 = USD, US dollar).
costAdditionalLastPeriod	<i>Int48</i>	Additional charges from the last billing period, in millionths of the currency specified in the ReadingType for this reading. (e.g. 840 = USD, US dollar).
currency	<i>CurrencyCode</i>	The ISO 4217 code indicating the currency applicable to the bill amounts in the summary. See list at http://www.unece.org/cefact/recommendations/rec09/rec09_ecetrd203.pdf
currentBillingPeriodOverAllConsumption	<i>SummaryMeasurement</i>	The total consumption for the billing period
currentDayLastYearNetConsumption	<i>SummaryMeasurement</i>	The amount of energy consumed one year ago interpreted as same day of week same week of year (see ISO 8601).
currentDayNetConsumption	<i>SummaryMeasurement</i>	Net consumption for the current day (delivered - received)
currentDayOverallConsumption	<i>SummaryMeasurement</i>	Overall energy consumption for the current day
peakDemand	<i>SummaryMeasurement</i>	Peak demand recorded for the current period
previousDayLastYearOverallConsumption	<i>SummaryMeasurement</i>	The amount of energy consumed on the previous day one year ago interpreted as same day of week same week of year (see ISO 8601).
previousDayNetConsumption	<i>SummaryMeasurement</i>	Net consumption for the previous day
previousDayOverallConsumption	<i>SummaryMeasurement</i>	The total consumption for the previous day
qualityOfReading	<i>QualityOfReading</i>	Indication of the quality of the summary readings
ratchetDemand	<i>SummaryMeasurement</i>	The current ratchet demand value for the ratchet demand period
ratchetDemandPeriod	<i>DateTimeInterval</i>	The period over which the ratchet demand applies



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statusTimeStamp	<i>TimeType</i>	Date/Time status of this UsageSummary

335 **ServiceCategory**

336 Category of service provided to the customer.

Name	Type	Description
kind	<i>ServiceKind</i>	Service classification Examples are: 0 - electricity 1 - gas The list of specific valid values per the standard are itemized in ServiceKind.

337 **UsagePoint**

338 Logical point on a network at which consumption or production is either physically
339 measured (e.g. metered) or estimated (e.g. unmetered street lights).

Name	Type	Description
status	<i>UInt8</i>	Specifies the current status of this usage point. The only valid values are: 0 = off 1 = on

340 **HexBinary128** «XSDsimpleType»

341 A 128-bit field encoded as a hex string (32 characters / 16 octets)

342 **HexBinary16** «XSDsimpleType»

343 A 16-bit field encoded as a hex string (4 characters / 2 octets)

344 **Int48** «XSDsimpleType»

345 Signed integer, max inclusive 281474976710655 (2⁴⁸-1), restriction of xs:long

346 **String32** «XSDsimpleType»

347 Character string of max length 32

348 **UInt16** «XSDsimpleType»

349 Unsigned integer, max inclusive 65535 (2¹⁶-1), same as xs:unsignedShort



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350 **UInt32** «XSDsimpleType»

351 Unsigned integer, max inclusive 4294967295 ($2^{32}-1$), same as xs:unsignedInt

352 **UInt48** «XSDsimpleType»

353 Unsigned integer, max inclusive 281474976710655 ($2^{48}-1$), restriction of
354 xs:unsignedLong

355 **UInt8** «XSDsimpleType»

356 Unsigned integer, max inclusive 255 (2^8-1), same as xs:unsignedByte

357 **AccumulationBehaviourType**

358 The only valid values are:

359

360 0 = Not Applicable

361 1 = BulkQuantity

362 3 = Cumulative

363 4 = DeltaData

364 6 = Indicating

365 9 = Summation

366 12 = Instantaneous

367 **CommodityType**

368 The only valid values are:

369

370 0 = Not Applicable

371 1 = Electricity secondary metered value (a premise meter is typically a secondary meter)

372 2 = Electricity primary metered value

373 4 = Air

374 7 = NaturalGas

375 8 = Propane

376 9 = PotableWater

377 10 = Steam

378 11 = WasteWater

379 12 = HeatingFluid

380 13 = CoolingFluid

381 **ConsumptionTierType**

382 The only valid values are:

383

384 0 = Not Applicable

385 1 = Block Tier 1

386 2 = Block Tier 2

387 3 = Block Tier 3

388 4 = Block Tier 4

389 5 = Block Tier 5



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- 390 6 = Block Tier 6
- 391 7 = Block Tier 7
- 392 8 = Block Tier 8
- 393 9 = Block Tier 9
- 394 10 = Block Tier 10
- 395 11 = Block Tier 11
- 396 12 = Block Tier 12
- 397 13 = Block Tier 13
- 398 14 = Block Tier 14
- 399 15 = Block Tier 15
- 400 16 = Block Tier 16

401 CurrencyCode

402 Follows codes defined in ISO 4217. Full list at tiny.cc/4217.

- 403
- 404 0 - Not Applicable
- 405 36 - Australian Dollar
- 406 124 - Canadian Dollar
- 407 840 - US Dollar
- 408 978 - Euro

409 DataQualifierType

410 The only valid values are:

- 411
- 412 0 = Not Applicable
- 413 2 = Average
- 414 8 = Maximum
- 415 9 = Minimum
- 416 12 = Normal

417 DateTimeInterval

418 Interval of date and time. End is not included because it can be derived from the start and
419 the duration.

Name	Type	Description
start	<i>TimeType</i>	Date and time that this interval started.
duration	<i>UInt32</i>	Duration of the interval, in seconds.

420 FlowDirectionType

421 The only valid values are:

- 422
- 423 0 = Not Applicable
- 424 1 = Forward
- 425 19 = Reverse

426 KindType



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Request Title: Energy Services Provider Interface Standard

427 The only valid values are:

428

429 0 = Not Applicable

430 3 = Currency

431 8 = Demand

432 12 = Energy

433 37 = Power

434 **PhaseCode**

435 The only valid values are:

436

437 0 = Not Applicable

438 129 = Phase AN

439 128 = Phase A

440 132 = Phase AB

441 64 = Phase BN

442 64 = Phase B

443 32 = Phase CN

444 32 = Phase C

445 224 = Phase ABC

446 66 = Phase BC

447 40 = Phase CA

448 **PowerOfTenMultiplierType** «XSDsimpleType»

449 The only valid values are:

450

451 0 = None

452 1 = deca= $\times 10$

453 2 = hecto= $\times 100$

454 -3 = mili= $\times 10^{-3}$

455 3 = kilo= $\times 1000$

456 6 = Mega= $\times 10^6$

457 -6 = micro= $\times 10^{-6}$

458 9 = Giga= $\times 10^9$

459 **QualityOfReading**

460 List of codes indicating the quality of the reading, using specification:

461

462 <system> "." <categorization> "." <index>

463

464 where <system> is one of:

465 0 - not applicable

466 1 - end device

467 2 - metering collection system

468 3 - meter data management system

469

470 <categorization> "." <index> is one of:



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- 471 0.0 - valid
- 472 0.1 - validated
- 473 7.0 - manually edited
- 474 8.0 - estimated
- 475 10.0 - questionable
- 476 11.0 - derived deterministically
- 477 11.1 - derived with inference
- 478 12.0 - projected

479 **ServiceKind**

480 The only valid values are:

- 481
- 482 0 - electricity
- 483 1 - gas
- 484 2 - water
- 485 4 - pressure
- 486 5 - heat
- 487 6 - cold
- 488 7 - communication
- 489 8 - time

490 **SummaryMeasurement**

491 An aggregated summary measurement reading.

Name	Type	Description
powerOfTenMultiplier	<i>PowerOfTenMultiplierType</i>	The multiplier part of the unit of measure, e.g. "kilo" (k)
timeStamp	<i>TimeType</i>	The date and time (if needed) of the summary measurement.
uom	<i>UomType</i>	The units of the reading, e.g. "Wh"
value	<i>UInt48</i>	The value of the summary measurement.

492 **TOUType**

493 The only valid values are:

- 494
- 495 0 = NotApplicable
- 496 1 = TOU A
- 497 2 = TOU B
- 498 3 = TOU C
- 499 4 = TOU D
- 500 5 = TOU E
- 501 6 = TOU F
- 502 7 = TOU G
- 503 8 = TOU H
- 504 9 = TOU I
- 505 10 = TOU J
- 506 11 = TOU K



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507 12 = TOU L
508 13 = TOU M
509 14 = TOU N
510 15 = TOU O

511 TimeAttributeType

512 The only valid values are:

513
514 0 = Not Applicable
515 1 = 10-minute
516 2 = 15-minute
517 4 = 24-hour
518 5 = 30-minute
519 7 = 60-minute
520 11 = Daily
521 13 = Monthly
522 15 = Present
523 16 = Previous
524 24 = Weekly
525 32 = ForTheSpecifiedPeriod
526 79 = Daily30minuteFixedBlock

527 TimeType «XSDsimpleType»

528 Time is a signed 64 bit value representing the number of seconds since 0 hours, 0
529 minutes, 0 seconds, on the 1st of January, 1970.

530 UomType

531 The only valid values are:

532
533 0 = Not Applicable
534 5 = A (Current)
535 29 = Voltage
536 31 = J (Energy joule)
537 33 = Hz (Frequency)
538 38 = Real power (Watts)
539 42 = m3 (Cubic Meter)
540 61 = VA (Apparent power)
541 63 = VAr (Reactive power)
542 65 = Cos? (Power factor)
543 67 = V² (Volts squared)
544 69 = A² (Amp squared)
545 71 = VAh (Apparent energy)
546 72 = Real energy (Watt-hours)
547 73 = VArh (Reactive energy)
548 106 = Ah (Ampere-hours / Available Charge)
549 119 = ft³ (Cubic Feet)
550 122 = ft³/h (Cubic Feet per Hour)



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- 551 125 = m³/h (Cubic Meter per Hour)
- 552 128 = US gl (US Gallons)
- 553 129 = US gl/h (US Gallons per Hour)
- 554 130 = IMP gl (Imperial Gallons)
- 555 131 = IMP gl/h (Imperial Gallons per Hour)
- 556 132 = BTU
- 557 133 = BTU/h
- 558 134 = Liter
- 559 137 = L/h (Liters per Hour)
- 560 140 = PA(gauge)
- 561 155 = PA(absolute)
- 562 169 = Therm

563 IntervalBlock

564 Time sequence of Readings of the same ReadingType.

Name	Type	Description
interval	<i>DateTimeInterval</i>	Specifies the time period during which the contained readings were taken.

565 IntervalReading

566 Specific value measured by a meter or other asset. Each Reading is associated with a
567 specific ReadingType.

Name	Type	Description
cost	<i>UInt48</i>	Specifies a cost associated with this reading, in millionths of the currency specified in the ReadingType for this reading. (e.g. 840 = USD, US dollar)
timePeriod	<i>DateTimeInterval</i>	The date time and duration of a reading. If not specified, readings for each "intervalLength" in ReadingType are present. (this is a bit confusing as it only provides the length and NOT the where the first one starts).
value	<i>UInt48</i>	Value in units specified by ReadingType

568 MeterReading

569 Set of values obtained from the meter.

570 ReadingQuality

571 Quality of a specific reading value or interval reading value. Note that more than one
572 Quality may be applicable to a given Reading. Typically not used unless problems or
573 unusual conditions occur (i.e., quality for each Reading is assumed to be 'Good' (valid)
574 unless stated otherwise in associated ReadingQuality).



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Name	Type	Description
quality	<i>QualityOfReading</i>	<p>Quality, to be specified if different than 'raw'.</p> <p>The specific format is specified per the standard is defined in QualityOfReading.</p> <p>(this is inconsistent with the "Quality of Reading" definition) 'raw' is not defined -- needs to be consistent with defaultQuality too)</p>

575 **ReadingType**

576

Characteristics associated with all Readings included in a MeterReading.

Name	Type	Description
accumulationBehaviour	<i>AccumulationBehaviourType</i>	<p>Code indicating how value is accumulated over time for Readings of ReadingType. The list of valid values per the standard are defined in AccumulationBehaviorType.</p> <p>Examples are: 0 = Not Applicable 1 = BulkQuantity 3 = Cumulative</p>
commodity	<i>CommodityType</i>	<p>Code for commodity classification of Readings of ReadingType. The valid values per the standard are defined in CommodityType.</p> <p>Examples are: 0 = Not Applicable 1 = Electricity secondary metered value (a premise meter is typically a secondary meter) 2 = Electricity primary metered value 4 = Air 7 = NaturalGas</p>
consumptionTier	<i>ConsumptionTierType</i>	<p>Code for consumption tier associated with a Reading of ReadingType. The valid values are define in ConsumptionTierType.</p> <p>Examples are: 0 = Not Applicable 1 = Block Tier 1 2 = Block Tier 2</p>
currency	<i>CurrencyCode</i>	Code for the currency for costs associated



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		<p>with this ReadingType. The valid values per the standard are defined in CurrencyCode.</p> <p>Examples are: 0 - Not Applicable 36 - Australian Dollar 124 - Canadian Dollar 840 - US Dollar 978 - Euro</p>
dataQualifier	<i>DataQualifierType</i>	<p>Code describing a salient attribute of Readings of ReadingType. Valid values per the standard are defined in DataQualifierType.</p> <p>Examples are: 0 = Not Applicable 2 = Average</p>
defaultQuality	<i>QualityOfReading</i>	<p>Default value to be used if no value of ReadingQuality.quality is provided.</p> <p>Specific format and valid values per the standard are specified in QualityOfReading.</p>
flowDirection	<i>FlowDirectionType</i>	<p>Direction associated with current related Readings. valid values per the standard are defined in FlowDirectionType.</p> <p>Examples are: 0 = Not Applicable 1 = Forward 19 = Reverse</p>
kind	<i>KindType</i>	<p>Code for general classification of a Reading of ReadingType. Valid values per the standard are defined in KindType.</p> <p>Examples are: 0 = Not Applicable 3 = Currency 8 = Demand</p>
intervalLength	<i>UInt32</i>	<p>Default interval length specified in seconds for Readings of ReadingType.</p>
phase	<i>PhaseCode</i>	<p>Code for phase information associated with Readings of ReadingType. Valid values per the standard are defined in PhaseCode.</p> <p>Examples are: 0 = Not Applicable</p>



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		129 = Phase AN 128 = Phase A 132 = Phase AB
powerOfTenMultiplier	<i>PowerOfTenMultiplierType</i>	Code for the power of ten multiplier which, when used in combination with the uom, specifies the actual unit of measure for Readings of ReadingType. Valid values per the standard are defined in PowerOfTenMultiplierType. Examples are: 0 = None 1 = deca= $\times 10$ 2 = hecto= $\times 100$ -3 = mili= $\times 10^{-3}$
timeAttribute	<i>TimeAttributeType</i>	Code used to specify a particular type of time interval method for Readings of ReadingType. Valid values per the standard are defined in TimeAttributeType. Examples are: 0 = Not Applicable 1 = 10-minute 2 = 15-minute
tou	<i>TOUType</i>	Code for the TOU type of Readings of ReadingType. valid values per the standard are defined in TOUType. Examples are: 0 = NotApplicable 1 = TOU A 2 = TOU B
uom	<i>UomType</i>	Code for the base unit of measure for Readings of ReadingType. Used in combination with the powerOfTenMultiplier to specify the actual unit of measure. Valid values per the standard are defined in UomType. Examples are: 0 = Not Applicable 5 = A (Current) 29 = Voltage

577
578
579

580 **REQ.21.4.2**

Additional Models in Support of Services



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581

582 **REQ.21.4.2.2**

Authorization

583 An Authorization is a Customer grant of 3rd Party access to specific resources.
584 The attributes of this object are listed below. The structure and format of these
585 fields is defined by OAuth.

- 586 • Information consumer (Third Party) identifier (Consumer Key)
- 587 • Resource subject (Scope)
588 Specifies the resource to which access from the information provider is
589 granted by the customer to the information consumer
- 590 • Authentication Token (Access Token)
591 One or more token / secret pairs proving the identity of the requester to
592 be the Customer associated with the resource. Different methods may be
593 defined against which token / secret pairs are created and verified.
- 594 • Authorized period
- 595 • Status (requested, valid, invalid, error, unavailable)

596

597 **REQ.21.5 Related Model Business Practices**

598

599 **REQ.21.5.1 Conformance to REQ.18 Energy Usage Information Model**

600 The ESPI services conform to REQ.18 Energy Usage Information Model (PAP10), due to the
601 ability to directly transform between the models without loss of precision, and without external
602 inputs. The ESPI model uses the same concept names and structures as NAESB PAP10 EUI.
603

604 **REQ.21.6 Technical Implementation**

605 **REQ.21.6.1 Protocol Specifications**

606 ESPI endpoints shall implement the following protocol aspects.

607

608 **REQ.21.6.1.1 Security**

609 Providers of ESPI services, including both data custodian and third party, are
610 responsible for protecting their systems, networks, and interface endpoints
611 against threats, as recommended in NIST-IR and Security Profile For Third Party
612 Data Access.

