The Green Button Initiative

white house inspired.
industry led.

In response to the Obama Administration's call to action, 150+utilities and service providers commit to provide 60+ million homes and businesses with their own energy usage information in the consensus industry standard Green Button format
www.greenbuttondata.org

Photo credit: Silver Spring Networks CustomerIQ™ Energy Portal

John Teeter, john.teeter@nist.gov

Marty Burns, martin.burns@nist.gov

Smart Grid and Cyber-Physical Systems Program Office
Engineering Laboratory, NIST

NIST
National Institute of
Standards and Technology
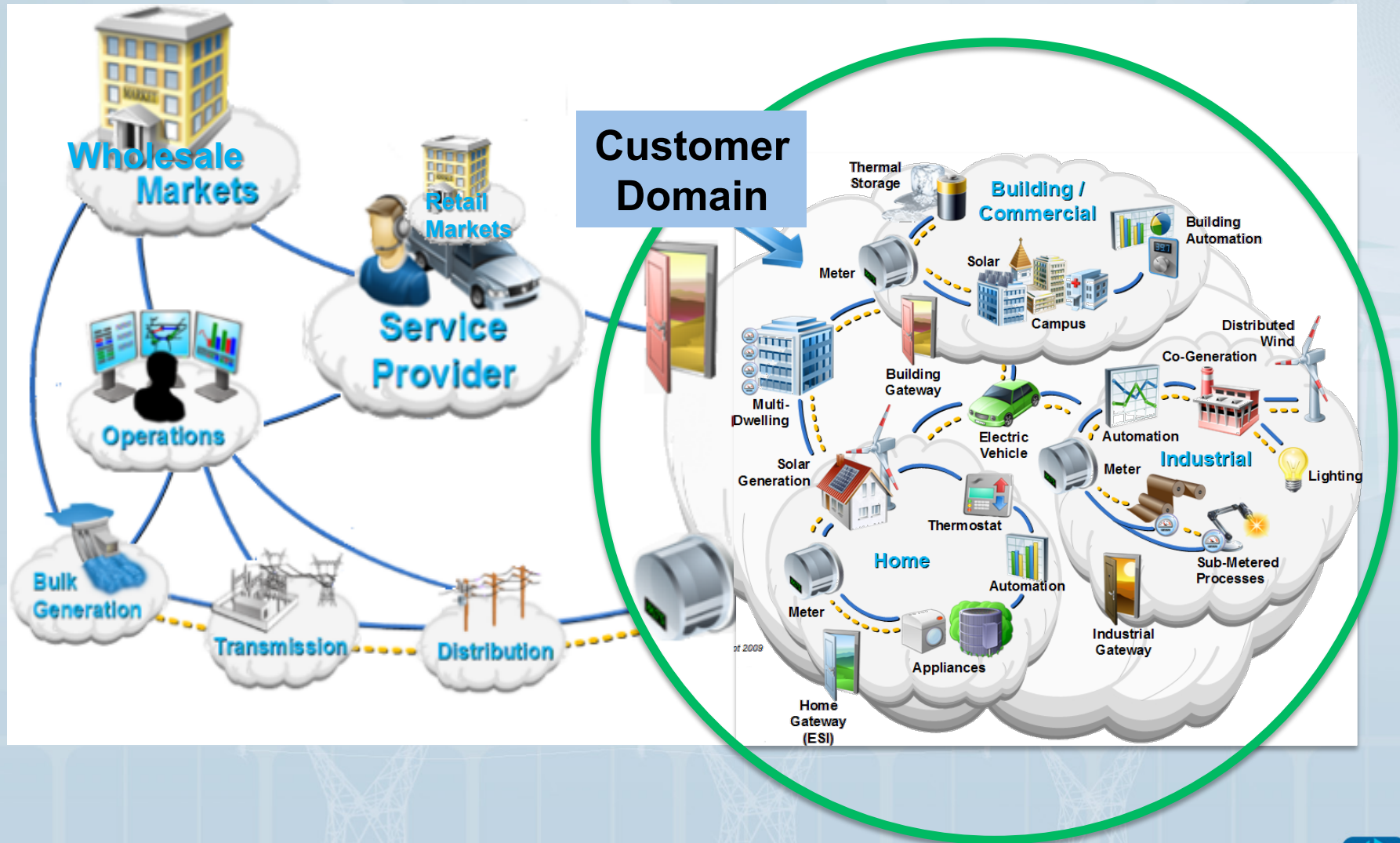U.S. Department of Commerce

engineering laboratory

Green Button Technology

– **Consistency**

– **Interoperability**

– **Scaling to Market**

Customer Domain

Current Status

- Green Button XML representation is stable.
  Review it at: Ref: espiDerived.xsd

- Download My Data Testing and Certification is ready.
  - Validate your XML Data
  - Review the DMD Test Plan

- Connect My Data implementations are underway.
  Implementation Agreements:
  - GreenButtonAuthorization.docx
  - GreenButtonAtomLinks.docx
  - espiDerived.xsd

- Green Button Sandbox
  - https://services.greenbuttondata.org
  - Deploy your own sandbox

- Open Data by Design Challenge ($17,000 in Prizes)

Definitions

EUI - One or more components of energy usage information including UsagePoint, MeterReading, IntervalBlock, ReadingType, LocalTimeParameters, ElectricPowerUsageSummary, and ElectricPowerQualitySummary

ApplicationInformation - A single data structure that contains definitions of all information shared between a Data Custodian and Authorized Third Party that govern their communications relationship.

Authorization - A single data structure that represents the three-party agreement between Retail Customer, Data Custodian, and Authorized Third Party which covers the life of the authorization for EUI exchange.

Ref: GreenButtonAuthorization.docx Section 1.1

Diversity of information in EUI

Dimensions

Kinds of Data

- Measurements of power, energy, gas, water, …
- Quality: Raw, validated, estimated, …
- Source: Meter near real-time, utility back end, third party
- Economics: Consumers need to know the cost of their consumed power (but we did not construct a pricing model)
- Identification: by customer, device, location