613

614 **REQ.21.6.1.1.1 Encryption**

615 Establishment of mutually-authenticated encrypted channels shall be performed
616 using HTTP/S, as documented in IETF RFC 2818, over which data may be
617 securely transferred between data custodian and third party.
618



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619 **REQ.21.6.1.1.2**

User Authorization

620 OAuth, as documented in IETF RFC 5849, shall be used for authorization grant
621 and access by Retail Customers and Authorized Third Parties to shared Data
622 Custodian resources. This protocol results in access tokens that can be used to
623 subscribe to specific user data, or to request it immediately, if supported.
624

625 **REQ.21.6.2**

Communication Specifications

626 This section defines the expected behavior of implementations using the ESPI
627 RESTful style. This style uses HTTP methods as verbs and URIs as nouns.
628

629 ESPI endpoints shall expose resources as described by Atom, IETF RFC 4287.

- 630 • Representations shall be identified as media type
631 “application/atom+xml”
- 632 • ESPI namespace and types (“http://naesb.org/espi”) shall be used
633 for objects in <content> element
- 634 • espi:mRID is implemented by atom:id
635 o UUIDs shall be used, as specified in IETF RFC 4122
- 636 • espi:description is implemented by atom:title
- 637 • Associated objects use atom:link (rel=“related”)

638
639 Links shall use the following tags and values to convey link types.
640

Association	rel	type
UsagePoint → MeterReading	related	application/atom+xml
UsagePoint → ElectricPowerQualitySummary	related	application/atom+xml
UsagePoint → ElectricPowerUsageSummary	related	application/atom+xml
MeterReading → IntervalBlock	related	application/atom+xml
MeterReading → ReadingType	related	application/atom+xml

641
642 ESPI endpoints shall use HTTP and/or HTTPS, IETF RFC 2616 and 2818, to
643 expose ESPI resources using the method conventions in Atom Publishing
644 Protocol, IETF RFC 5023.
645

646 URIs should be kept as short as possible, and must not exceed 255 bytes.
647

648 Relative URIs may be used when resources are on the same host. Additional
649 definition regarding URIs and HTTP/S shall follow the IETF specifications.
650

651 A URI example is provided below.

- 652 • https://espi.datacustodian.com/{third_party_id}/Batch

653 Since all URIs are opaque references, there is no mandated form. However, it
654 may be useful to organize them hierarchically, in order to define URIs for the
655 appropriate containers (feeds), and to manage permissions. URIs should be as



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656 persistent as possible, but they may change. `atom:id`, however, shall not change,
657 even if the resource is moved or replicated. Clients accessing out-of-date URIs
658 may be redirected, but if they are not, may need to request the current preferred
659 resource location.

660
661 The following query parameters may be used to filter the resources returned by a
662 feed. These use typical “?name=value[&...]” syntax.

- 663 • `published-max`, `published-min`
- 664 • `updated-max`, `updated-min`
- 665 • `max-results`
- 666 • `start-index`

667
668 Date and time values for the above parameters shall use RFC 3339 format.

REQ.21.6.3

Examples

669
670 The following examples show the creation, retrieval, update, and deletion of an
671 object within a feed.

672
673 Upon authorization of a resource, the OAuth “scope” attribute will contain the
674 URI of the resource. With it, the client can request a subscription to it as in the
675 example below. Note that this URI is a reference to the target resource of the
676 subscription. (The resource being subscribed to) The Subscription object
677 identifier is not specified, since it is assigned by the data custodian. Note also that
678 signed OAuth parameters must be included in the header to prove authorization.

```
681 POST /Subscription HTTP/1.1
682 Host: espi.datacustodian.com
683 Content-Type: application/atom+xml
684 Content-Length: 163
685
686 <?xml version="1.0" encoding="UTF-8"?>
687 <entry xmlns="http://www.w3.org/2005/Atom"
688     xsi:schemaLocation="http://naesb.org/espi espi.xsd"
689     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
690   <link rel="related" href="/User/9b6c7063"/>
691   <content>
692     <Subscription xmlns="http://naesb.org/espi"/>
693   </content>
694 </entry>
```

695
696 The server may refuse this request, if valid authorization was not provided, in
697 which case result “401 Not Authorized” or similar, shall be returned.

698
699 If the request is accepted, the server shall respond with the full resource
700 representation, as in the response example below.

```
701 HTTP/1.1 200 OK
702
```



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```
Content-Type: application/atom+xml
Content-Length: 335

<?xml version="1.0" encoding="UTF-8"?>
<entry xmlns="http://www.w3.org/2005/Atom"
  xsi:schemaLocation="http://naesb.org/espi espi.xsd"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <id>urn:uuid:e69c4c25-2885-4de0-a3d8-d29b5f823b79</id>
  <link rel="self" href="/Subscription/7f23"/>
  <link rel="related" href="/User/9b6c7063"/>
  <content>
    <Subscription xmlns="http://naesb.org/espi"/>
  </content>
  <published>2012-01-23T05:11:38Z</published>
  <updated>2012-01-23T05:11:38Z</updated>
</entry>
```

Retrieval of the object is performed using GET. The example below shows the request – the response would be the same as the response to POST above.

```
GET /Subscription/7f23 HTTP/1.1
Host: espi.datacustodian.com
```

Deletion uses DELETE, as in the example below. Again, authorization parameters must also be included.

```
DELETE /Subscription/7f23 HTTP/1.1
Host: espi.datacustodian.com
```

Response is simply the status of the request, as below.

```
HTTP/1.1 200 OK
```

Batch processing involves inclusion of the “Batch” attributes with regular objects in a list, as in the example below. This example shows delivery of new objects.

```
<?xml version="1.0" encoding="UTF-8"?>
<feed
  xmlns="http://www.w3.org/2005/Atom"
  xsi:schemaLocation="http://naesb.org/espi espi.xsd"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <id>urn:uuid:046638c0-8701-11e0-9d78-0800200c9a66</id>
  <title>ThirdPartyX Batch Feed</title>
  <updated>2012-05-21T18:01:00Z</updated>
  <link rel="self" href="/83e269c1"/>
  <entry>
    <id>urn:uuid:c990b150-8320-11e0-9d78-0800200c9a66</id>
    <link rel="self" href="/ThirdParty/83e269c1/Batch"/>
  </entry>
  <entry>
    <id>urn:uuid:c990b150-8320-11e0-9d78-0800200c9a66</id>
    <link rel="self" href="/User/9b6c7063/UsagePoint/01"/>
    <link rel="up" href="/User/9b6c7063/UsagePoint"/>
    <link rel="related" href="/User/9b6c7063/UsagePoint/01/MeterReading"/>
    <title>Elm St.</title>
  </entry>
</feed>
```



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```
<UsagePoint xmlns="http://naesb.org/espi">
  <ServiceCategory>
    <kind>0</kind>
  </ServiceCategory>
</UsagePoint>
</content>
<published>2012-05-21T18:01:00Z</published>
<updated>2012-05-21T18:01:00Z</updated>
</entry>
<entry>
  <id>urn:uuid:f2034e91-8320-11e0-9d78-0800200c9a66</id>
  <link rel="self" href="/User/9b6c7063/UsagePoint/01/MeterReading/01"/>
  <link rel="up" href="/User/9b6c7063/UsagePoint/01/MeterReading"/>
  <link rel="related" href="/User/9b6c7063/UsagePoint/01/MeterReading/01/IntervalBlock"/>
  <link rel="related" href="/ReadingType/07"/>
  <title>Hourly Energy Consumption</title>
  <content>
    <MeterReading xmlns="http://naesb.org/espi"/>
  </content>
  <published>2012-05-21T18:01:00Z</published>
  <updated>2012-05-21T18:01:00Z</updated>
</entry>
<entry>
  <id>urn:uuid:f2034e93-8320-11e0-9d78-0800200c9a66</id>
  <link rel="self" href="/User/9b6c7063/UsagePoint/01/MeterReading/01/IntervalBlock/0173"/>
  <link rel="up" href="/User/9b6c7063/UsagePoint/01/MeterReading/01/IntervalBlock"/>
  <title/>
  <content>
    <IntervalBlock xmlns="http://naesb.org/espi">
      <interval>
        <duration>86400</duration>
        <start>1325397600</start>
      </interval>
      <IntervalReading>
        <cost>3000000</cost>
        <timePeriod>
          <duration>3600</duration>
          <start>1325397600</start>
        </timePeriod>
        <value>383</value>
      </IntervalReading>
      <IntervalReading>
        <cost>3000000</cost>
        <timePeriod>
          <duration>3600</duration>
          <start>1325401200</start>
        </timePeriod>
        <value>427</value>
      </IntervalReading>
    </IntervalBlock>
  </content>
  <published>2012-05-21T18:01:00Z</published>
  <updated>2012-05-21T18:01:00Z</updated>
</entry>
<entry>
  <id>urn:uuid:2557def0-8321-11e0-9d78-0800200c9a66</id>
  <link rel="self" href="/ReadingType/07"/>
  <link rel="up" href="/ReadingType"/>
  <title>Energy Delivered (kWh)</title>
  <content>
    <ReadingType xmlns="http://naesb.org/espi">
      <accumulationBehaviour>4</accumulationBehaviour><!--DeltaData-->
      <commodity>1</commodity><!--Electricity-->
      <consumptionTier>0</consumptionTier><!--N/A-->
      <currency>0</currency><!--N/A-->
      <dataQualifier>12</dataQualifier><!--Normal-->
      <flowDirection>1</flowDirection><!--Forward-->
      <kind>12</kind><!--Energy-->
      <phase>0</phase><!--N/A-->
      <powerOfTenMultiplier>3</powerOfTenMultiplier><!--kilo-->
      <timeAttribute>0</timeAttribute><!--N/A-->
      <tou>0</tou><!--N/A-->
      <uom>72</uom><!--Watt hours-->
    </ReadingType>
  </content>
</entry>
```



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<published>2012-05-21T18:01:00Z</published>
<updated>2012-05-21T18:01:00Z</updated>
</entry>
</feed>

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840 **REQ.21.6.4**

Conformance

Conformant Data Custodian implementations must implement the following:

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- Security
 - Server certificates and mutually authenticated HTTPS
 - Accept requests to OAuth endpoints
- Subscriptions
 - Accept POST to Subscription, Batch resource
 - Allow subscriptions to authorized resources
- Delivery
 - Accept GET to Batch resource, specific to each Authorized Third Party.
 - Optionally support POST to Authorized Third Party Notification resource
 - Optionally support POST to Authorized Third Party Batch resource
 - Optionally support GET of resources directly
- Content
 - No specific subset of domain information elements is required for conformance, but those that are made available must use the format defined.
 - Any additional information elements must be placed in extension elements, must be optional, must use a different namespace, and must be requested and refused for standardization in a future release by the ESPI task force.

Conformant Third Party implementations must implement the following:

- Security
 - Server certificates and mutually authenticated HTTPS
 - Make requests to OAuth endpoints
- Subscriptions
 - Submit POST requests to Subscription, Batch resource
 - Sign requests with access tokens
- Delivery
 - Submit GET request to Batch resource
 - Optionally accept POST to Authorized Third Party Notification resource
 - Optionally accept POST to Authorized Third Party Batch resource
 - Optionally GET resources directly



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For Quadrant: Retail Electric Quadrant

Requesters: Open ADE Task Force

Request No.: R10008

Request Title: Energy Services Provider Interface Standard

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880 **REQ.21.6.5**

XML Schema

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The following is the XML Schema (espi.xsd) definitions used to declare the format of the ESPI types. This is the official normative version of these definitions. A separate version of this file, in plain text, appropriate for machine reading, is maintained at **TBD**.

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```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns="http://naesb.org/espi"
targetNamespace="http://naesb.org/espi" elementFormDefault="qualified"
attributeFormDefault="unqualified" version="0.01">
<xs:import namespace="http://www.w3.org/2005/Atom" schemaLocation="atom.xsd"/>
<xs:complexType name="IntervalBlock">
<xs:annotation>
<xs:documentation>Time sequence of Readings of the same ReadingType.</xs:documentation>
</xs:annotation>
<xs:complexContent>
<xs:extension base="IdentifiedObject">
<xs:sequence>
<xs:element name="interval" minOccurs="0" maxOccurs="1" type="DateTimeInterval">
<xs:annotation>
<xs:documentation>Specifies the time period during which the contained readings
were taken.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="IntervalReading" type="IntervalReading" minOccurs="0"
maxOccurs="unbounded" />
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="IntervalReading">
<xs:annotation>
<xs:documentation>Specific value measured by a meter or other asset. Each Reading is
associated with a specific ReadingType.</xs:documentation>
</xs:annotation>
<xs:complexContent>
<xs:extension base="Object">
<xs:sequence>
<xs:element name="cost" minOccurs="0" maxOccurs="1" type="UInt48">
<xs:annotation>
<xs:documentation>Specifies a cost associated with this reading, in millionths
of the currency specified in the ReadingType for this reading. (e.g. 840 = USD, US
dollar)</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="ReadingQuality" type="ReadingQuality" minOccurs="0"
maxOccurs="unbounded" />
<xs:element name="timePeriod" minOccurs="0" maxOccurs="1" type="DateTimeInterval">
<xs:annotation>
<xs:documentation>The date time and duration of a reading. If not specified,
readings for each "intervalLength" in ReadingType are present.
(this is a bit confusing as it only provides the length and NOT the where the first one
starts).</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="value" minOccurs="0" maxOccurs="1" type="UInt48">
<xs:annotation>
<xs:documentation>Value in units specified by ReadingType</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:extension>
</xs:complexContent>
```

```
</xs:complexType>
<xs:complexType name="MeterReading">
<xs:annotation>
<xs:documentation>Set of values obtained from the meter.</xs:documentation>
</xs:annotation>
<xs:complexContent>
<xs:extension base="IdentifiedObject" />
</xs:complexContent>
</xs:complexType>
<xs:complexType name="ReadingQuality">
<xs:annotation>
<xs:documentation>Quality of a specific reading value or interval reading value. Note
that more than one Quality may be applicable to a given Reading. Typically not used unless
problems or unusual conditions occur (i.e., quality for each Reading is assumed to be 'Good'
(valid) unless stated otherwise in associated ReadingQuality).</xs:documentation>
</xs:annotation>
<xs:complexContent>
<xs:extension base="Object">
<xs:sequence>
<xs:element name="quality" minOccurs="1" maxOccurs="1" type="QualityOfReading">
<xs:annotation>
<xs:documentation>Quality, to be specified if different than 'raw'.
The specific format is specified per the standard is defined in QualityOfReading.
(this is inconsistent with the "Quality of Reading" definition) 'raw' is not defined -- needs
to be consistent with defaultQuality too)</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="ReadingType">
<xs:annotation>
<xs:documentation>Characteristics associated with all Readings included in a
MeterReading.</xs:documentation>
</xs:annotation>
<xs:complexContent>
<xs:extension base="IdentifiedObject">
<xs:sequence>
<xs:element name="accumulationBehaviour" minOccurs="0" maxOccurs="1"
type="AccumulationBehaviourType">
<xs:annotation>
<xs:documentation>Code indicating how value is accumulated over time for
Readings of ReadingType. The list of valid values per the standard are defined in
AccumulationBehaviorType.
Examples are:
0 = Not Applicable
1 = BulkQuantity
3 = Cumulative</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="commodity" minOccurs="0" maxOccurs="1" type="CommodityType">
<xs:annotation>
```



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<xs:documentation>Code for commodity classification of Readings of ReadingType. The valid values per the standard are defined in CommodityType.

Examples are:

- 0 = Not Applicable
1 = Electricity secondary metered value (a premise meter is typically a secondary meter)
2 = Electricity primary metered value
4 = Air
7 = NaturalGas</xs:documentation>

</xs:element>
<xs:element name="consumptionTier" minOccurs="0" maxOccurs="1" type="ConsumptionTierType">

<xs:annotation>
<xs:documentation>Code for consumption tier associated with a Reading of ReadingType. The valid values are define in ConsumptionTierType.

Examples are:

- 0 = Not Applicable
1 = Block Tier 1
2 = Block Tier 2</xs:documentation>

</xs:element>
<xs:element name="currency" minOccurs="0" maxOccurs="1" type="CurrencyCode">

<xs:annotation>
<xs:documentation>Code for the currency for costs associated with this ReadingType. The valid values per the standard are defined in CurrencyCode.

Examples are:

- 0 - Not Applicable
36 - Australian Dollar
124 - Canadian Dollar
840 - US Dollar
978 - Euro</xs:documentation>

</xs:element>
<xs:element name="dataQualifier" minOccurs="0" maxOccurs="1" type="DataQualifierType">

<xs:annotation>
<xs:documentation>Code describing a salient attribute of Readings of ReadingType. Valid values per the standard are defined in DataQualifierType.

Examples are:

- 0 = Not Applicable
2 = Average</xs:documentation>

</xs:element>
<xs:element name="defaultQuality" minOccurs="0" maxOccurs="1" type="QualityOfReading">

<xs:annotation>
<xs:documentation>Default value to be used if no value of ReadingQuality.quality is provided.

Specific format and valid values per the standard are specified in QualityOfReading.</xs:documentation>

</xs:annotation>
</xs:element>

<xs:element name="flowDirection" minOccurs="0" maxOccurs="1" type="FlowDirectionType">

<xs:annotation>
<xs:documentation>Direction associated with current related Readings. valid values per the standard are defined in FlowDirectionType.

Examples are:

- 0 = Not Applicable
1 = Forward
19 = Reverse</xs:documentation>

</xs:element>
<xs:element name="intervalLength" minOccurs="0" maxOccurs="1" type="UInt32">

<xs:annotation>
<xs:documentation>Default interval length specified in seconds for Readings of ReadingType.</xs:documentation>

</xs:element>
<xs:element name="kind" minOccurs="0" maxOccurs="1" type="KindType">

<xs:annotation>
<xs:documentation>Code for general classification of a Reading of ReadingType. Valid values per the standard are defined in KindType.

Examples are:

- 0 = Not Applicable
3 = Currency
8 = Demand</xs:documentation>

</xs:element>
<xs:element name="phase" minOccurs="0" maxOccurs="1" type="PhaseCode">

<xs:annotation>
<xs:documentation>Code for phase information associated with Readings of ReadingType. Valid values per the standard are defined in PhaseCode.

Examples are:

- 0 = Not Applicable
129 = Phase AN
128 = Phase A
132 = Phase AB</xs:documentation>

</xs:element>
<xs:element name="powerOfTenMultiplier" minOccurs="0" maxOccurs="1" type="PowerOfTenMultiplierType">

<xs:annotation>
<xs:documentation>Code for the power of ten multiplier which, when used in combination with the uom, specifies the actual unit of measure for Readings of ReadingType. Valid values per the standard are defined in PowerOfTenMultiplierType.

Examples are:

- 0 = None
1 = deca=x10
2 = hecto=x100
-3 = mili=x10-3</xs:documentation>

</xs:annotation>
</xs:element>



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```
<xs:element name="timeAttribute" minOccurs="0" maxOccurs="1"
type="TimeAttributeType">
  <xs:annotation>
    <xs:documentation>Code used to specify a particular type of time interval method
for Readings of ReadingType. Valid values per the standard are defined in TimeAttributeType.
Examples are:
0 = Not Applicable
1 = 10-minute
2 = 15-minute</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="tou" minOccurs="0" maxOccurs="1" type="TOUType">
  <xs:annotation>
    <xs:documentation>Code for the TOU type of Readings of ReadingType. valid values
per the standard are defined in TOUType.
Examples are:
0 = NotApplicable
1 = TOU A
2 = TOU B</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="uom" minOccurs="0" maxOccurs="1" type="UomType">
  <xs:annotation>
    <xs:documentation>Code for the base unit of measure for Readings of ReadingType.
Used in combination with the powerOfTenMultiplier to specify the actual unit of measure. Valid
values per the standard are defined in UomType.
Examples are:
0 = Not Applicable
5 = A (Current)
29 = Voltage</xs:documentation>
  </xs:annotation>
</xs:element>
</xs:sequence>
</xs:extension>
</xs:complexType>
<xs:complexType name="IdentifiedObject">
  <xs:annotation>
    <xs:documentation>This is a root class to provide common naming attributes for all
classes needing naming attributes</xs:documentation>
  </xs:annotation>
  <xs:complexContent>
    <xs:extension base="Object">
      <xs:sequence>
        <xs:element name="BatchItemInfo" type="BatchItemInfo" minOccurs="0" maxOccurs="1" />
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:complexType name="ServiceCategory">
  <xs:annotation>
    <xs:documentation>Category of service provided to the customer.</xs:documentation>
  </xs:annotation>
  <xs:complexContent>
    <xs:extension base="Object">
```

```
<xs:sequence>
  <xs:element name="kind" minOccurs="1" maxOccurs="1" type="ServiceKind">
    <xs:annotation>
      <xs:documentation>Service classification
Examples are:
0 - electricity
1 - gas
The list of specific valid values per the standard are itemized in
ServiceKind.</xs:documentation>
  </xs:annotation>
</xs:element>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="UsagePoint">
  <xs:annotation>
    <xs:documentation>Logical point on a network at which consumption or production is
either physically measured (e.g. metered) or estimated (e.g. unmetered street
lights).</xs:documentation>
  </xs:annotation>
  <xs:complexContent>
    <xs:extension base="IdentifiedObject">
      <xs:sequence>
        <xs:element name="ServiceCategory" type="ServiceCategory" minOccurs="0"
maxOccurs="1" />
        <xs:element name="status" minOccurs="0" maxOccurs="1" type="UInt8">
          <xs:annotation>
            <xs:documentation>Specifies the current status of this usage point.
The only valid values are:
0 = off
1 = on</xs:documentation>
          </xs:annotation>
        </xs:element>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:complexType name="ElectricPowerQualitySummary">
  <xs:annotation>
    <xs:documentation>A summary of power quality events. This information represents a
summary of power quality information typically required by customer facility energy management
systems. It is not intended to satisfy the detailed requirements of power quality monitoring.
All values are as defined by measurementProtocol during the period. The standards typically
also give ranges of allowed values; the information attributes are the raw measurements, not
the "yes/no" determination by the various standards. See referenced standards for definition,
measurement protocol and period.</xs:documentation>
  </xs:annotation>
  <xs:complexContent>
    <xs:extension base="IdentifiedObject">
      <xs:sequence>
        <xs:element name="flickerPlt" minOccurs="0" maxOccurs="1" type="Int48">
          <xs:annotation>
            <xs:documentation>A measurement of long term Rapid Voltage Change in hundredths.
```



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flickerPlt is derived from 2 hours of Pst values (12 values combined in cubic relationship)... flickerPst is a value measured over 10 minutes that characterizes the likelihood that the voltage fluctuations would result in perceptible light flicker... The value reported is represented as an integer in hundredths... harmonicVoltage... longInterruptions... mainsVoltage... measurementProtocol... powerFrequency... rapidVoltageChanges... shortInterruptions

<xs:documentation>A count of Short Interruption events during the summary interval period</xs:documentation>... <xs:documentation>Interval of summary period</xs:documentation>... <xs:documentation>A count of Supply Voltage Dip events during the summary interval period</xs:documentation>... <xs:documentation>A count of Supply Voltage Imbalance events during the summary interval period</xs:documentation>... <xs:documentation>A count of Supply Voltage Variations during the summary interval period</xs:documentation>... <xs:documentation>A count of Temporary Overvoltage events (as defined by measurementProtocol) during the summary interval period</xs:documentation>... <xs:documentation>Summary of usage for a billing period</xs:documentation>... <xs:documentation>The amount of the bill for the previous period, in millionths of the currency specified in the ReadingType for this reading (e.g. 840 = USD, US dollar).</xs:documentation>



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```

1340 </xs:annotation>
1341 </xs:element>
1342 <xs:element name="billToDate" minOccurs="0" maxOccurs="1" type="Int48">
1343 <xs:annotation>
1344 <xs:documentation>The bill amount related to the billing period as of the date
1345 received, in millionths of the currency specified in the ReadingType for this reading. (e.g.
1346 840 = USD, US dollar).</xs:documentation>
1347 </xs:annotation>
1348 </xs:element>
1349 <xs:element name="costAdditionalLastPeriod" minOccurs="0" maxOccurs="1"
1350 type="Int48">
1351 <xs:annotation>
1352 <xs:documentation>Additional charges from the last billing period, in millionths
1353 of the currency specified in the ReadingType for this reading. (e.g. 840 = USD, US
1354 dollar).</xs:documentation>
1355 </xs:annotation>
1356 </xs:element>
1357 <xs:element name="currency" minOccurs="0" maxOccurs="1" type="CurrencyCode">
1358 <xs:annotation>
1359 <xs:documentation>The ISO 4217 code indicating the currency applicable to the
1360 bill amounts in the summary. See list at
1361 http://www.unece.org/cefact/recommendations/rec09/rec09_ecetrdr203.pdf</xs:documentation>
1362 </xs:annotation>
1363 </xs:element>
1364 <xs:element name="currentBillingPeriodOverAllConsumption" minOccurs="0"
1365 maxOccurs="1" type="SummaryMeasurement">
1366 <xs:annotation>
1367 <xs:documentation>The total consumption for the billing
1368 period</xs:documentation>
1369 </xs:annotation>
1370 </xs:element>
1371 <xs:element name="currentDayLastYearNetConsumption" minOccurs="0" maxOccurs="1"
1372 type="SummaryMeasurement">
1373 <xs:annotation>
1374 <xs:documentation>The amount of energy consumed one year ago interpreted as same
1375 day of week same week of year (see ISO 8601).</xs:documentation>
1376 </xs:annotation>
1377 </xs:element>
1378 <xs:element name="currentDayNetConsumption" minOccurs="0" maxOccurs="1"
1379 type="SummaryMeasurement">
1380 <xs:annotation>
1381 <xs:documentation>Net consumption for the current day (delivered -
1382 received)</xs:documentation>
1383 </xs:annotation>
1384 </xs:element>
1385 <xs:element name="currentDayOverallConsumption" minOccurs="0" maxOccurs="1"
1386 type="SummaryMeasurement">
1387 <xs:annotation>
1388 <xs:documentation>Overall energy consumption for the current
1389 day</xs:documentation>
1390 </xs:annotation>
1391 </xs:element>
1392 <xs:element name="peakDemand" minOccurs="0" maxOccurs="1" type="SummaryMeasurement">
1393 <xs:annotation>
1394 <xs:documentation>Peak demand recorded for the current period</xs:documentation>
1395 </xs:annotation>
1396 </xs:element>

```

```

1397 <xs:element name="previousDayLastYearOverallConsumption" minOccurs="0" maxOccurs="1"
1398 type="SummaryMeasurement">
1399 <xs:annotation>
1400 <xs:documentation>The amount of energy consumed on the previous day one year ago
1401 interpreted as same day of week same week of year (see ISO 8601).</xs:documentation>
1402 </xs:annotation>
1403 </xs:element>
1404 <xs:element name="previousDayNetConsumption" minOccurs="0" maxOccurs="1"
1405 type="SummaryMeasurement">
1406 <xs:annotation>
1407 <xs:documentation>Net consumption for the previous day</xs:documentation>
1408 </xs:annotation>
1409 </xs:element>
1410 <xs:element name="previousDayOverallConsumption" minOccurs="0" maxOccurs="1"
1411 type="SummaryMeasurement">
1412 <xs:annotation>
1413 <xs:documentation>The total consumption for the previous day</xs:documentation>
1414 </xs:annotation>
1415 </xs:element>
1416 <xs:element name="qualityOfReading" minOccurs="0" maxOccurs="1"
1417 type="QualityOfReading">
1418 <xs:annotation>
1419 <xs:documentation>Indication of the quality of the summary
1420 readings</xs:documentation>
1421 </xs:annotation>
1422 </xs:element>
1423 <xs:element name="ratchetDemand" minOccurs="0" maxOccurs="1"
1424 type="SummaryMeasurement">
1425 <xs:annotation>
1426 <xs:documentation>The current ratchet demand value for the ratchet demand
1427 period</xs:documentation>
1428 </xs:annotation>
1429 </xs:element>
1430 <xs:element name="ratchetDemandPeriod" minOccurs="0" maxOccurs="1"
1431 type="DateTimeInterval">
1432 <xs:annotation>
1433 <xs:documentation>The period over which the ratchet demand
1434 applies</xs:documentation>
1435 </xs:annotation>
1436 </xs:element>
1437 <xs:element name="statusTimeStamp" minOccurs="1" maxOccurs="1" type="TimeType">
1438 <xs:annotation>
1439 <xs:documentation>Date/Time status of this UsageSummary</xs:documentation>
1440 </xs:annotation>
1441 </xs:element>
1442 </xs:sequence>
1443 </xs:extension>
1444 </xs:complexType>
1445 </xs:complexType>
1446 <xs:simpleType name="HexBinary128">
1447 <xs:annotation>
1448 <xs:documentation>A 128-bit field encoded as a hex string (32 characters / 16
1449 octets)</xs:documentation>
1450 </xs:annotation>
1451 <xs:restriction base="xs:hexBinary">
1452 <xs:maxLength value="16" />
1453 </xs:restriction>

```



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```
1454 </xs:simpleType>
1455 <xs:simpleType name="HexBinary16">
1456 <xs:annotation>
1457 <xs:documentation>A 16-bit field encoded as a hex string (4 characters / 2
1458 octets)</xs:documentation>
1459 </xs:annotation>
1460 <xs:restriction base="xs:hexBinary">
1461 <xs:maxLength value="2" />
1462 </xs:restriction>
1463 </xs:simpleType>
1464 <xs:simpleType name="String32">
1465 <xs:annotation>
1466 <xs:documentation>Character string of max length 32</xs:documentation>
1467 </xs:annotation>
1468 <xs:restriction base="xs:string">
1469 <xs:maxLength value="32" />
1470 </xs:restriction>
1471 </xs:simpleType>
1472 <xs:simpleType name="UInt16">
1473 <xs:annotation>
1474 <xs:documentation>Unsigned integer, max inclusive 65535 (2^16-1), same as
1475 xs:unsignedShort</xs:documentation>
1476 </xs:annotation>
1477 <xs:restriction base="xs:unsignedShort" />
1478 </xs:simpleType>
1479 <xs:simpleType name="UInt32">
1480 <xs:annotation>
1481 <xs:documentation>Unsigned integer, max inclusive 4294967295 (2^32-1), same as
1482 xs:unsignedInt</xs:documentation>
1483 </xs:annotation>
1484 <xs:restriction base="xs:unsignedInt" />
1485 </xs:simpleType>
1486 <xs:simpleType name="UInt48">
1487 <xs:annotation>
1488 <xs:documentation>Unsigned integer, max inclusive 281474976710655 (2^48-1), restriction
1489 of xs:unsignedLong</xs:documentation>
1490 </xs:annotation>
1491 <xs:restriction base="xs:unsignedLong">
1492 <xs:maxInclusive value="281474976710655" />
1493 </xs:restriction>
1494 </xs:simpleType>
1495 <xs:simpleType name="UInt8">
1496 <xs:annotation>
1497 <xs:documentation>Unsigned integer, max inclusive 255 (2^8-1), same as
1498 xs:unsignedByte</xs:documentation>
1499 </xs:annotation>
1500 <xs:restriction base="xs:unsignedByte" />
1501 </xs:simpleType>
1502 <xs:simpleType name="Int48">
1503 <xs:annotation>
1504 <xs:documentation>Signed integer, max inclusive 281474976710655 (2^48-1), restriction of
1505 xs:long</xs:documentation>
1506 </xs:annotation>
1507 <xs:restriction base="xs:long">
1508 <xs:maxInclusive value="281474976710655" />
1509 </xs:restriction>
1510 </xs:simpleType>
```

```
1511 <xs:complexType name="AccumulationBehaviourType">
1512 <xs:annotation>
1513 <xs:documentation>The only valid values are:
1514
1515 0 = Not Applicable
1516 1 = BulkQuantity
1517 3 = Cumulative
1518 4 = DeltaData
1519 6 = Indicating
1520 9 = Summation
1521 12 = Instantaneous</xs:documentation>
1522 </xs:annotation>
1523 <xs:simpleContent>
1524 <xs:extension base="UInt8" />
1525 </xs:simpleContent>
1526 </xs:complexType>
1527 <xs:complexType name="CommodityType">
1528 <xs:annotation>
1529 <xs:documentation>The only valid values are:
1530
1531 0 = Not Applicable
1532 1 = Electricity secondary metered value (a premise meter is typically a secondary meter)
1533 2 = Electricity primary metered value
1534 4 = Air
1535 7 = NaturalGas
1536 8 = Propane
1537 9 = PotableWater
1538 10 = Steam
1539 11 = WasteWater
1540 12 = HeatingFluid
1541 13 = CoolingFluid</xs:documentation>
1542 </xs:annotation>
1543 <xs:simpleContent>
1544 <xs:extension base="UInt8" />
1545 </xs:simpleContent>
1546 </xs:complexType>
1547 <xs:complexType name="ConsumptionTierType">
1548 <xs:annotation>
1549 <xs:documentation>The only valid values are:
1550
1551 0 = Not Applicable
1552 1 = Block Tier 1
1553 2 = Block Tier 2
1554 3 = Block Tier 3
1555 4 = Block Tier 4
1556 5 = Block Tier 5
1557 6 = Block Tier 6
1558 7 = Block Tier 7
1559 8 = Block Tier 8
1560 9 = Block Tier 9
1561 10 = Block Tier 10
1562 11 = Block Tier 11
1563 12 = Block Tier 12
1564 13 = Block Tier 13
1565 14 = Block Tier 14
1566 15 = Block Tier 15
1567 16 = Block Tier 16</xs:documentation>
```