- Readings
- Interval data
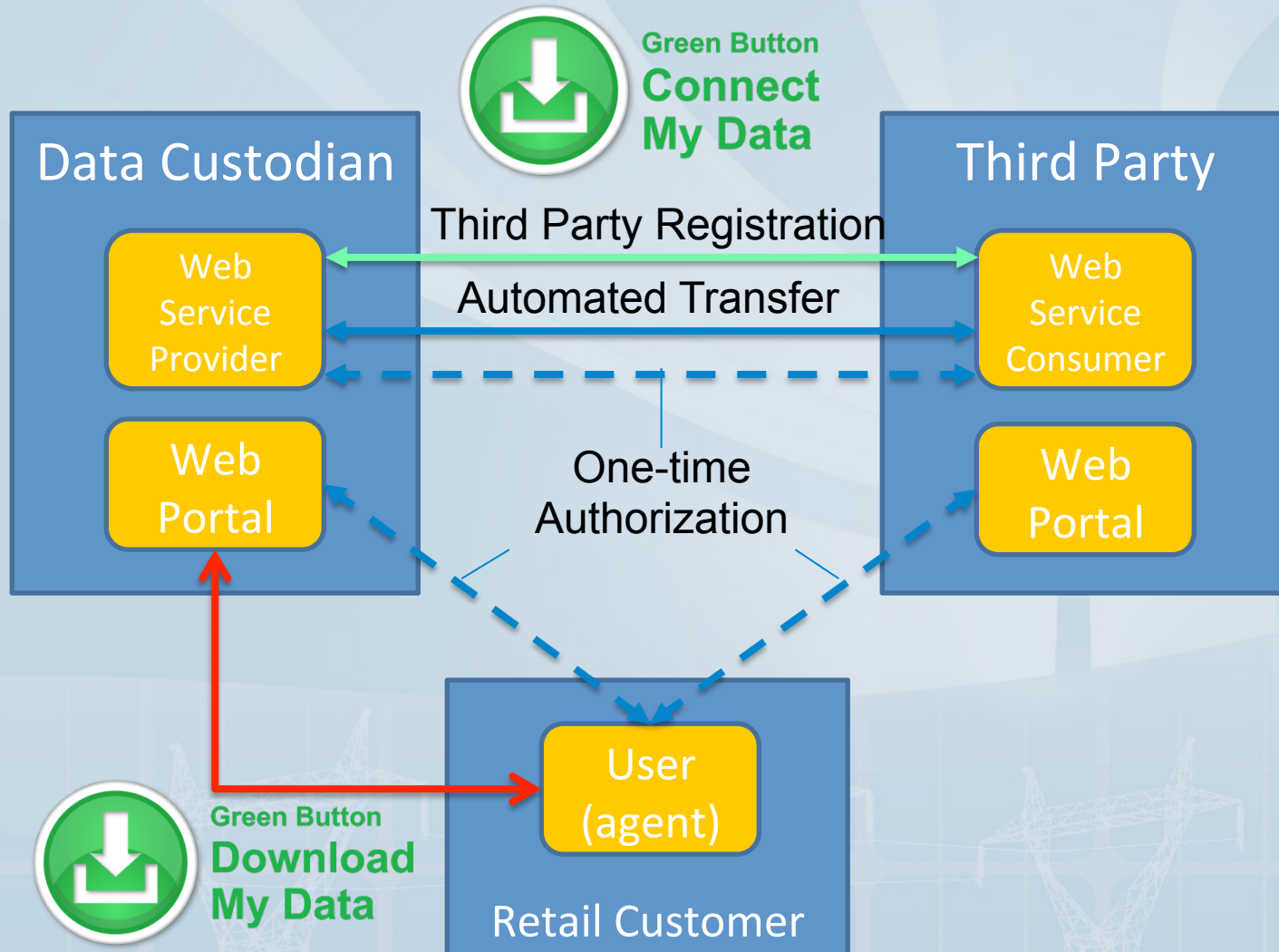- Summary Information
- Power Quality Metrics

Green Button Data Exchange

Green Button
**Connect
My Data**

Data Custodian

Third Party

Third Party Registration

| Web Service Provider | Web Service Consumer |

Automated Transfer

Web Portal

One-time Authorization

Web Portal

User (agent)

Green Button
**Download
My Data**

Retail Customer

Green Button Connect My Data

Establish Relationships

Terminate Relationships

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

3: Retail Customer Modifies Resource Authorization

4: Retail Customer Revokes Resource Authorization

5: Data Custodian Revokes Resource Authorization

1: Authorized Third Party Establishes Relationship With Data Custodian

6: Authorized Third Party Terminates Relationship

RetailCustomer

AuthorizedThirdParty

DataCustodian

7: Authorized Third Party Establishes Subscription with Data Custodian - Asynchronous

12: Authorized Third Party Requests EUI from Data Custodian - Synchronous

8: Authorized Third Party Requests EUI from Data Custodian - Asynchronous

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

10: Data Custodian Notifies Authorized Third Party of EUI Availability - Asynchronous

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

Synchronous

Asynchronous

Operational Activities

Green Button Sandbox

Open source implementation
- RESTful API functions
- Determined by "Function Block"
- Focus today on Batch transfers

Services.greenbuttondata.org
- Individual Retail Customer Accounts
    – single and multiple Usage Points
- Portfolio of Accounts[1]
- Scope Parameters[1]

Making a private sandbox
- Download/Run the Virtual Machine
- Clone/Build/Run the Github repositories
- Deploy the Amazon Machine Image (AMI) [1]

Third Party Perspective

Registration of Third Party ←←
- Manual and not yet standardized
- Each Data Custodian will have unique process
- Moving toward OAuth2 Dynamic Client Registration

Authorization of Data Access
- Individual Retail Customer Accounts
    – single and multiple Usage Points
- Scope Parameters
- Portfolio of Accounts

Process of Data Exchange
- Notifications
- OAuth2 access_tokens
- Pull Scenarios

Registration of Third Party

Manual and not yet standardized
- Relationship between Data Custodian and Third Party
- Information captured in ApplicationInformation Resource
- Updates and Termination

Each Data Custodian will have unique process
- May involve manual steps
- Accountability and Validation
- Collecting ApplicationInformation data

Moving toward OAuth2 Dynamic Client Registration
- Not yet IETF RFC – Working Draft
- Rapid movement to support when ratified
- Open source implementation soon

ApplicationInformation

ThirdParty 1

ThirdParty 2

ThirdParty N

A p p l I c a t I o n I n f o r m a t I o n

PG&E

SCE

SDG&E

DataCustodian M
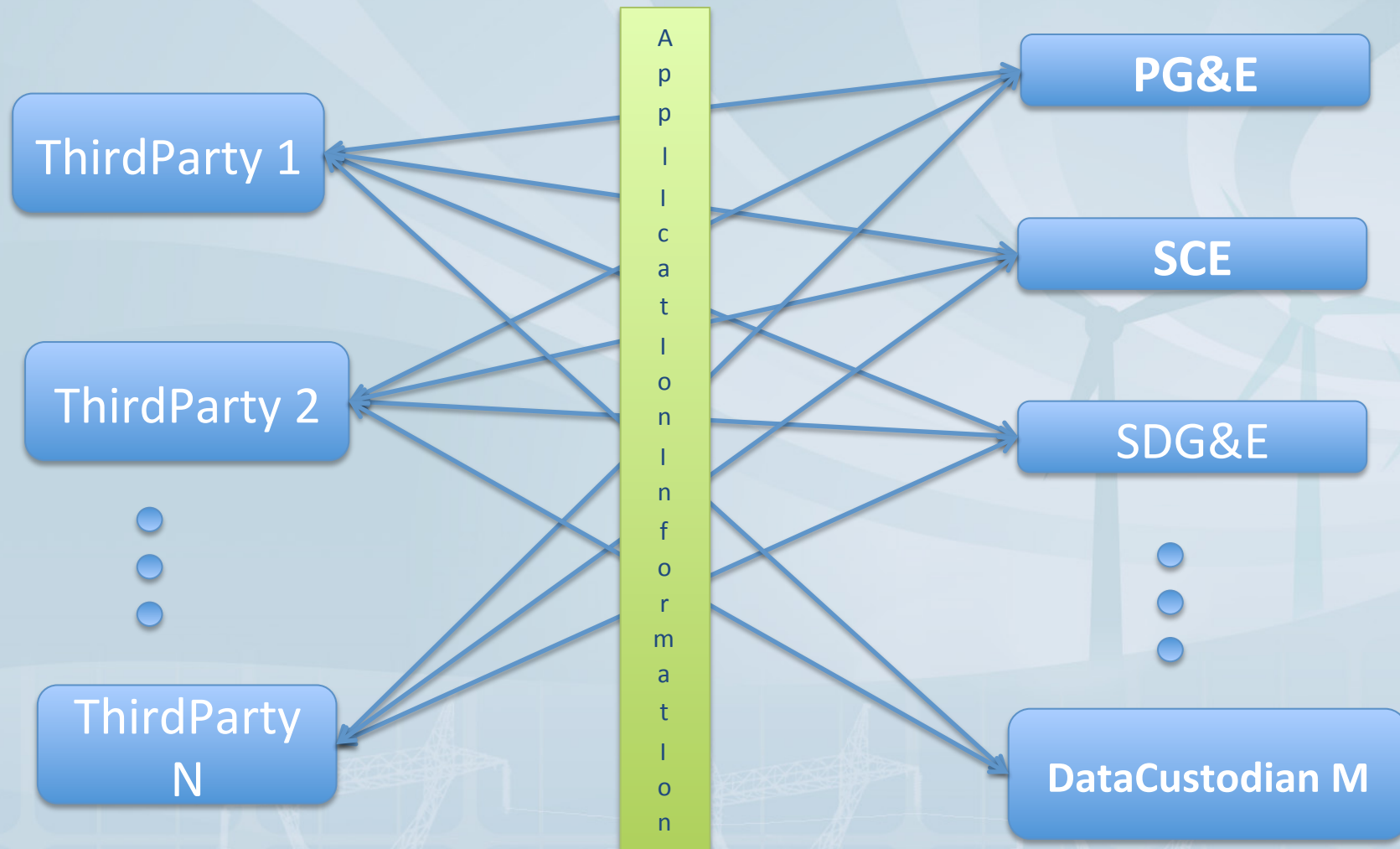
Each Relationship shares an
ApplicationInformation Resource