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```
1568 </xs:annotation>
1569 <xs:simpleContent>
1570   <xs:extension base="UInt8" />
1571 </xs:simpleContent>
1572 </xs:complexType>
1573 <xs:complexType name="CurrencyCode">
1574   <xs:annotation>
1575     <xs:documentation>Follows codes defined in ISO 4217. Full list at tiny.cc/4217.
1576
1577 0 - Not Applicable
1578 36 - Australian Dollar
1579 124 - Canadian Dollar
1580 840 - US Dollar
1581 978 - Euro</xs:documentation>
1582 </xs:annotation>
1583 <xs:simpleContent>
1584   <xs:extension base="UInt8" />
1585 </xs:simpleContent>
1586 </xs:complexType>
1587 <xs:complexType name="DataQualifierType">
1588   <xs:annotation>
1589     <xs:documentation>The only valid values are:
1590
1591 0 = Not Applicable
1592 2 = Average
1593 8 = Maximum
1594 9 = Minimum
1595 12 = Normal</xs:documentation>
1596 </xs:annotation>
1597 <xs:simpleContent>
1598   <xs:extension base="UInt8" />
1599 </xs:simpleContent>
1600 </xs:complexType>
1601 <xs:complexType name="DateTimeInterval">
1602   <xs:annotation>
1603     <xs:documentation>Interval of date and time. End is not included because it can be
1604     derived from the start and the duration.</xs:documentation>
1605 </xs:annotation>
1606 <xs:complexContent>
1607   <xs:extension base="Object">
1608     <xs:sequence>
1609       <xs:element name="duration" minOccurs="1" maxOccurs="1" type="UInt32">
1610         <xs:annotation>
1611           <xs:documentation>Duration of the interval, in seconds.</xs:documentation>
1612         </xs:annotation>
1613       </xs:element>
1614       <xs:element name="start" minOccurs="1" maxOccurs="1" type="TimeType">
1615         <xs:annotation>
1616           <xs:documentation>Date and time that this interval started.</xs:documentation>
1617         </xs:annotation>
1618       </xs:element>
1619     </xs:sequence>
1620   </xs:extension>
1621 </xs:complexContent>
1622 </xs:complexType>
1623 <xs:complexType name="FlowDirectionType">
1624   <xs:annotation>
```

```
1625   <xs:documentation>The only valid values are:
1626
1627 0 = Not Applicable
1628 1 = Forward
1629 19 = Reverse</xs:documentation>
1630 </xs:annotation>
1631 <xs:simpleContent>
1632   <xs:extension base="UInt8" />
1633 </xs:simpleContent>
1634 </xs:complexType>
1635 <xs:complexType name="KindType">
1636   <xs:annotation>
1637     <xs:documentation>The only valid values are:
1638
1639 0 = Not Applicable
1640 3 = Currency
1641 8 = Demand
1642 12 = Energy
1643 37 = Power</xs:documentation>
1644 </xs:annotation>
1645 <xs:simpleContent>
1646   <xs:extension base="UInt8" />
1647 </xs:simpleContent>
1648 </xs:complexType>
1649 <xs:complexType name="PhaseCode">
1650   <xs:annotation>
1651     <xs:documentation>The only valid values are:
1652
1653 0 = Not Applicable
1654 129 = Phase AN
1655 128 = Phase A
1656 132 = Phase AB
1657 64 = Phase BN
1658 64 = Phase B
1659 32 = Phase CN
1660 32 = Phase C
1661 224 = Phase ABC
1662 66 = Phase BC
1663 40 = Phase CA</xs:documentation>
1664 </xs:annotation>
1665 <xs:simpleContent>
1666   <xs:extension base="UInt8" />
1667 </xs:simpleContent>
1668 </xs:complexType>
1669 <xs:simpleType name="PowerOfTenMultiplierType">
1670   <xs:annotation>
1671     <xs:documentation>The only valid values are:
1672
1673 0 = None
1674 1 = deca=x10
1675 2 = hecto=x100
1676 -3 = mili=x10-3
1677 3 = kilo=x1000
1678 6 = Mega=x106
1679 -6 = micro=x10-3
1680 9 = Giga=x109</xs:documentation>
1681 </xs:annotation>
```




RECOMMENDATION TO NAESB EXECUTIVE COMMITTEE

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```
796 67 = V2 (Volts squared)
797 69 = A2 (Amp squared)
798 71 = VAh (Apparent energy)
799 72 = Real energy (Watt-hours)
800 73 = VARh (Reactive energy)
801 106 = Ah (Ampere-hours / Available Charge)
802 119 = ft3 (Cubic Feet)
803 122 = ft3/h (Cubic Feet per Hour)
804 125 = m3/h (Cubic Meter per Hour)
805 128 = US gl (US Gallons)
806 129 = US gl/h (US Gallons per Hour)
807 130 = IMP gl (Imperial Gallons)
808 131 = IMP gl/h (Imperial Gallons per Hour)
809 132 = BTU
810 133 = BTU/h
811 134 = Liter
812 137 = L/h (Liters per Hour)
813 140 = PA (gauge)
814 155 = PA (absolute)
815 169 = Therm</xs:documentation>
816 </xs:annotation>
817 <xs:simpleContent>
818 <xs:extension base="UInt8" />
819 </xs:simpleContent>
820 </xs:complexType>
821 <xs:complexType name="SummaryMeasurement">
822 <xs:annotation>
823 <xs:documentation>An aggregated summary measurement reading.</xs:documentation>
824 </xs:annotation>
825 <xs:complexContent>
826 <xs:extension base="Object">
827 <xs:sequence>
828 <xs:element name="powerOfTenMultiplier" minOccurs="0" maxOccurs="1"
829 type="PowerOfTenMultiplierType">
830 <xs:annotation>
831 <xs:documentation>The multiplier part of the unit of measure, e.g. "kilo"
832 (k)</xs:documentation>
833 </xs:annotation>
834 </xs:element>
835 <xs:element name="timeStamp" minOccurs="0" maxOccurs="1" type="TimeType">
836 <xs:annotation>
837 <xs:documentation>The date and time (if needed) of the summary
838 measurement.</xs:documentation>
839 </xs:annotation>
840 </xs:element>
841 <xs:element name="uom" minOccurs="0" maxOccurs="1" type="UomType">
842 <xs:annotation>
843 <xs:documentation>The units of the reading, e.g. "Wh"</xs:documentation>
844 </xs:annotation>
845 </xs:element>
846 <xs:element name="value" minOccurs="0" maxOccurs="1" type="UInt48">
847 <xs:annotation>
848 <xs:documentation>The value of the summary measurement.</xs:documentation>
849 </xs:annotation>
850 </xs:element>
851 </xs:sequence>
852 </xs:extension>
```

```
853 </xs:complexContent>
854 </xs:complexType>
855 <xs:complexType name="BatchItemInfo">
856 <xs:annotation>
857 <xs:documentation>Includes elements that make it possible to include multiple
858 transactions in a single (batch) request.</xs:documentation>
859 </xs:annotation>
860 <xs:complexContent>
861 <xs:extension base="Object">
862 <xs:sequence>
863 <xs:element name="name" minOccurs="0" maxOccurs="1" type="HexBinary16">
864 <xs:annotation>
865 <xs:documentation>An identifier for this object that is only unique within the
866 containing collection.</xs:documentation>
867 </xs:annotation>
868 </xs:element>
869 <xs:element name="operation" minOccurs="0" maxOccurs="1" type="UInt8">
870 <xs:annotation>
871 <xs:documentation>Specifies the operation requested of this item.
872 0=Create
873 1=Read
874 2=Update
875 3=Delete</xs:documentation>
876 </xs:annotation>
877 </xs:element>
878 <xs:element name="statusCode" minOccurs="0" maxOccurs="1" type="UInt16">
879 <xs:annotation>
880 <xs:documentation>Indicates the status code of the associated transaction.
881 200 - Ok
882 201 - Created
883 204 - No Content
884 301 - Moved Permanently
885 302 - Redirect
886 304 - Not Modified
887 400 - Bad Request
888 401 - Unauthorized
889 403 - Forbidden
890 404 - Not Found
891 405 - Method Not Allowed
892 410 - Gone
893 500 - Internal Server Error</xs:documentation>
894 </xs:annotation>
895 </xs:element>
896 <xs:element name="statusReason" minOccurs="0" maxOccurs="1" type="String32">
897 <xs:annotation>
898 <xs:documentation>Indicates the reason for the indicated status
899 code.</xs:documentation>
900 </xs:annotation>
901 </xs:element>
902 </xs:sequence>
903 </xs:extension>
904 </xs:complexContent>
905 </xs:complexType>
906 <xs:complexType name="Object">
907 <xs:annotation>
```



RECOMMENDATION TO NAESB EXECUTIVE COMMITTEE

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```
1910 <xs:documentation>Superclass of all object classes to allow
1911 extensions.</xs:documentation>
1912 </xs:annotation>
1913 </xs:sequence>
1914 <xs:element name="extension" minOccurs="0" maxOccurs="unbounded" type="xs:anyType">
1915 <xs:annotation>
1916 <xs:documentation>Contains an extension.</xs:documentation>
1917 </xs:annotation>
1918 </xs:element>
1919 </xs:sequence>
1920 </xs:complexType>
1921 <xs:complexType name="ServiceStatus">
1922 <xs:annotation>
1923 <xs:documentation>Contains the current status of the service.</xs:documentation>
1924 </xs:annotation>
1925 <xs:complexContent>
1926 <xs:extension base="Object">
1927 <xs:sequence>
1928 <xs:element name="currentStatus" minOccurs="1" maxOccurs="1" type="UInt8">
1929 <xs:annotation>
1930 <xs:documentation>The current status of the service.
1931
1932 0 = Unavailable
1933 1 = Normal, operational</xs:documentation>
1934 </xs:annotation>
1935 </xs:element>
1936 </xs:sequence>
1937 </xs:extension>
1938 </xs:complexContent>
1939 </xs:complexType>
1940 <xs:complexType name="Subscription">
1941 <xs:annotation>
1942 <xs:documentation>Defines the parameters of a subscription between third party and data
1943 custodian</xs:documentation>
1944 </xs:annotation>
1945 <xs:complexContent>
1946 <xs:extension base="IdentifiedObject" />
1947 </xs:complexContent>
1948 </xs:complexType>
1949 <xs:element name="IntervalBlock" type="IntervalBlock" />
1950 <xs:element name="IntervalReading" type="IntervalReading" />
1951 <xs:element name="MeterReading" type="MeterReading" />
1952 <xs:element name="ReadingQuality" type="ReadingQuality" />
1953 <xs:element name="ReadingType" type="ReadingType" />
1954 <xs:element name="IdentifiedObject" type="IdentifiedObject" />
1955 <xs:element name="ServiceCategory" type="ServiceCategory" />
1956 <xs:element name="UsagePoint" type="UsagePoint" />
1957 <xs:element name="ElectricPowerQualitySummary" type="ElectricPowerQualitySummary" />
1958 <xs:element name="ElectricPowerUsageSummary" type="ElectricPowerUsageSummary" />
1959 <xs:element name="AccumulationBehaviourType" type="AccumulationBehaviourType" />
1960 <xs:element name="CommodityType" type="CommodityType" />
1961 <xs:element name="ConsumptionTierType" type="ConsumptionTierType" />
1962 <xs:element name="CurrencyCode" type="CurrencyCode" />
1963 <xs:element name="DataQualifierType" type="DataQualifierType" />
1964 <xs:element name="DateTimeInterval" type="DateTimeInterval" />
1965 <xs:element name="FlowDirectionType" type="FlowDirectionType" />
1966 <xs:element name="KindType" type="KindType" />
```