ApplicationInformation

- The result of the registration process is the creation of an ApplicationInformation object (with @40 Attributes)

- A shared view of the capabilities and relevant endpoints maintained by both parties (the contract b/t the actors)

- Updates and access (via RESTful https requests) are available. (manageable for dynamic configuration)
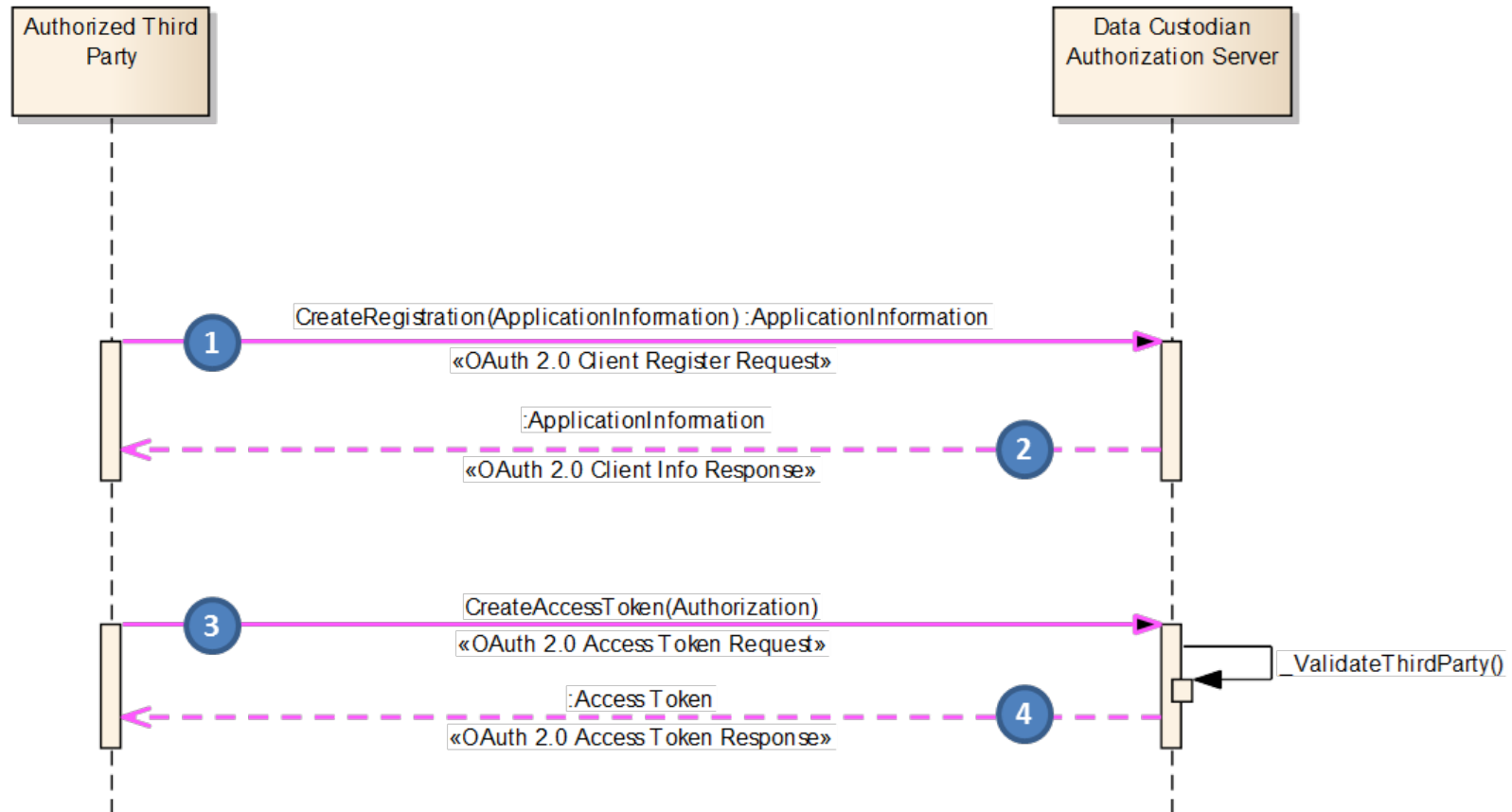
- Detail in references