```
1967 <xs:element name="PhaseCode" type="PhaseCode" />
1968 <xs:element name="QualityOfReading" type="QualityOfReading" />
1969 <xs:element name="ServiceKind" type="ServiceKind" />
1970 <xs:element name="TimeAttributeType" type="TimeAttributeType" />
1971 <xs:element name="TOUType" type="TOUType" />
1972 <xs:element name="UomType" type="UomType" />
1973 <xs:element name="SummaryMeasurement" type="SummaryMeasurement" />
1974 <xs:element name="BatchItemInfo" type="BatchItemInfo" />
1975 <xs:element name="Object" type="Object" />
1976 <xs:element name="ServiceStatus" type="ServiceStatus" />
1977 <xs:element name="Subscription" type="Subscription" />
1978 </xs:schema>
```



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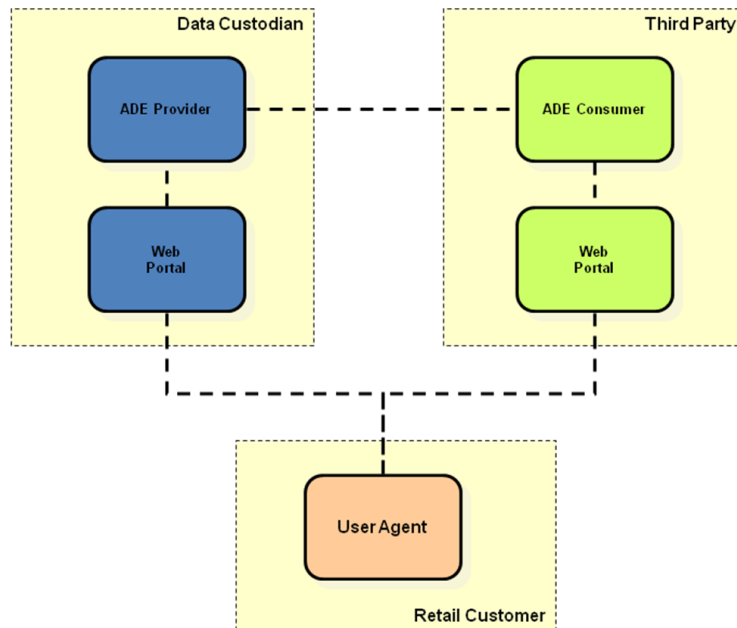
1979

Appendices

1980 This section contains informative descriptions and requirements derived by the committee for these service
1981 definitions.

1982 A. Overview

1983 The scope of these Model Business Practices includes authorization by the Retail Customer and the Automatic Data
1984 Exchange of the EUI to the Authorized Third Party in accordance with parameters (e.g. term of access, type of data,
1985 quantity of data, etc.) determined by the Retail Customer subject to the Governing Documents and Applicable
1986 Regulatory Authority. The diagram below shows the logical components involved in this authorization and data
1987 exchange process. Note that while the authorization process shown in this figure is made using a web browser, the
1988 services provided by the Authorized Third Party are not required to use a web browser to deliver such services.



1989

1990

Figure 7: Overview of Logical Components



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1991

1992 **B. Use Cases**

1993 This section presents a superset of the use cases that are informative of the third party data access relationship.
1994 Alternative use cases are presented for certain activities that can be achieved in different ways, such as the delivery
1995 of shared resource information by push or by pull.

1996
1997 The concept of a Shared Resource Key is used throughout these use cases. A Shared Resource Key is a token used
1998 to uniquely identify an instance of a Third Party data access relationship (i.e., each Retail Customer-Data Custodian-
1999 Third Party combination for a particular resource will have a unique Shared Resource Key). A Shared Resource Key
2000 contains no PII regarding the Retail Customer and so can be freely shared among all three roles without unnecessary
2001 disclosure of sensitive information. Once the relationship is established, inclusion of a Shared Resource Key in an
2002 interaction is sufficient to identify a specific Third Party data access relationship.

2003
2004 Each use case contains the following sections:

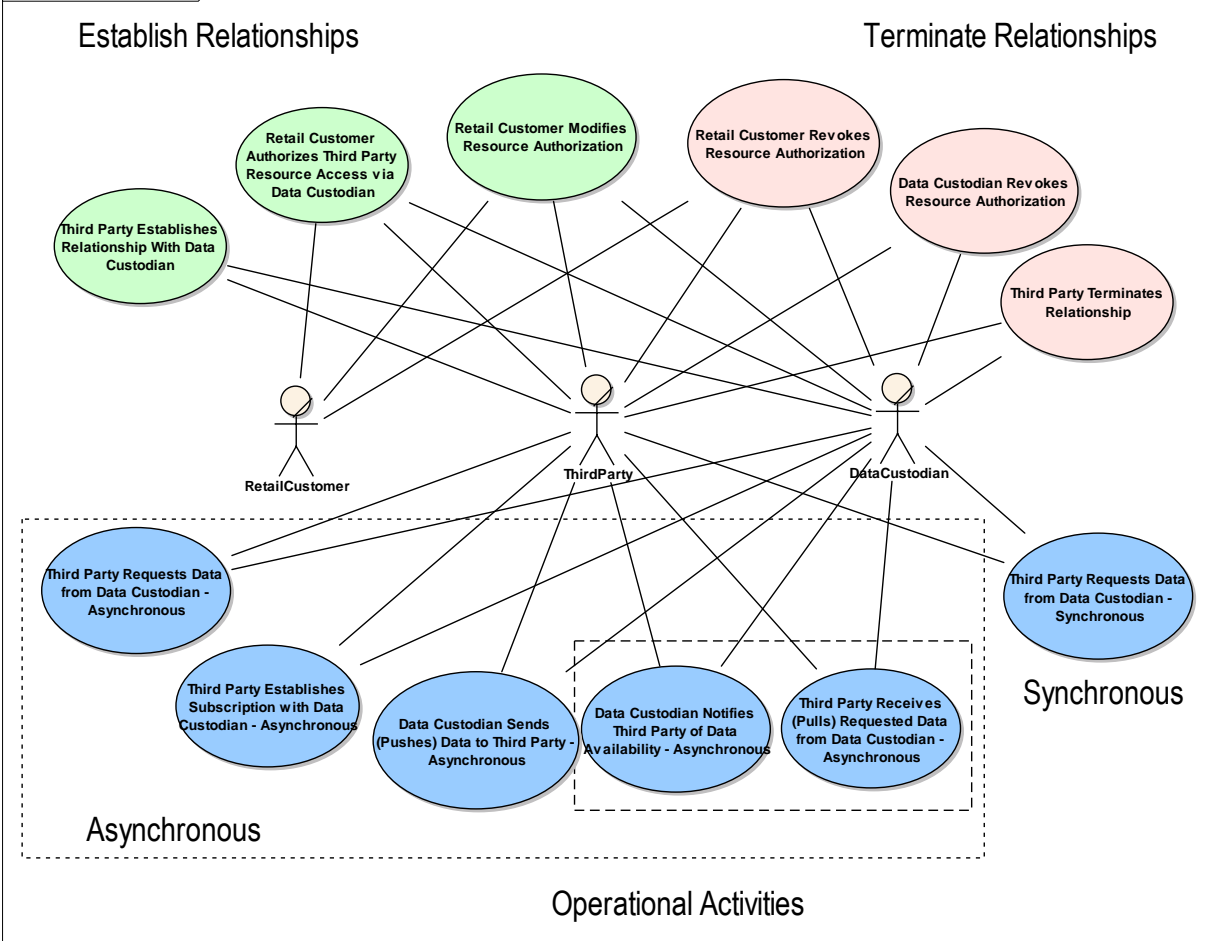
- 2005 • Use Case Description: This is a summary of the use case, describing the overall purpose.
- 2006 • Pre-Conditions: These are conditions that must be true for the use case to be successfully executed.
- 2007 • Invariant Conditions: These are properties that will be true any time the use case is initiated, regardless of
2008 whether it terminates successfully.
- 2009 • Post-Conditions: These are properties that will be true only if the use case terminates successfully. This requires
2010 that all preconditions and all condition checks (e.g., for validity of a request) be satisfied during execution of the
2011 use case.
- 2012 • Basic Path Scenario: This defines the series of steps undertaken by each role during successful execution of the
2013 use case. The scenario is depicted graphically in a Unified Modeling Language (UML) sequence diagram and
2014 each step is summarized in text.

2015 The following use cases are informative and not normative.



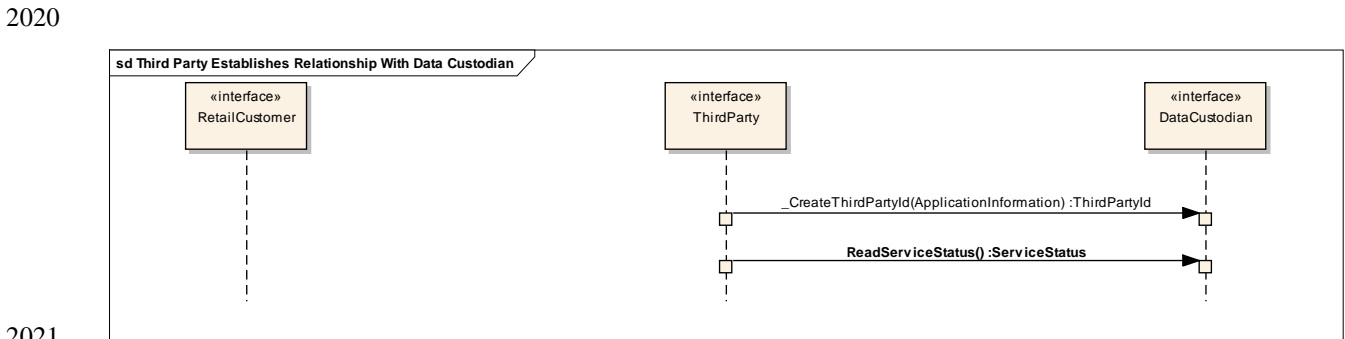
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uc ESPI Use Case Diagram



2016
2017
Figure 8: ESPI Use Case Diagram

2018
2019
1: Third Party Establishes Relationship With Data Custodian



2021
2022
Figure 9: Third Party Establishes Relationship With Data Custodian



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2023 **Description**

2024 A Third Party service provider wants to register with a Data Custodian to provide services to Retail Customers with
2025 data stored at the Data Custodian.

2026 **Pre-Condition:** Third Party had demonstrated that it meets security and privacy requirements as specified by
2027 governing documents.

2028 **Invariant Constraint:** No resource data or personal data is provided to the Third Party by the Data Custodian as
2029 part of this interaction.

2030 **Post-Condition:** A Shared Identity Key is generated to allow the Third Party to identify its identity to Data
2031 Custodian.

2032 **Post-Condition:** The Third Party has permission to get specified resource data from the Data Custodian with
2033 permission of a Retail Customer.

2034 **Scenario:** Basic Path

- 2035 1. The Third Party wishes to provide value added services to Retail Customers with data stored by the Data
2036 Custodian.
- 2037 2. Third Party requests that the Data Custodian establish relationship.
- 2038 3. Third Party provides proof that they meet the governing documents' requirements for data security and privacy
2039 protection.
- 2040 4. Third Party provides description of the services it wishes provide for Retail Customers.
- 2041 5. The Data Custodian generates an Identity Key for the Third Party. Third Party will use this key to identify itself
2042 during Use Cases 2 through 12.
- 2043 6. The Data Custodian adds the Third Party to its list of available services it presents to Retail Customers in Use
2044 Case 2.
- 2045 7. Third Party adds Data Custodian to its list of Data Custodians it presents in Use Case 2.
- 2046 8. Third Party persists the Identity Key.
- 2047 9. As needed, Third Party checks their ability to connect to the service, and obtains the current status of the
2048 service.
- 2049

2050

2051 **2: Retail Customer Authorizes Third Party Resource Access via Data Custodian**

2052



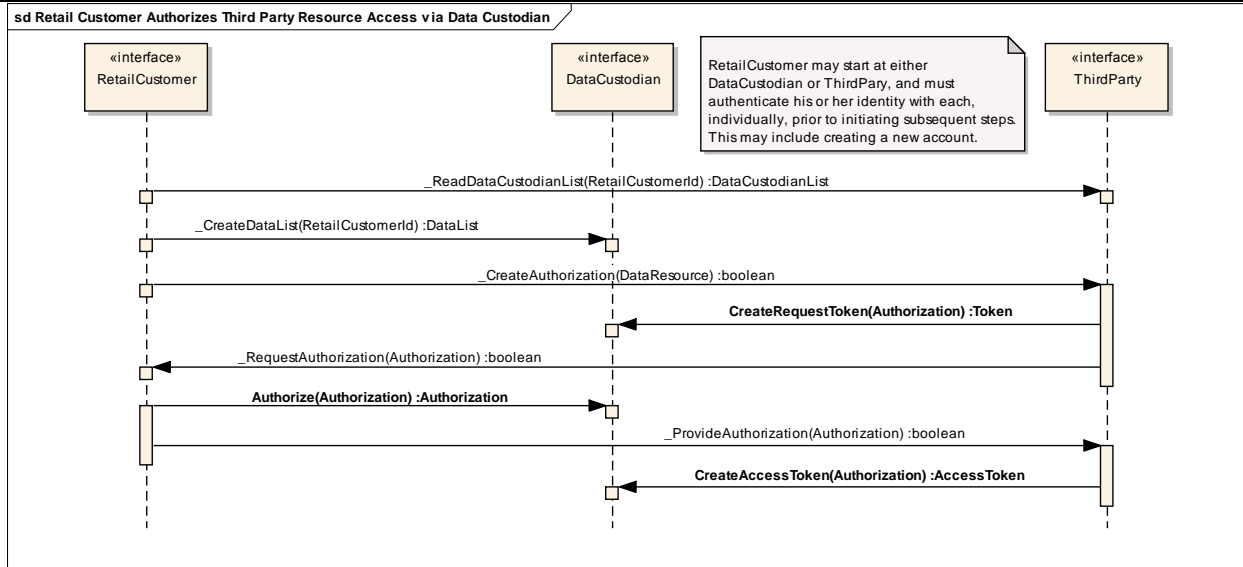
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2053
2054

Figure 10: Retail Customer Authorizes Third Party Resource Access via Data Custodian

2055 **Description**

2056 A Retail Customer wants to grant permission for a Data Custodian to share a particular data resource with a Third
2057 Party. The Retail Customer initiates the process through the Data Custodian.

2058 **Pre-Condition:** Retail Customer has established accounts with Data Custodian and Third Party.

2059 **Pre-Condition:** Third Party has an established account with Data Custodian.

2060 **Pre-Condition:** Data Custodian and Third Party have published and made Retail Customer aware of their privacy
2061 policy related to collection and handling of customer information.

2062 **Invariant Constraint:** No resource data or personal data is provided to the Third Party by the Data Custodian as
2063 part of this interaction.

2064 **Post-Condition:** A Shared Resource Key is generated to allow all three roles to refer to the same shared resource
2065 without disclosing PII. This key is known to all three roles.

2066 **Post-Condition:** The Third Party has the Retail Customer's permission to get the specified resource data from the
2067 Data Custodian.

2068 **Post-Condition:** The Data Custodian sends the Retail Customer confirmation of establishment of the Third Party
2069 data access relationship.

2070 **Scenario: Basic Path**

- 2071 1. The Retail Customer decides to grant permission for the Data Custodian to share their resource data with the
2072 Third Party
- 2073 2. (Optional) Retail Customer finds their appropriate Data Custodian from Third Party, and navigates to the
2074 appropriate place to begin establishment of sharing relationship.
- 2075 3. Retail Customer requests that the Data Custodian establish a new data access relationship.
- 2076 4. Data Custodian presents the Retail Customer with a list of resources that can be shared with Third Parties. Any
2077 additional attributes (e.g., duration for which permission should be granted) that can be selected are also
2078 presented.
- 2079 5. Retail Customer selects a resource to share, sets any available attributes for the relationship, and specifies a
2080 Third Party that is known to the Data Custodian. Selecting these parameters and completing the interaction
2081 indicates permission for the Data Custodian to grant the specified Third Party access to the specified shared



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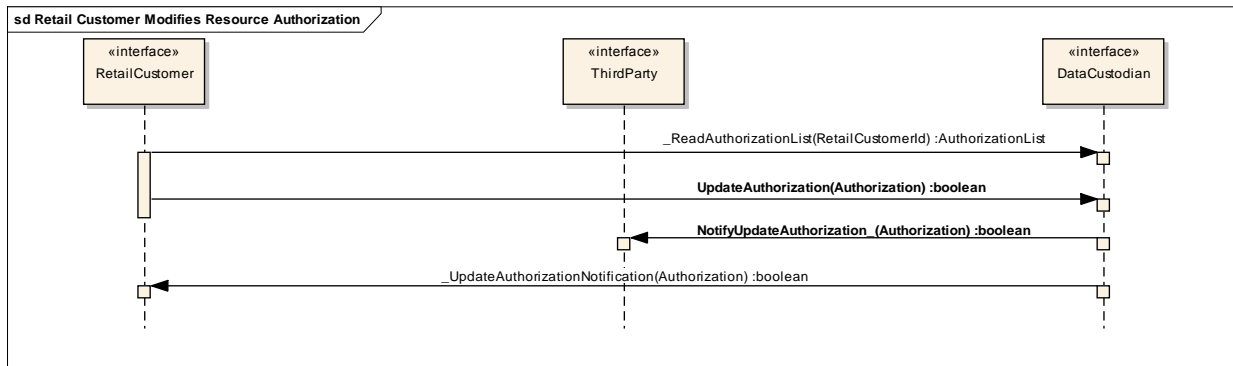
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- 2082 resource.
- 2083 6. The relationship will only be created if the Data Custodian accepts the selections for the Third Party (e.g., a
- 2084 Data Custodian may constrain access to certain resource attributes depending on resource sensitivity).
- 2085 7. Data Custodian generates a Shared Resource Key (Request Token) to begin creation of this relationship and
- 2086 provides it to the Third Party. Each Shared Resource Key is unique to the relationship between a Retail
- 2087 Customer, Data Custodian, Third Party, and specific data resource.
- 2088 8. Third Party requests authorization of the token by the Retail Customer, via the Data Custodian.
- 2089 9. Retail Customer authenticates with Data Custodian and authorizes the Request Token.
- 2090 10. Third Party exchanges the authorized Request Token for an Access Token from the Data Custodian.
- 2091 11. Third Party and Data Custodian persist the Authorization, associating it with its identity of the Retail Customer.
- 2092
- 2093

2094 **3: Retail Customer Modifies Resource Authorization**

2095



2096 **Figure 11: Retail Customer Modifies Resource Authorization**

2097

2098 **Description**

2099 The Retail Customer has an existing third party data access relationship with a particular Data Custodian and Third

2100 Party and wants to either extend or restrict the permissions associated with that relationship.

2101 **Pre-Condition:** Retail Customer has established a Third Party data access relationship with the Data Custodian and

2102 the Third Party with respect to a particular resource, resulting in a unique Shared Resource Key identifying the

2103 relationship.

2104 **Invariant Constraint:** No resource data or personal data is provided to the Third Party by the Data Custodian as

2105 part of this interaction.

2106 **Post-Condition:** Future interactions between the Data Custodian and the Third Party with respect to the specified

2107 resource are governed by the modified permissions.

2108 **Post-Condition:** The Third Party handles any data not allowed by the termination of the relationship in the manner

2109 specified in any service agreements among the parties in the relationship (e.g., all instances of the data in control of

2110 the Third Party are deleted within**Post-Condition:** The Data Custodian sends the Retail Customer confirmation of

2111 modification of the permissions of the Third Party data access relationship.

2112 **Scenario: Basic Path**

- 2113 1. Retail Customer chooses to modify relationship permissions with the Data Custodian.
- 2114 2. Data Custodian presents the Retail Customer with a list of resources that are shared with Third Parties. If the



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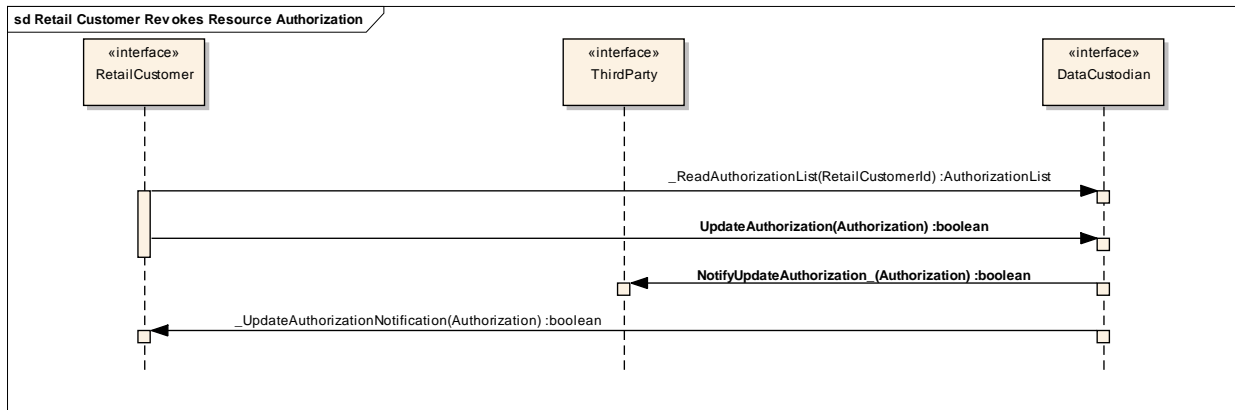
Request Title: Energy Services Provider Interface Standard

- 2115 Retail Customer may only grant access to one resource, S2 and S3 may be skipped.
- 2116 3. Retail Customer chooses particular resource whose permissions he/she wishes to modify.
- 2117 4. Data Custodian provides available resource attributes and current settings to Retail Customer.
- 2118 5. Retail Customer chooses new settings.
- 2119 6. The new permissions governing the relationship will apply only if the Data Custodian accepts the selections for
- 2120 the Third Party (e.g., a Data Custodian may constrain access to certain resource attributes depending on
- 2121 resource sensitivity).
- 2122 7. Data Custodian persists the new permissions, which will be used from this point forward to govern the
- 2123 relationship (until further changed or the relationship is terminated).
- 2124 8. Data Custodian notifies Third Party that permissions have changed (identifying the resource by its Shared