Ref: Authorization.docx Appendix D   Ref: espiDerived.xsd

Green Button Connect My Data Registration
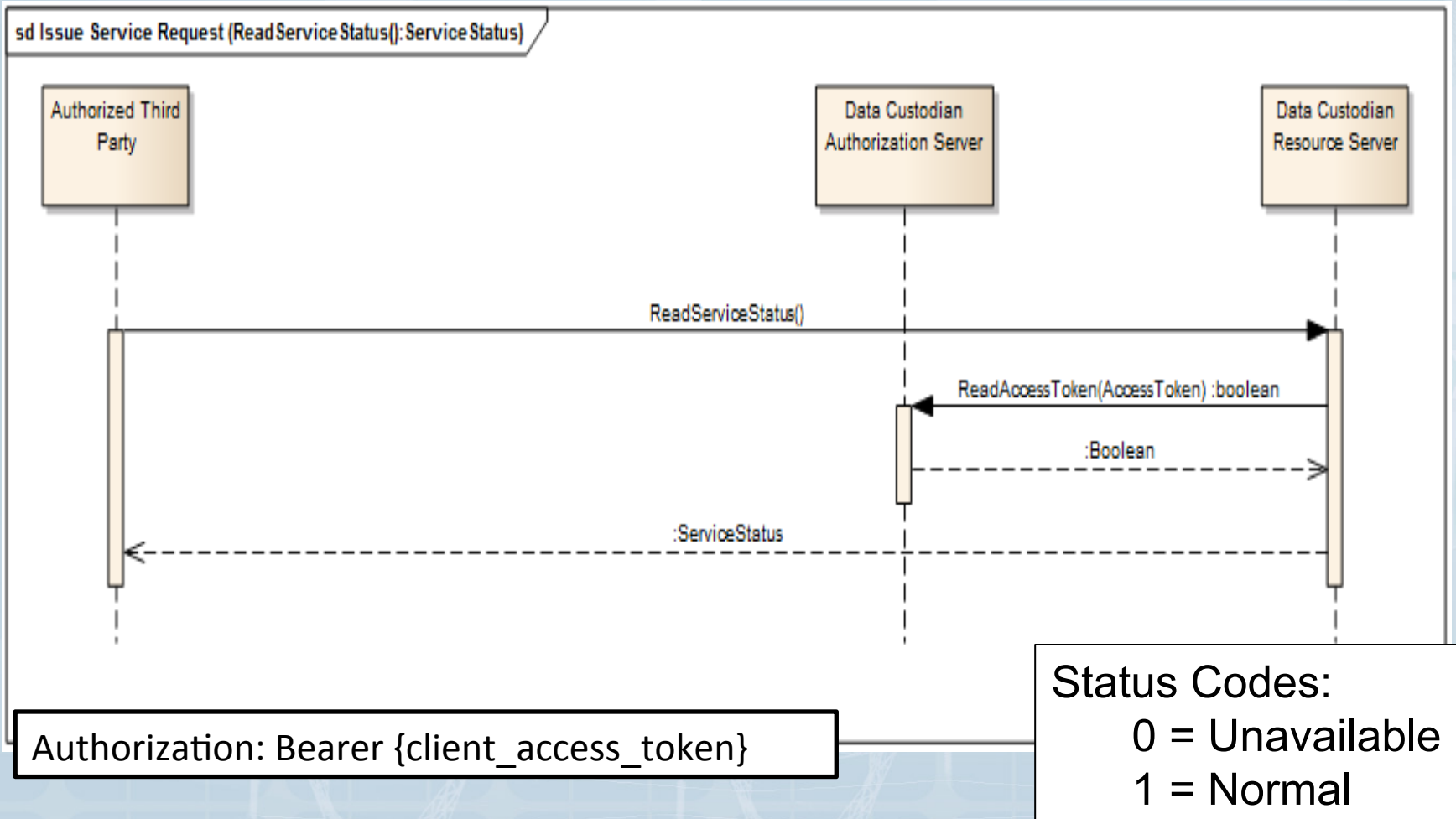

sd Authorized Third Party Establishes Relationship With Data Custodian

Authorized Third Party

Data Custodian Authorization Server

1   CreateRegistration(ApplicationInformation) :ApplicationInformation
«OAuth 2.0 Client Register Request»

2   :ApplicationInformation
«OAuth 2.0 Client Info Response»

3   CreateAccessToken(Authorization)
«OAuth 2.0 Access Token Request»

_ValidateThirdParty()

4   :Access Token
«OAuth 2.0 Access Token Response»

Ref: Authorization.docx Section 2.2

Green Button Connect My Data Status and Notification

sd Issue Service Request (ReadServiceStatus(): Service Status)

Authorized Third Party → Data Custodian Authorization Server → Data Custodian Resource Server

ReadServiceStatus()

ReadAccessToken(AccessToken) :boolean

:Boolean

:ServiceStatus

Authorization: Bearer {client_access_token}

Status Codes:
  0 = Unavailable
  1 = Normal

Ref: Authorization.docx Section 2.2.2

Third Party Perspective

Registration of Third Party
- Manual and not yet standardized
- Each Data Custodian will have unique process
- Moving toward OAuth2 Dynamic Client Registration

Authorization of Data Access ←←
- Individual Retail Customer Accounts
    - single and multiple Usage Points
- Portfolio of Accounts
- Scope Parameters

Process of Data Exchange
- Notifications
- OAuth2 access_tokens
- Pull Scenarios

Authorization of Data Access

OAuth2 Authorization Patterns

- Using client_credential and authorization access codes
- OAuth2 scope negotiation

Authorization of Data Access

- Single Retail Customer/UsagePoint
- Message Patterns
- Scope Parameters

Scope parameter details

- Resource Terms
- Function Blocks supported
- Kinds of Data (Intervals, durations, …)

Green Button Connect My Data
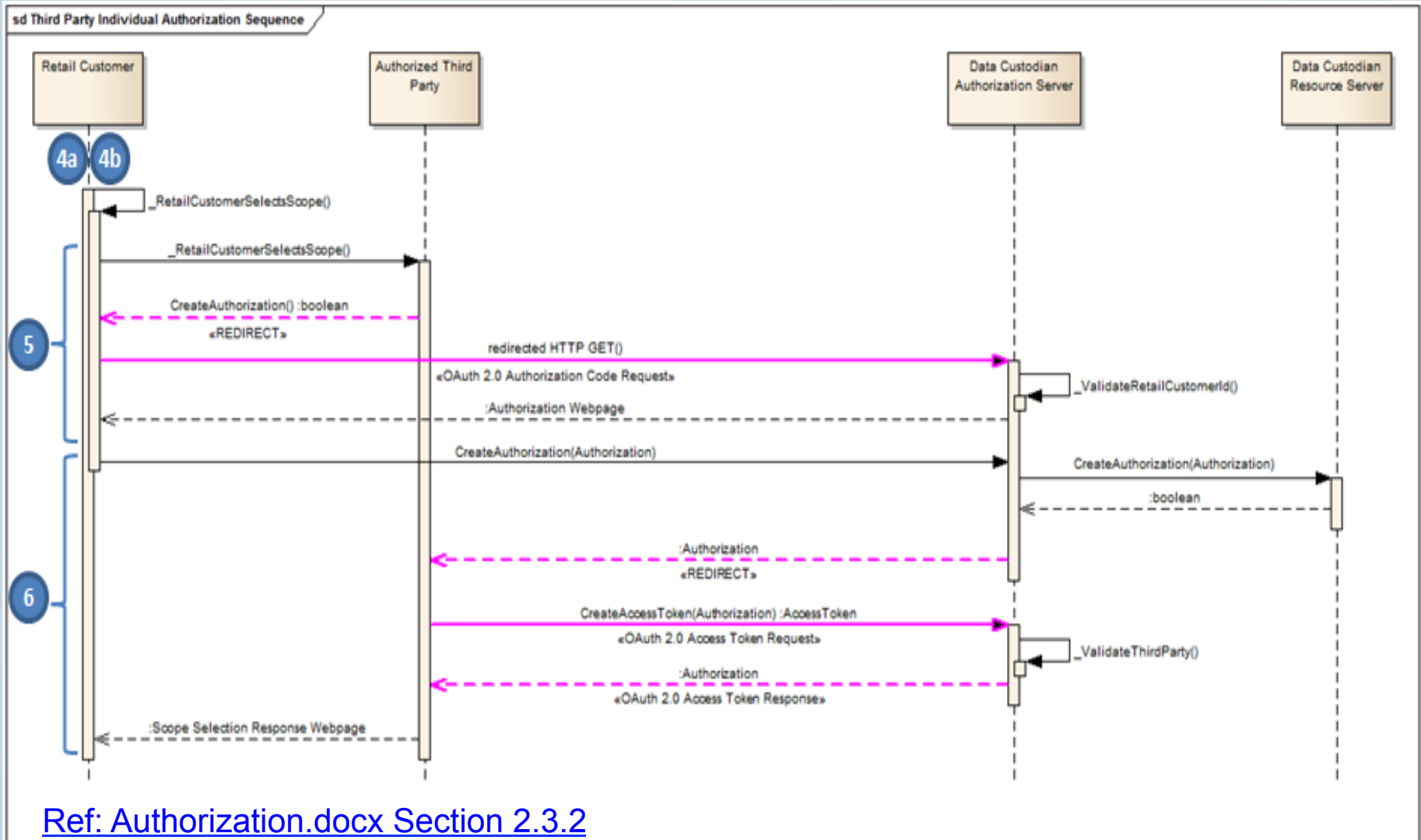# User Experience Guidelines

Green Button Connect My Data RetailCustomer Authorization
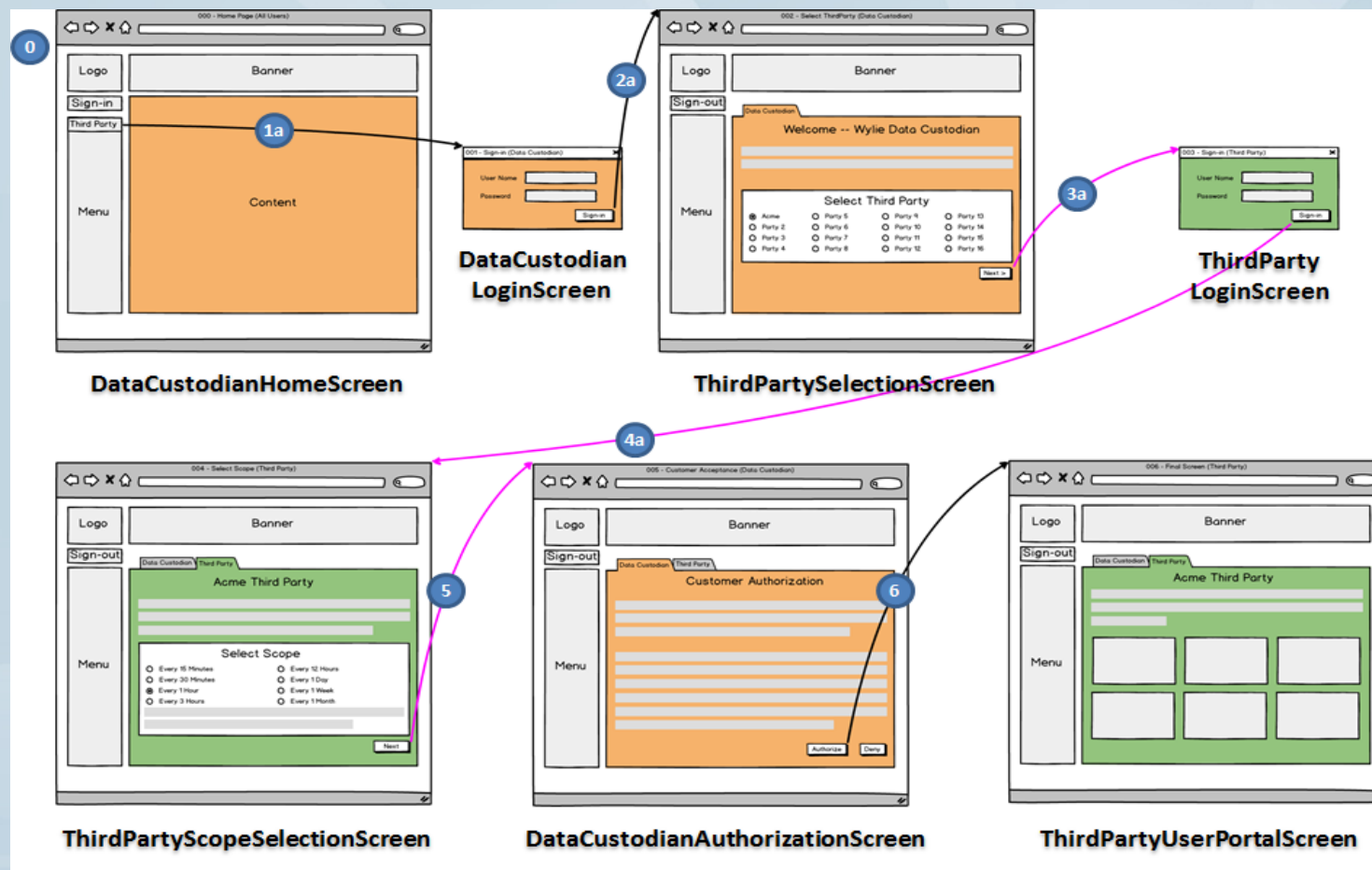
Ref: Authorization.docx Section 2.3.2

Green Button Connect My Data RetailCustomer Authorization

sd Third Party Individual Authorization Sequence

Ref: Authorization.docx Section 2.3.2
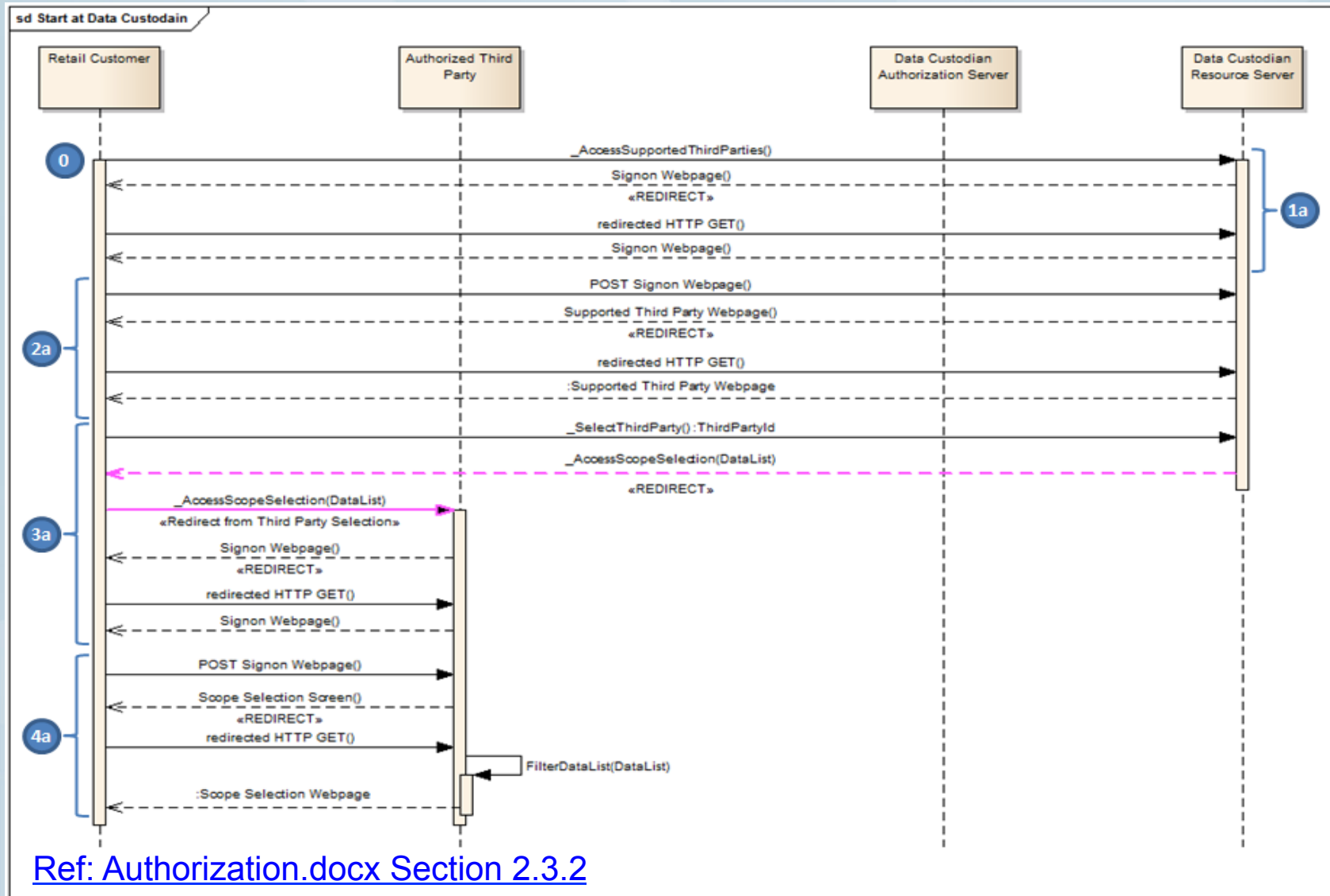
Access Tokens Obtained