- 2125 Resource Key). This notification may be immediate or deferred (e.g., as part of a resource push from Use Case
- 2126 8, perhaps as part of a header).
- 2127 9. Data Custodian notifies Retail Customer that permissions have been changed.
- 2128 10. The Third Party handles any data not allowed by the modification of the resource authorization in the manner
- 2129 specified in any service agreements among the parties in the relationship.

2131

2132 **4: Retail Customer Revokes Resource Authorization**

2133



2134 **Figure 12: Retail Customer Revokes Resource Authorization**

2135 **Description**

2136 The Retail Customer has an existing third party data access relationship with a particular Data Custodian and Third
 2137 Party and wants to terminate that relationship

2138 **Pre-Condition:** Third Party has an established account with Data Custodian.

2139 **Pre-Condition:** Retail Customer has established a Third Party data access relationship with the Data Custodian and
 2140 the Third Party with respect to a particular resource, resulting in a unique Shared Resource Key identifying the
 2141 relationship.

2142 **Invariant Constraint:** No resource data or personal data is provided to the Third Party by the Data Custodian as
 2143 part of this interaction.

2144 **Post-Condition:** Both the Third Party and the Data Custodian delete the Shared Resource Key for the relationship
 2145 and no future interactions are permitted for that relationship.



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2147 **Post-Condition:** The Third Party handles any data not allowed by the termination of the relationship in the manner
2148 specified in any service agreements among the parties in the relationship (e.g., all instances of the data in control of
2149 the Third Party are deleted within

2150 **Post-Condition:** The Data Custodian sends the Retail Customer confirmation of termination of the Third Party data
2151 access relationship.

2152 **Scenario:** Basic Path

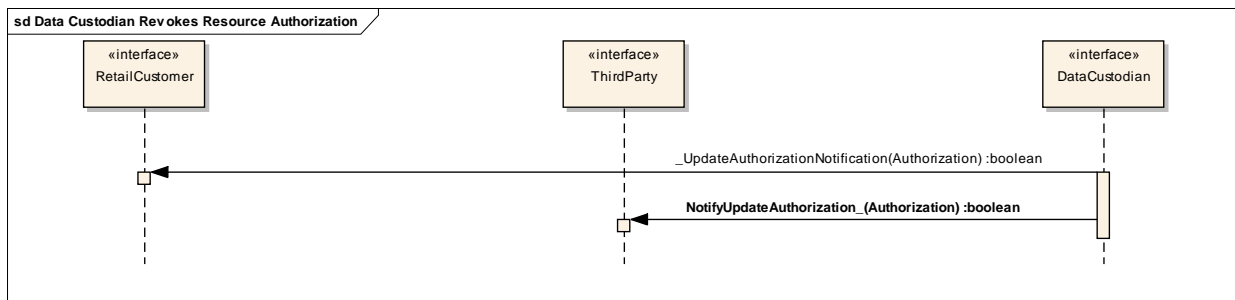
- 2153 1. Retail Customer requests that Data Custodian terminate the data access relationship.
- 2154 2. Data Custodian presents the Retail Customer with a list of resources for which there are valid relationships with
2155 Third Parties. If the Retail Customer only has one valid relationship, S2 and S3 may be skipped.
- 2156 3. Retail Customer chooses a resource whose relationship is to be terminated.
- 2157 4. Data Custodian terminates the relationship, deleting the appropriate Shared Resource Key from its list of valid
2158 relationships.
- 2159 5. Data Custodian notifies Third Party that the relationship has been terminated (identifying the relationship by its
2160 Shared Resource Key).
- 2161 6. Data Custodian notifies Retail Customer that the relationship has been terminated.
- 2162 7. The Third Party handles any data not allowed by the termination of the relationship, in the manner specified in
2163 any service agreements among the parties in the relationship.

2164

2165

2166 5: Data Custodian Revokes Resource Authorization

2167



2168

2169 **Figure 13:** Data Custodian Revokes Resource Authorization

2170 Description

2171 The Retail Customer has an existing third party data access relationship with a particular Data Custodian and Third
2172 Party. The Data Custodian wants to terminate the relationship (for whatever reason).

2173 **Pre-Condition:** Third Party has an established account with Data Custodian.

2174 **Pre-Condition:** Retail Customer has established a Third Party data access relationship with the Data Custodian and
2175 the Third Party with respect to a particular resource, resulting in a unique Shared Resource Key identifying the
2176 relationship.

2177 **Invariant Constraint:** No resource data or personal data is provided to the Third Party by the Data Custodian as
2178 part of this interaction.

2179 **Post-Condition:** Both the Third Party and the Data Custodian delete the Shared Resource Key for the relationship
2180 and no future interactions are permitted for that relationship.



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2181 **Post-Condition:** The Third Party handles any data not allowed by the termination of the relationship, in the manner
 2182 specified in any service agreements among the parties in the relationship (e.g., all instances of the data in control of
 2183 the Third Party are deleted within

2184 **Post-Condition:** The Data Custodian sends the Retail Customer notification of termination of the Third Party data
 2185 access relationship.

2186 **Scenario:** Basic Path

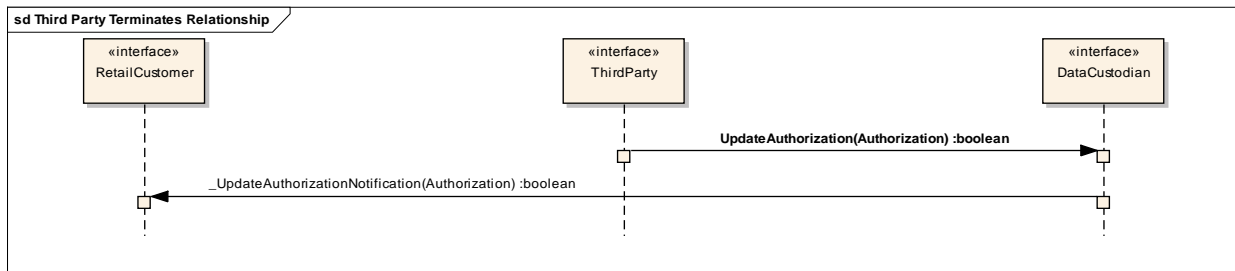
- 2187 1. Data Custodian decides to terminate relationship with Third Party.
- 2188 2. Data Custodian notifies Retail Customer of termination decision; no acknowledgement or confirmation is
 2189 required.
- 2190 3. Data Custodian notifies Third Party of termination of the relationship, identifying the relationship by a Shared
 2191 Resource Key.
- 2192 4. The Third Party handles any data not allowed by the termination of the relationship, in the manner specified in
 2193 any service agreements among the parties in the relationship.

2194

2195

2196 6: Third Party Terminates Relationship

2197



2198 **Figure 14:** Third Party Terminates Relationship

2199

2200 Description

2201 The Retail Customer has an existing third party data access relationship with a particular Data Custodian and Third
 2202 Party. The Third Party determines that it no longer wants to provide services to the Retail Customer and terminates
 2203 the relationship.

2204 **Pre-Condition:** Third Party has an established account with Data Custodian.

2205 **Pre-Condition:** Retail Customer has established a Third Party data access relationship with the Data Custodian and
 2206 the Third Party with respect to a particular resource, resulting in a unique Shared Resource Key identifying the
 2207 relationship.

2208 **Invariant Constraint:** No resource data or personal data is provided to the Third Party by the Data Custodian as
 2209 part of this interaction.

2210 **Post-Condition:** Both the Third Party and the Data Custodian delete the Shared Resource Key for the relationship
 2211 and no future interactions are permitted for that relationship.

2212 **Post-Condition:** The Third Party handles any data not allowed by the termination of the relationship, in the manner
 2213 specified in any service agreements among the parties in the relationship (e.g., all instances of the data in control of
 2214 the Third Party are deleted within

2215 **Post-Condition:** The Data Custodian sends the Retail Customer notification of termination of the Third Party data
 2216 access relationship.



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For Quadrant: Retail Electric Quadrant

Requesters: Open ADE Task Force

Request No.: R10008

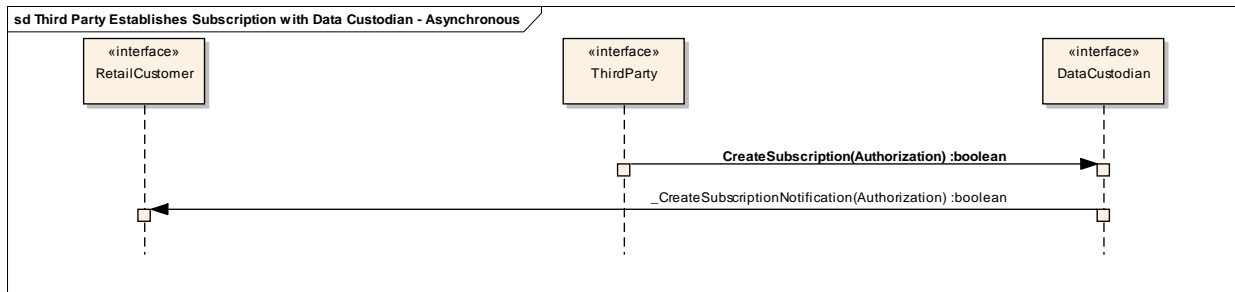
Request Title: Energy Services Provider Interface Standard

2217 **Scenario:** Basic Path

- 2218 1. Third Party decides to terminate a third party data access relationship.
- 2219 2. Third Party notifies Data Custodian of termination of relationship, identifying the relationship by the Shared
- 2220 Resource Key.
- 2221 3. An invalid request (e.g., specification of a Shared Resource Key not associated with the Third Party) will not be
- 2222 accepted.
- 2223 4. Data Custodian deletes Shared Resource Key, terminating the relationship.
- 2224 5. Data Custodian notifies the Retail Customer of termination of the relationship. No acknowledgement or
- 2225 confirmation is required.
- 2226 6. The Third Party handles any data not allowed by the termination of the relationship, in the manner specified in
- 2227 any service agreements among the parties in the relationship.
- 2228
- 2229

2230 **7: Third Party Establishes Subscription with Data Custodian - Asynchronous**

2231



2232 **Figure 15: Third Party Establishes Subscription with Data Custodian - Asynchronous**

2234 **Description**

2235 The Retail Customer has an existing third party data access relationship with a particular Data Custodian and Third
 2236 Party. The Third Party establishes a *subscription* indicating the circumstances (i.e., an agreed-upon schedule and/or
 2237 specification of special events) under which the Data Custodian should provide the Third Party with the relevant
 2238 resource data.

2239 Depending on the services offered by a Data Custodian, the subscription may indicate the circumstances under
 2240 which the Data Custodian will send resource data or only notification that resource data is available (i.e., whether
 2241 the Data Custodian supports a push or pull model). Subscriptions may be parameterized, if supported by the Data
 2242 Custodian, to define preferred delivery criteria (e.g., new data whenever available or only once per day).

2243 **Pre-Condition:** Third Party has an established account with Data Custodian.

2244 **Pre-Condition:** Retail Customer has established a Third Party data access relationship with the Data Custodian and
 2245 the Third Party with respect to a particular resource, resulting in a unique Shared Resource Key identifying the
 2246 relationship.

2247 **Invariant Constraint:** No resource data or personal data is provided to the Third Party by the Data Custodian as
 2248 part of this interaction.

2249 **Post-Condition:** The Data Custodian records a valid subscription on behalf of the Third Party. Future data
 2250 availability triggers satisfying the subscription will result in the appropriate information being sent to the Third
 2251 Party.

2252 **Post-Condition:** Data Custodian sends the Third Party confirmation of its subscription request

2253 **Post-Condition:** Data Custodian sends the Retail Customer notification of the Third Party's subscription request



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Request Title: Energy Services Provider Interface Standard

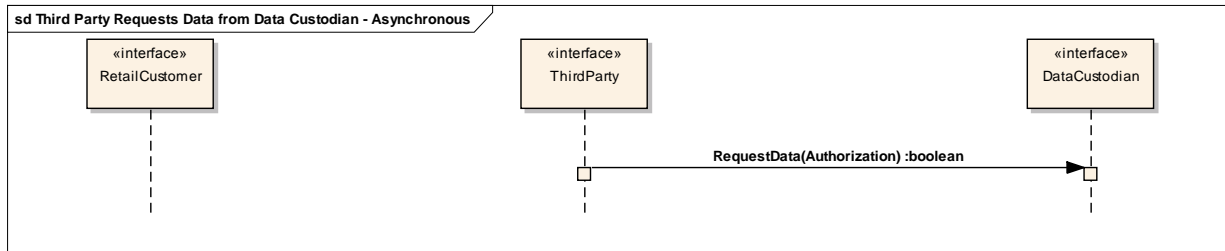
2254 **Scenario: Basic Path**

- 2255 1. Third Party requests that the Data Custodian establish a new subscription.
- 2256 2. Third Party provides Data Custodian with information defining the subscription request. At a minimum, this
- 2257 information includes a Shared Resource Key identifying the resource whose data is to be shared. The
- 2258 information may include additional subscription parameters, as supported by the Data Custodian.
- 2259 3. The subscription will not be accepted if the Shared Resource Key is invalid.
- 2260 4. The Data Custodian saves the subscription information, associating the subscription with the Shared Resource
- 2261 Key and the Third Party.
- 2262 5. The Data Custodian notifies the Third Party that the subscription request was successful. No acknowledgement
- 2263 or confirmation is required.
- 2264 6. The Data Custodian notifies the Retail Customer that the Third Party has completed a subscription for their
- 2265 resource data. No confirmation is required, as the Third Party already has permissions as indicated by the valid
- 2266 Shared Resource Key. If the subscription is not acceptable to the Retail Customer, Use Case 3 can be exercised
- 2267 to modify permissions for the Third Party.
- 2268

2269

2270 **8: Third Party Requests Data from Data Custodian - Asynchronous**

2271



2272

2273 **Figure 16: Third Party Requests Data from Data Custodian - Asynchronous**

2274 **Description**

2275 The Retail Customer has an existing third party data access relationship with a particular Data Custodian and Third
 2276 Party. The Third Party requests specific resource data to be delivered with next transfer.

2277 **Pre-Condition:** Third Party has an established account with Data Custodian

2278 **Pre-Condition:** Retail Customer has established a Third Party data access relationship with the Data Custodian and
 2279 the Third Party with respect to a particular resource, resulting in a unique Shared Resource Key identifying the
 2280 relationship

2281 **Invariant Constraint:** No resource data or personal data is provided to the Third Party by the Data Custodian as
 2282 part of this interaction.

2283 **Post-Condition:** The Data Custodian records the request on behalf of the Third Party. Future data availability
 2284 triggers will result in the appropriate information being sent to the Third Party.