access_token: allocated by datacustodian for individual account authorizations

refresh_token: allocated at the time of authorization and used to renew an access_token

Note that access tokens are entirely under the control of the Data Custodian which can determine the life cycle of the access tokens and refresh tokens. The Authorized Third Party is required to react to the changes in the access token and/or refresh token as they occur.

Use:

```
GET {ResourcePath}<resource>/{ResourceID} HTTP/1.1
Host: {ResourceServer}
Content-Type: application/atom+xml
Authorization: Bearer {AccessToken}
```

Ref: Authorization.docx Section 1.2.2

Portfolio and Multiple Accounts

Work is currently underway: OpenADE
- To extend the information model
- Insure PII integrity of ESPI

PII Containing information

Anononymous EUI

Subscription

RetailCustomer

ServiceLocation

UsagePoint

Customer Agreement

Normal ESPI Resources

EndDeviceAsset

ServiceSupplier

PositionPoint

TariffProfile

Authorization

Key:

New Resource

Existing Resource

Non-Resource Class

*This data structure is to be developed on an aggressive schedule based on HelpDesk issue #83 and PAP10 NAESB Std REQ.18. No single API request can retrieve both PII and Anonymous data

Ref: OpenADE Meeting Notes: Slide 05

Example Scope String

Scope = "FB=1_3_4_5_8_13_18_19_31_34_35_39;
IntervalDuration=900_3600;BlockDuration=Daily;
HistoryLength= 34128000;SubscriptionFrequency=Daily;
AccountCollection=5;BR=1;"

– Identifying which Function Blocks

– Looking at 15 min and 1 hour interval data blocked daily

– An initial history of 13 months, with daily feed

– When doing bulk (using bulkId = 1) there will be 5 usage points in the transfer

Ref: Authorization.docx Section 2.6   Ref: GreenButtonCMDWorkshop: Slide 04

Examples for Connect My Data

- **Example Scope Strings** (* subject to change)

  - SCE[*]

    - Scope = "FB=1_3_4_5_8_13_18_19_31_34_35_39;
      ➥IntervalDuration=900_3600;BlockDuration=Daily; HistoryLength=
      34128000;SubscriptionFrequency=Daily;
      ➥ AccountCollection=5;BR=1;"

  - PG&E[*]

    - Scope = "FB=1_3_4_5_7_8_13_14_15_18_19_31_32_34_35_37_38_39_40;
      ➥IntervalDuration=300_900_3600;BlockDuration=Daily_BillingPeriod_Weekly_
      Monthly; HistoryLength=63072000;SubscriptionFrequency=Daily;
      ➥ AccountCollection=5;BR=1;"

  - SDG&E[*]

    - Scope = "FB=1_3_4_5_8_13_14_18_19_31_34_35_39_40;
      ➥IntervalDuration=300_900_3600;BlockDuration=Daily_BillingPeriod_Weekly_
      Monthly; HistoryLength=94608000;SubscriptionFrequency=Daily;
      ➥ AccountCollection=5;BR=1;"

Ref: Authorization.docx Section 2.6   Ref: GreenButtonCMDWorkshop: Slide 04

Scope Term Descriptions

Where:	
ResourceTerms	If a Bulk resource is specified via the "BR" term, the value of the {bulkID} is provided after the equals sign ("="). There could be one or more terms in this list that express the granularity of notifications about resource changes. If the Subscription has more than one UsagePoint, the AccountCollection term can indicate the number of UsagePoints included
FBTerms	The function blocks supported
ValueTerms	These are parameterized terms
IntervalDuration	This is the minimum default length of an interval in seconds (e.g. 900 for 15 minutes, 3600 for one hour, …)
BlockDuration	This is the length of a block that contains the intervals (based on enumeration of MacroPeriodKind in ESPI above as namedFrequency)
HistoryLength	This is the length of history buffer seconds
BulkAccountCollection	Used where the DC wants to provide for the reporting of multiple UsagePoints in a single Subscription. The number of UsagePoints is represented by the value in the assignment statement – e.g. 4 UsagePoints would be BulkAccountCollection=4.

Ref: Authorization.docx Section 2.6

Scope

Term	Expansion
Scope	[FBTerms], [ValueTerms], [ResourceTerms];
FBTerms	"FB=", { [FBTerm], "_"} , FBTerm, ScopeDelimiter ;
FBTerm	"4" | "5" | "6" | "7" | "8" | "9" | "10" | "11" | "12" | "15" | "16" | "17" | "18" | "19" | "27" | "28" | "29" | "31" | "32" | "33" | "34" | "35" | "36" | "37" | "38" | "39" | "40" | "41" | "43"
ValueTerms	{ ("IntervalDuration=", namedOrNumber,{"_", namedOrNumber}), | ("BlockDuration=", namedOrNumber,{"_", namedOrNumber}), | ("HistoryLength=", nonNegativeNumber), | ("SubscriptionFrequency=", nonNegativeNumber | namedFrequency), ScopeDelimiter };
ResourceTerms	{ ("AccountCollection=", nonNegativeNumber) | "BR=", brID), ScopeDelimiter}
ScopeDelimiter	";"
namedFrequency	"billingPeriod" | "daily" | "monthly" | "seasonal" | "weekly" |
namedOrNumber	nonNegativeNumber | namedFrequency;
brID	Character, {Character}*;
nonNegativeNumber	digit, { digit };
Digit	0 | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9" ;
Character	Digit | "-" | "A" | "B" | "C" | "D" | "E" | "F" | "G" | "H" | "I" | "J" | "K" | "L" | "M" | "N" | "O" | "P" | "Q" | "R" | "S" | "T" | "U" | "V" | "W" | "X" | "Y" | "Z" | "a" | "b" | "c" | "d" | "e" | "f" | "g" | "h" | "i" | "j" | "k" | "l" | "m" | "n" | "o" | "p" | "q" | "r" | "s" | "t" | "u" | "v" | "w" | "x" | "y" | "z" ;

NIST smart grid program   engineering laboratory

Function Blocks for CMD

FunctionBlocks for Green Button Connect My Data	Description	Min
[FB_3] Core Green Button Connect My Data	Core Services	✓
[FB_13] Security and Privacy classes	HTTPS support	✓
[FB_14] Authorization and Authentication (OAuth)	Oauth	✓
[FB_19] Partial update data	IntervalBlocks without full data sets (Ups,MR, …)	✓
~~[FB_31] Core Rest Services~~	~~Third Party Access to Subscription/Authorization~~	
[FB_32] Resource Level REST	Third Party Access to UsagePoints, MeterReading, … and collections	
[FB_33] Management REST Interfaces	GET PUT POST DELETE individual resources …	
[FB_34] SFTP for Bulk	SFTP delivery of Bulk for Bulk request	
[FB_35] REST for Bulk	Support the REST request for Bulk	
[FB_36] Third Party (Client) Dynamic Registration	Use Case 1	
[FB_37] Query Parameters		✓
[FB_38] On Demand Requests	Without Notification	
[FB_39] PUSH model	Notification followed by GET	✓
[FB_40] Offline Authorization	Allows manual Authorization without OAuth but produces Authorization resource XML	
[FB_42] Third Party Core REST Services		
[FB_43] Third Party Management REST Services		
[FB_44] Manage ApplicationInformation Resource	Allows PUT and DEL of ApplicationInformation	
[FB_41] Manage Authorization Resource	Allows PUT and DEL of Authorization	

Ref: Green Button Test Datasheet   (Ref: FunctionBLocks by RESTful API)

Third Party Perspective

Registration of Third Party

- Manual and not yet standardized
- Each Data Custodian will have unique process
- Moving toward [OAuth2 Dynamic Client Registration](#)

Authorization of Data Access

- Individual Retail Customer Accounts
    - single and multiple Usage Points
- Portfolio of Accounts
- Scope Parameters

Data Exchange ⬅⬅

- Atom encapsulation
- ESPI Data Representation
- RESTful APIs

Data Exchange

Atom (RFC 4287/5023)

- Atom Overview
- ESPI integration
- Time Stamps

ESPI (espiDerived.xsd)

- ESPI Resources
- OAuth2 access_tokens
- Message Patterns

RESTful API

- Classes of API functions
- Determined by "Function Block"
- Focus today on Batch transfers

Composition and Atom Feed

Syntactic Model
Atom Feed View
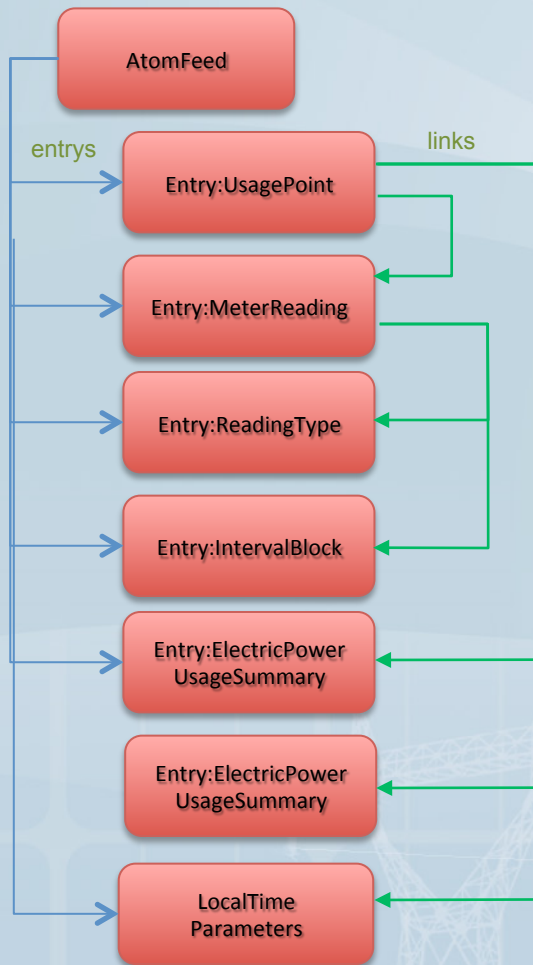
Information Model
Profile View
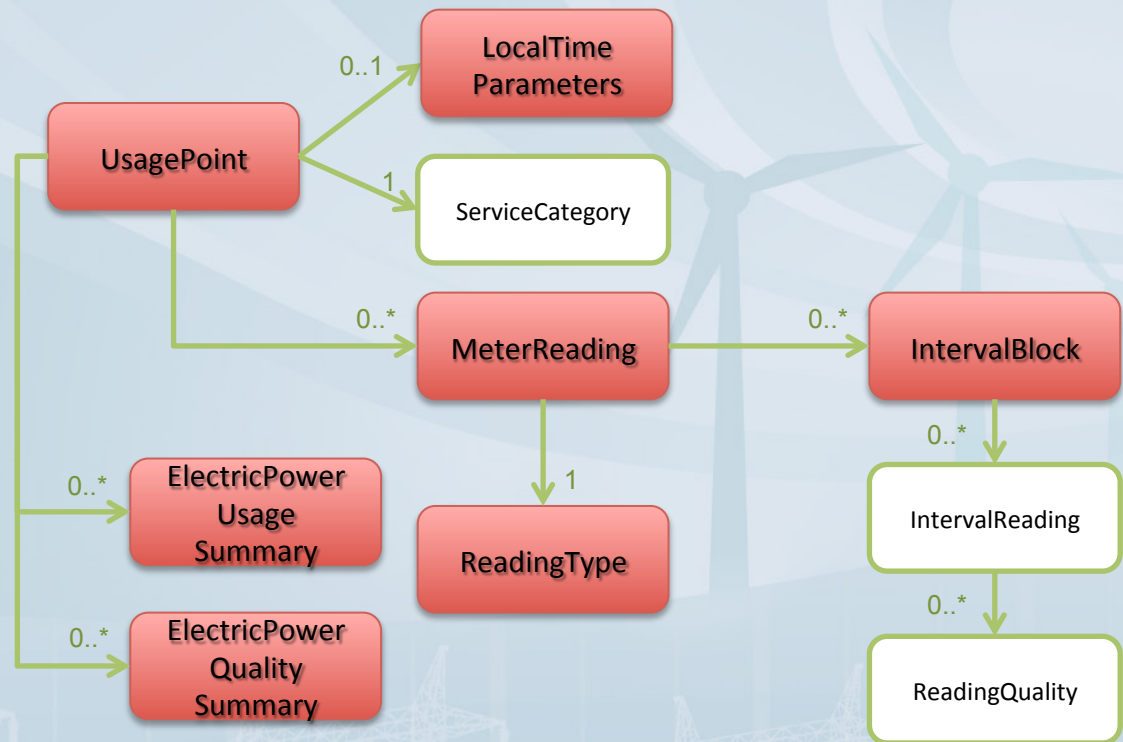
Note: This information is multidimensional. Many different reading types, summaries, and readings possible. i.e. not "flat"

Notes about Time

- All Atom related times (publish-time, update-time) are of the form: 2012-10-24T00:00:00Z

- Time Localization of all times requires the LocalTimeParameters resource to be known.