2285 **Post-Condition:** Data Custodian sends the Third Party confirmation of its data request.

2286 **Scenario: Basic Path**

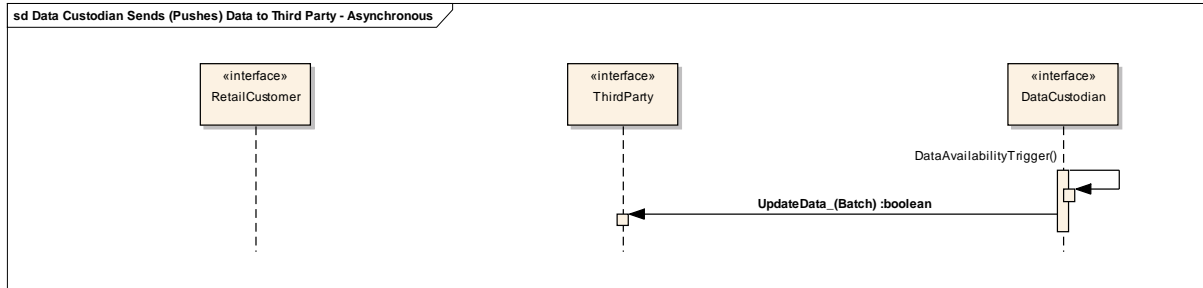
- 2287 1. Third Party decides to request resource data from the Data Custodian.
- 2288 2. Data Custodian Checks validity of request.
- 2289 3. Data Custodian queues request for next asynchronous transfer.
- 2290 4. Data Custodian sends confirmation to Third Party.
- 2291



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2292
2293
2294

9: Data Custodian Sends (Pushes) Data to Third Party - Asynchronous



2295
2296

Figure 17: Data Custodian Sends (Pushes) Data to Third Party - Asynchronous

2297 Description

2298 The Retail Customer has an existing third party data access relationship with a particular Data Custodian and Third
2299 Party. The Third Party has established a subscription for receiving the relevant resource data from the Data
2300 Custodian. This resource data is sent (pushed) to the subscribed Third Party by the Data Custodian when an event
2301 triggers indicates a need to push new resource data.
2302 Conditions observable to the Data Custodian change, causing a data availability trigger to be checked to see if there
2303 is a need to push resource data to the Third Party. Such triggers can be caused by any of the following observable
2304 changes

- 2305 • New resource data is received by the Data Custodian
- 2306 • A new subscription is received by the Data Custodian
- 2307 • A pre-defined interval has elapsed
- 2308 • A request for resource data has been received from a Third Party

2309

2310 **Pre-Condition:** Third Party has an established account with Data Custodian.

2311 **Pre-Condition:** Retail Customer has established a Third Party data access relationship with the Data Custodian and
2312 the Third Party with respect to a particular resource, resulting in a unique Shared Resource Key identifying the
2313 relationship.

2314 **Pre-Condition:** A subscription by the Third Party to receive resource data from the Data Custodian has been
2315 established.

2316 **Invariant Constraint:** No personal information is provided to the Third Party by the Data Custodian.

2317 **Post-Condition:** The Data Custodian sends resource data to the subscribed Third Party.

2318 **Post-Condition:** Only data specifically requested or modified and in a subscription is sent to the Third Party.

2319 Scenario: Basic Path

- 2320 1. A data availability trigger is received by the Data Custodian.
- 2321 2. Data Custodian determines the Shared Resource Keys associated with the data availability trigger. It then
2322 determines if there are any subscriptions associated with the Shared Resource Key and whether the conditions
2323 of the subscription are satisfied (i.e., if it is time to send out resource data). If so, it proceeds to S3.
- 2324 3. Data Custodian determines the Third Party associated with the subscriptions. This includes a check that the
2325 Third Party is still in a valid relationship with the Data Custodian and any other relevant checks prior to
2326 releasing resource data to that Third Party.
- 2327 4. Data Custodian provides data resources to Third Party.



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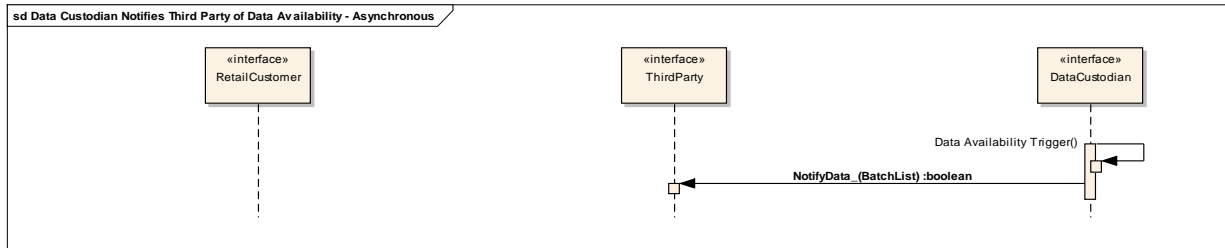
2328 5. Third party persists data for the period specified by data retention requirements.

2329

2330

2331 10: Data Custodian Notifies Third Party of Data Availability - Asynchronous

2332



2333

2334 Figure 18: Data Custodian Notifies Third Party of Data Availability - Asynchronous

2335 Description

2336 The Retail Customer has an existing third party data access relationship with a particular Data Custodian and Third
2337 Party. The Third Party has established a subscription for receiving the relevant resource data from the Data
2338 Custodian. A Third Party is notified when new data satisfying its subscription parameters is available.

2339 Conditions observable to the Data Custodian change, causing a data availability trigger to be checked to see if there
2340 is a need to notify a Third Party of resource data availability. Such triggers can be caused by any of the following
2341 observable changes

- 2342 • New resource data is received by the Data Custodian
- 2343 • A new subscription is received by the Data Custodian
- 2344 • A pre-defined interval has elapsed
- 2345 • A request for resource data has been received from a Third Party

2346

2347 Pre-Condition: Third Party has an established account with Data Custodian

2348 Pre-Condition: Retail Customer has established a Third Party data access relationship with the Data Custodian and
2349 the Third Party with respect to a particular resource, resulting in a unique Shared Resource Key identifying the
2350 relationship.

2351 Pre-Condition: Data Custodian has resource data relevant to the Third Party

2352 Invariant Constraint: No personal information is provided to the Third Party by the Data Custodian

2353 Post-Condition: The Data Custodian has resource data (e.g., electricity usage data) that is available for access by
2354 the Third Party

2355 Post-Condition: The Data Custodian sends the Third Party notification of availability of resource data

2356 Scenario: Basic Path

- 2357 1. A data availability trigger event is received by the Data Custodian.
- 2358 2. Data Custodian determines the Shared Resource Keys associated with the data availability trigger. The Data
2359 Custodian then determines if there are any subscriptions associated with the Shared Resource Key and whether
2360 the conditions of the subscription are satisfied (i.e., if it is time to notify a Third Party). If so, it proceeds to S3.
- 2361 3. Data Custodian determines the Third Party associated with subscriptions. This includes a check that the Third
2362 Party is still in a valid relationship with the Data Custodian and any other relevant checks prior to determining
2363 that it is appropriate to send resource data to that Third Party



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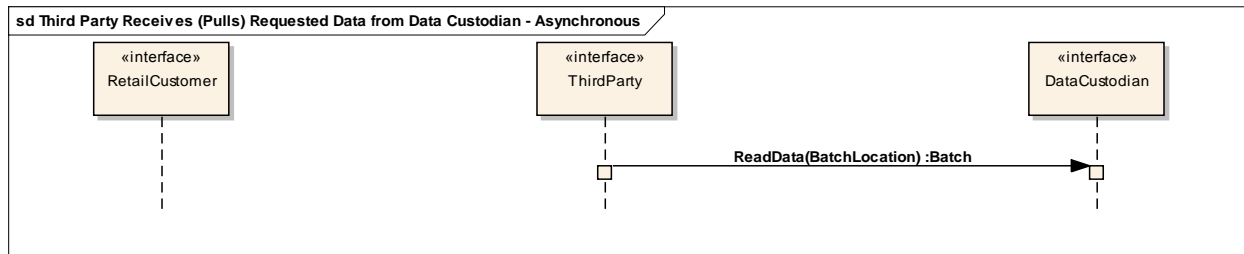
Request Title: Energy Services Provider Interface Standard

2364 4. Data Custodian notifies the Third Party of the availability of resource data associated with the Shared Resource
 2365 Key. Note that notification can take different forms. Notification could be sent asynchronously as soon as the
 2366 trigger is evaluated. Notification for several resources could be bundled for delivery to a common Third Party.
 2367 Notification could be queued, awaiting the next scheduled interaction with the Third Party (e.g., as part of a
 2368 response to a regular pull from the Third Party). The essence of the use case is that a notification is prepared and
 2369 delivered at some point; the specific mechanism and timing is not restricted.
 2370

2371

2372 11: Third Party Receives (Pulls) Requested Data from Data Custodian - Asynchronous

2373



2374

2375 **Figure 19:** Third Party Receives (Pulls) Requested Data from Data Custodian - Asynchronous

2376 **Description**

2377 The Retail Customer has an existing third party data access relationship with a particular Data Custodian and Third
 2378 Party. The Third Party requests the relevant subscribed and requested resource data from the Data Custodian, who
 2379 replies with the data if the request is valid.

2380 **Pre-Condition:** Third Party has an established account with Data Custodian

2381 **Pre-Condition:** Retail Customer has established a Third Party data access relationship with the Data Custodian and
 2382 the Third Party with respect to a particular resource, resulting in a unique Shared Resource Key identifying the
 2383 relationship

2384 **Pre-Condition:** Data Custodian has resource data relevant to the Third Party

2385 **Invariant Constraint:** No personal data is provided to Third Parties by the Data Custodian.

2386 **Post-Condition:** The Data Custodian replies with the requested data

2387 **Post-Condition:** Only the requested resource data is provided by the Data Custodian

2388 **Scenario:** Basic Path

2389 1. Third Party receives notification or periodically attempts to pull resource data from the Data Custodian.

2390 2. Data Custodian checks validity of request.

2391 3. Data Custodian replies with requested and subscribed resource data to Third Party.

2392 4. Third Party persists resource data for use in performing services for Retail Customer.

2393

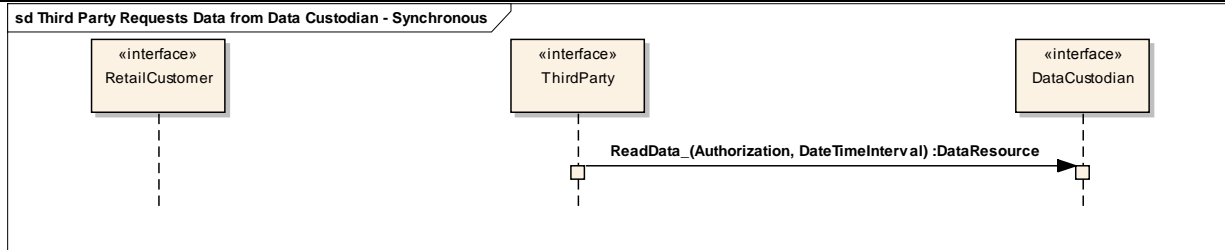
2394

2395 12: Third Party Requests Data from Data Custodian - Synchronous

2396



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2397
2398

Figure 20: Third Party Requests Data from Data Custodian - Synchronous

2399 **Description**

2400 The Retail Customer has an existing third party data access relationship with a particular Data Custodian and Third
2401 Party. The Third Party directly requests specific resource data from the Data Custodian, who replies with the
2402 requested data synchronously if the request is valid.

2403 **Pre-Condition:** Third Party has an established account with Data Custodian

2404 **Pre-Condition:** Retail Customer has established a Third Party data access relationship with the Data Custodian and
2405 the Third Party with respect to a particular resource, resulting in a unique Shared Resource Key identifying the
2406 relationship

2407 **Pre-Condition:** Third Party requests authorized resource data

2408 **Invariant Constraint:** No personal data is provided to Third Parties by the Data Custodian.

2409 **Post-Condition:** The Data Custodian replies with the requested data.

2410 **Post-Condition:** Only the requested resource data is provided by the Data Custodian.

2411 **Scenario: Basic Path**

- 2412 1. Third Party decides to pull resource data from the Data Custodian.
- 2413 2. Third Party specifies the resource data being requested. The request must contain the Shared Resource Key. It
2414 may also contain parameters (e.g., the period over which the specified data is requested), if permitted by Data
2415 Custodian.
- 2416 3. Data Custodian checks validity of request (e.g., Shared Resource Key is still valid and registered with this Third
2417 Party or validity of any additional parameters).
- 2418 4. Data Custodian sends requested resource data to Third Party.
- 2419 5. Third Party persists resource data for use in performing services for Retail Customer.

2420



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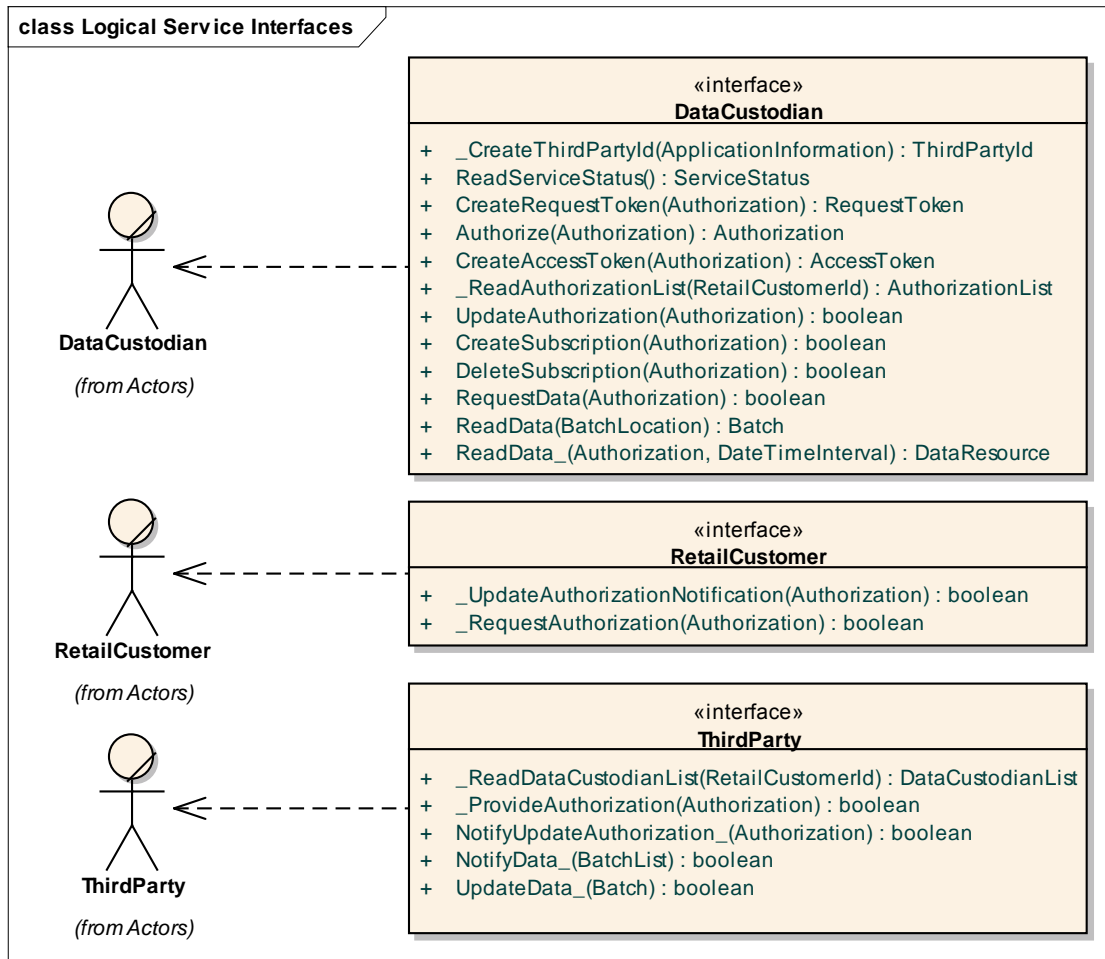
Request Title: Energy Services Provider Interface Standard

2421 **C. ESPI Abstract Services**

2422 This section provides definition of the abstract services used in the use cases. These are the services that will be
 2423 specified fully for the ESPI model business practice specification. The services are named using the following
 2424 conventions, since not all are intended to be fully standardized.

- 2425 • Underscore before the method name means “must be done, but is not standardized”
- 2426 • Underscore after the method name means “optional”

2427



2428 **Figure: 21 - Logical Service Interfaces**

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2436

DataCustodian

The DataCustodian service interface contains methods to be called by Third Party in order to authorize and receive data.



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2437

Operations

Method	Notes	Parameters
_CreateThirdPartyId() ThirdPartyId	Allows Data Custodian to obtain agreement to terms of service, contact information and application details about a Third Party application. Provides Third Party with service key and consumer secret.	<u>ApplicationInformation</u> [in] <u>ApplicationInformation</u>
ReadServiceStatus() ServiceStatus	Allows Third Parties to check their ability to access the Data Custodian service, and its current status.	
CreateRequestToken() RequestToken	Allows Third Party to request an unauthorized request token.	<u>Authorization</u> [in] <u>authRequest</u>
Authorize() Authorization	Provides ability for Retail Customer to authenticate and verify desire to authorize a Third Party request token. This results in a verifier to be used with CreateAccessToken.	<u>Authorization</u> [in] <u>authorization</u>
CreateAccessToken() AccessToken	Allows Third Party to exchange an authorized request token for an access token.	<u>Authorization</u> [in] <u>authRequest</u>
_ReadAuthorizationList() AuthorizationList	Allows Retail Customer to choose an existing Authorization. Is not standardized, since the method involves user input.	<u>RetailCustomerId</u> [in] <u>customerID</u>
UpdateAuthorization() boolean	Provides ability to update an existing Authorization.	<u>Authorization</u> [in] <u>authorization</u>
CreateSubscription() boolean	Allows Third Party to request ongoing updates to the data resources associated with the specified Authorization, to be delivered asynchronously.	<u>Authorization</u> [in] <u>authorization</u>
DeleteSubscription() boolean	Removes the data resources associated with the specified Authorization from the subscriptions.	<u>Authorization</u> [in] <u>authorization</u>
RequestData() boolean	Allows Third Parties to request initial transfer of existing authorized data, or re-transfer of same. Results are delivered asynchronously.	<u>Authorization</u> [in] <u>authorization</u>
ReadData() Batch	Allows Third Party request ("pull") of asynchronously requested and subscribed data.	<u>BatchLocation</u> [in] <u>batch</u>
ReadData_() DataResource	Allows "on demand" (synchronous) access to authorized data. Some providers may choose not to make this method available.	<u>Authorization</u> [in] <u>authorization</u> <u>DateTimeInterval</u> [in] <u>requestedInterval</u>



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Method	Notes	Parameters

2438
2439
2440
2441
2442
2443
2444

RetailCustomer

The Retail Customer service interface represents methods used to make requests of the Retail Customer.

Operations

Method	Notes	Parameters
_UpdateAuthorizationNotification() boolean	This method is not standardized, but provides notification to the Retail Customer that an Authorization was updated. May be optional, based on policies of Data Custodian.	<u>Authorization</u> [in] <u>authorization</u>
_RequestAuthorization() boolean	This method represents the delivery of the request to authorize an access grant. The normal flow implements this using a URL redirect, but other methods may be possible.	<u>Authorization</u> [in] <u>authorization</u>

2445
2446
2447
2448
2449
2450
2451

ThirdParty

The Third Party service interface contains methods to be called by the Data Custodian.

Operations

Method	Notes	Parameters
_ReadDataCustodianList() DataCustodianList	This is a required, but not standardized, method to allow the Retail Customer to find their Data Custodian.	<u>RetailCustomerId</u> [in] <u>reatilCustomerID</u>
_ProvideAuthorization() boolean	This method represents the callback after authorization of a request token.	<u>Authorization</u> [in] <u>authorization</u>
NotifyUpdateAuthorization() boolean	This method allows for a Data Custodian to notify a Third Party when an authorization has been modified, so that timely requests to extend authorizations can be provided to Retail Customer, and so that the Third Party can differentiate between problems and lack of authorization.	<u>Authorization</u> [in] <u>authorization</u>
NotifyData_() boolean	This optional method can be implemented in order to avoid having to poll for new data. It is called by the Data Custodian to indicate that requested authorized data is available via ReadData.	<u>BatchList</u> [in] <u>batchList</u>



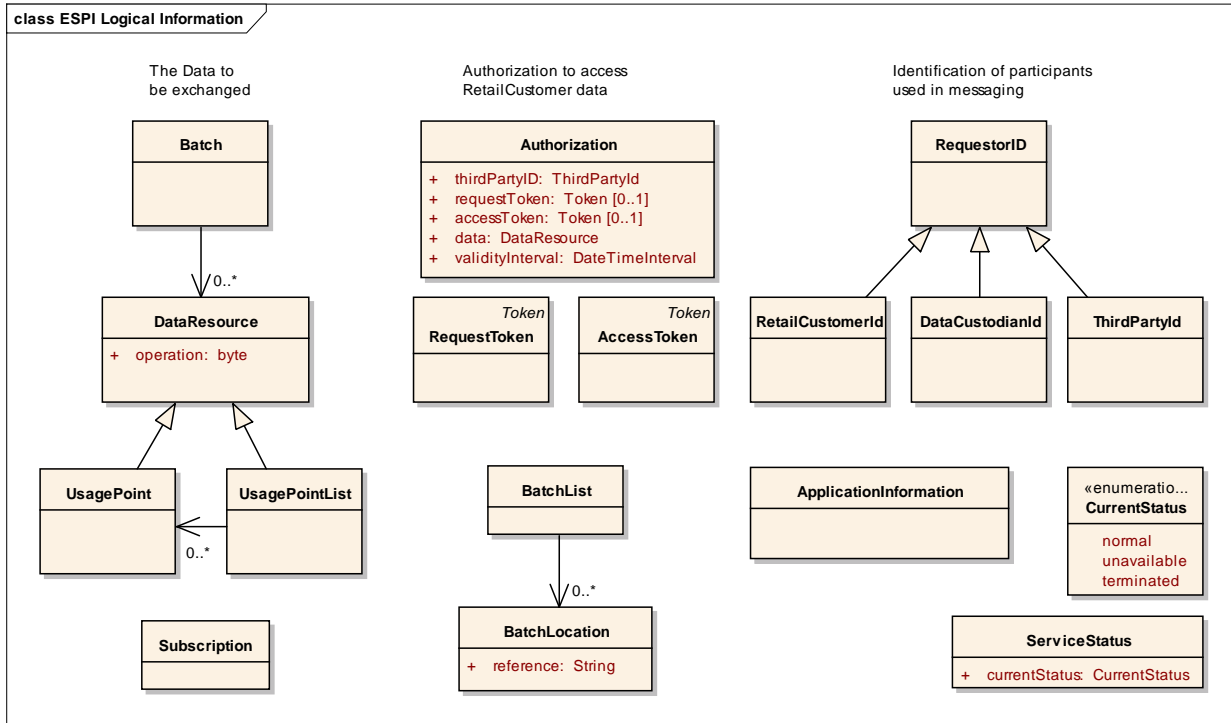
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Method	Notes	Parameters
UpdateData_() boolean	This method can be implemented by the Third Party to allow asynchronous transfers to use the "push" model for delivery. If used, notify is not used, and polling is avoided.	Batch [in] <u>data</u>

2452
2453

Logical Information Model

2455 This section contains descriptions of the data elements used in the abstract services.



2456
2457 **Figure 22: ESPI Logical Information Model**
2458

AccessToken

2459
2460
2461

AccessToken is a shared key representing the relationship between a RetailCustomer, DataCustodian, and ThirdParty for a particular data resource.

ApplicationInformation

2462
2463
2464
2465

Includes (non-standardized) information about the Third Party Application requesting access to the DataCustodian services. Information requested may include items such as Organization Name, Website, Contact Info, Application Name, Description, Icon, Type,



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2466 default Notification and Callback endpoints, and may also include agreement with terms
2467 of service.

2468 **Authorization**

2469 Description of an authorization. Includes the information constraining and defining
2470 access to the Data. May include additional security elements, such as signature,
2471 timestamp, nonce, etc. as well as callback to allow redirection of the user agent.

Name	Type	Description
thirdPartyID	<i>ThirdPartyId</i>	The identifier issued to the Third Party by the Data Custodian.
requestToken	<i>Token</i>	An unauthorized token, issued by Data Custodian.
accessToken	<i>Token</i>	An access token that has been authorized by the user at the Data Custodian.
data	<i>DataResource</i>	The data resource to which the authorization was granted.
validityInterval	<i>DateTimeInterval</i>	The date time interval during which this access is authorized.

2472 **Batch**

2473 This object is simply a container to hold a number of data resources.

2474 **BatchList**

2475 BatchList is a container to refer to a multiple batches of data.

2476 **BatchLocation**

2477 Specifies the location of a specific batch of data.

Name	Type	Description
reference	<i>String</i>	

2478 **CurrentStatus** «enumeration»

2479 Valid values for current status.

Name	Type	Description
normal		
unavailable		
terminated		

2480 **DataCustodianId**

2481 An identifier for the Data Custodian.



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2482 **DataResource**

2483 Generalization of any data object that can be exchanged.

Name	Type	Description
operation	<i>byte</i>	Create, Update, Delete

2484 **RequestToken**

2485 RequestToken is the first step toward obtaining an authorized AccessToken.

2486 **RequestorID**

2487 Generic superclass for identifiers.

2488 **RetailCustomerId**

2489 An identifier for the Retail Customer.

2490 **ServiceStatus**

2491 Contains the current status of the service.

Name	Type	Description
currentStatus	<i>CurrentStatus</i>	

2492 **Subscription**

2493 Defines the parameters of a subscription between third party and data custodian

2494 **ThirdPartyId**

2495 An identifier for the Third Party.

2496 **Token**

2497 A Token is a key associated with a secret used for securing exchanges.

2498 **UsagePointList**

2499 Container to hold multiple UsagePoint objects.

2500

2501 **D. Goals for the Capability of the Standard**

2502 **Sample Business Process Guidelines**

- 2503 ▪ ESPI Discovery
- 2504 ○ Authorized Third Party and Data Custodian agree to service level agreements (SLAs)
- 2505 and configure ESPIs services (REQ 21.1.3, REQ 21.1.16, REQ 21.1.18)



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- 2506 ○ Authorized Third Party retrieves listing of supported operations with extensions and
- 2507 versions (REQ 21.1.14)
- 2508 ○ Data Custodian retrieves listing of supported operations with extensions and versions
- 2509 (REQ 21.1.14)
- 2510 ○ Authorized Third Party and Data Custodian subscribe to notifications
- 2511 ■ Retail Customer Authorization
- 2512 ○ Retail Customer Grants Permission (REQ.21.1.4, REQ.21.1.7, REQ.21.1.8,
- 2513 REQ.21.1.9, REQ.21.1.10, REQ.21.1.15)
- 2514 ○ Retail Customer Extends Permission (REQ.21.1.9)
- 2515 ○ Retail Customer Terminates Permission (REQ.21.1.10)
- 2516 ■ ADE Publication
- 2517 ○ Authorized Third Party Requests or Subscribes to Retail Customer EUI
- 2518 ○ Data Custodian Provides Retail Customer EUI to Authorized Third Party
- 2519 (REQ.21.1.20)

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E. Cyber Security Requirements

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2523 *[These will be provided by CSWG/ASAP as contribution assignee: MJB Coordinator]*

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F. Model Conformance Information

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2526 The following table provides information about the elements included in ESPI and their relation to the NAESB
 2527 PAP10 Energy Usage Information Model as well as the IEC TC57 CIM Model. Harmonization across these models
 2528 is a goal of this recommendation, as is aligning with other usage information interfaces, including Smart Energy
 2529 Profile 2.0.

2530

PAP10 EUI Model Element	Type	ESPI Model Element	Type	CIM Notes
CustomerAuthorisation.name	String	(OAuth) access_token		N/A
CustomerAuthorisation.validityInterval	DateTimeInterval	(OAuth 2.0) expires_in		N/A
UsagePoint.name	String	UsagePoint.mRID	HexBinary128	Same
UsagePoint.description	String	UsagePoint.description	String32	Same
		UsagePoint.status	UInt8	connectionState
ServiceCategory.kind	ServiceKind	ServiceCategory.kind	ServiceKind	Same
ServiceKind.electricity		ServiceKind 0		(encoded)
ServiceKind.gas		ServiceKind 1		(encoded)
ServiceKind.water		ServiceKind 2		(encoded)
MeterReading.name	String	MeterReading.mRID	HexBinary128	Same
		MeterReading.description	String32	Same
ReadingType.name	String	ReadingType.mRID	HexBinary128	Same
		ReadingType.description	String32	Same
ReadingType.defaultQuality	QualityOfReading	ReadingType.defaultQuality	QualityOfReading	Recommended extension
ReadingType.direction	ReadingDirection	ReadingType.flowDirection	FlowDirectionType	Same
ReadingType.intervalLength	Duration	ReadingType.intervalLength	UInt32	Recommended extension



RECOMMENDATION TO NAESB EXECUTIVE COMMITTEE

For Quadrant: Retail Electric Quadrant

Requesters: Open ADE Task Force

Request No.: R10008

Request Title: Energy Services Provider Interface Standard

PAP10 EUI Model Element	Type	ESPI Model Element	Type	CIM Notes
ReadingType.kind	ReadingKind	ReadingType.kind	KindType	measurementKind
ReadingType.multiplier	UnitMultiplier	ReadingType.powerOfTenMultiplier	PowerOfTenMultiplierType	Recommended extension
ReadingType.unit	UnitSymbol	ReadingType.uom	UomType	unit
		ReadingType.accumulationBehaviour	AccumulationBehaviourType	accumulation
		ReadingType.dataQualifier	DataQualifierType	Recommended extension
		ReadingType.tou	TOUType	Same
		ReadingType.currency	CurrencyCode	Same
		ReadingType.commodity	CommodityType	Same
		ReadingType.consumptionTier	ConsumptionTierType	Same
		ReadingType.phase	PhaseCode	phases
		IntervalBlock.mRID	HexBinary128	Recommended extension
		IntervalBlock.description	String32	Recommended extension
		IntervalBlock.interval	DateTimeInterval	Recommended extension
Reading.cost	Float	Reading.cost	UInt48	Recommended extension
Reading.timeStamp	AbsoluteDateTime	Reading.timePeriod	DateTimeInterval	Same
Reading.value	Float	Reading.value	UInt48	Same
ReadingQuality.quality	QualityOfReading	ReadingQuality.quality	QualityOfReading	Recommended extension
DateTimeInterval.start	AbsoluteDateTime	DateTimeInterval.start	TimeType	Same
DateTimeInterval.duration	Duration	DateTimeInterval.duration	UInt32	Uses "end" instead of "duration"
QualityOfReading.estimated		QualityOfReading *.8.0		(encoded)
QualityOfReading.raw		QualityOfReading 1.*		(encoded)
QualityOfReading.validated		QualityOfReading *.0.1		(encoded)
ReadingDirection.forward		FlowDirectionType 1		(encoded)
ReadingDirection.reverse		FlowDirectionType 19		(encoded)
ReadingKind.energy		FlowDirectionType 12		(encoded)
ReadingKind.power		FlowDirectionType 37		(encoded)
ReadingKind.demand		FlowDirectionType 8		(encoded)
UnitMultiplier.micro		PowerOfTenMultiplierType -6		(encoded)
UnitMultiplier.m		PowerOfTenMultiplierType -3		(encoded)
UnitMultiplier.c		PowerOfTenMultiplierType -2		(encoded)
UnitMultiplier.d		PowerOfTenMultiplierType -1		(encoded)
UnitMultiplier.k		PowerOfTenMultiplierType 3		(encoded)
UnitMultiplier.M		PowerOfTenMultiplierType 6		(encoded)
UnitMultiplier.G		PowerOfTenMultiplierType 9		(encoded)
UnitMultiplier.T		PowerOfTenMultiplierType 12		(encoded)
UnitMultiplier.none		PowerOfTenMultiplierType 0		(encoded)

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2533 **4. SUPPORTING DOCUMENTATION**

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2535 **a. Description of Request:**

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2538 **b. Description of Recommendation:**

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2541 **c. Business Purpose:**

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2544 **d. Commentary/Rationale of Subcommittee(s)/Task Force(s):**