- All interval and durations are in seconds in zulu time, also requiring LocalTimeParameters for interpretation

- PublishTime (at the Atom level) and interval start/durations should be consistent

Access Tokens Used

access_token: allocated by datacustodian for individual account authorizations

refresh_token: allocated at the time of authoriztion and used to renew an access_token

datacustodian_access_token: access token used by trusted administrative accounts

client_access_token: used by thirdparty applications to access bulk or multiple authorization subscriptions

upload_access_token: used by MeterDataManagement (backend) systems to upload/ import data into a datacustodian

registration_access_token: reserved for future use in dynamic registration patterns

Note that access tokens are entirely under the control of the Data Custodian which can determine the life cycle of the access tokens and refresh tokens. The Authorized Third Party is required to react to the changes in the access token and/or refresh token as they occur.

Ref: Authorization.docx Section 1.2.2

Green Button Connect My Data Data Flows

sd 11: Authorized Third Party Receives (Pulls) Requested EUI from Data Custodian - Asynchronous

Authorized Third Party | Data Custodian Authorization Server | Data Custodian Resource Server

3 ReadData(DataResource) :Batch
«OAUTH 2.0 Information Request»

ReadAccessToken(AccessToken)
:boolean

4 :Batch
«OAUTH 2.0 Information Response»

Note: A valid Access Token is a precondition for all exchanges under the Authorization. The Third Party must be prepared to validate the Access Token prior to use or upon rejection by the Authorization Server. See the Third Party Validates Access Token sequence for details.

Authorization: Bearer {client_access_token}
Ref: GreenButtonAuthorization.docx: Appendix B

Ref: GreenButtonAuthorization.docx Section 2.2.4

PUSH Model – Notify/Get

Data Custodian (SCE)

Third Party

Data Ready

REST : Notification (ReqestDataURL : URL for 3rd party to request the data)

Transaction (Req/Resp)

REST GET : RequestDataURL

Response with pay load

Authorization: Bearer {client_access_token | {access_token}
Ref: GreenButtonAuthorization.docx: Appendix B
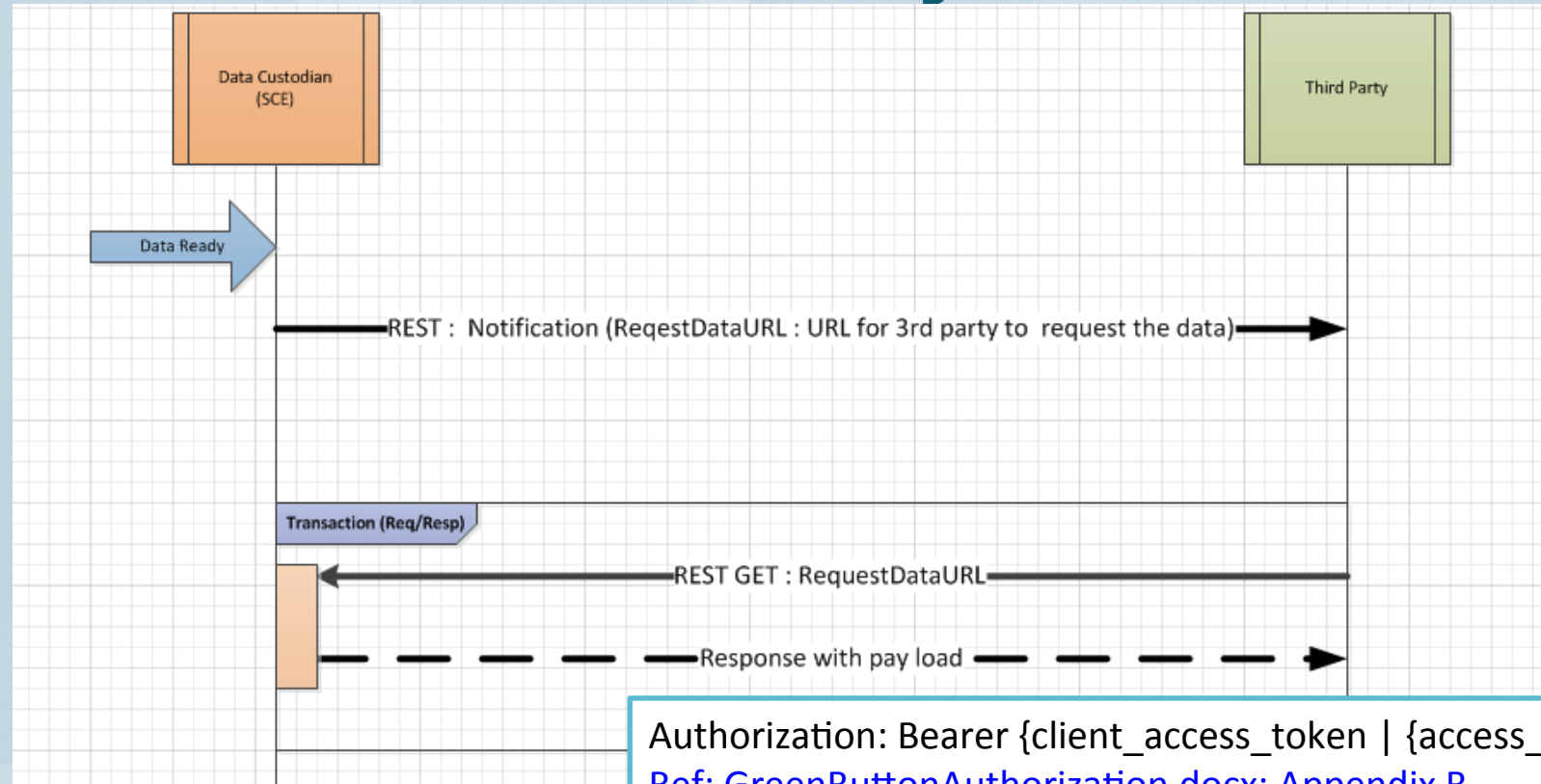
- When data is ready, data custodian will notify third party with Multiple URLS

- Third party will make call (GET) based on the URL(s) provided

- Data custodian will respond with the data as part of response to GET call

Ref: GreenButtonCDMWorkshop: Slide 16

NIST smart grid program

engineering laboratory

Notification(*no access_token needed)

DC → TP

Request:
HTTP POST
https://localhost/ThirdParty/espi/1_1/Notification
Content-type: application/xml
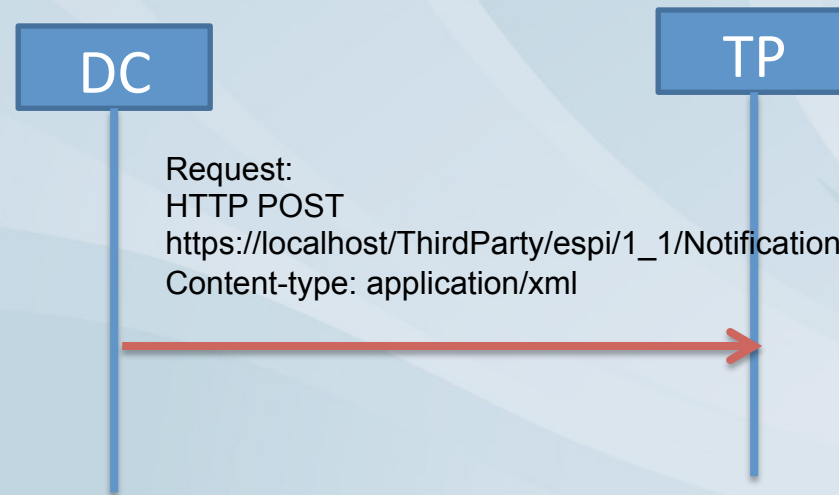
Response:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<BatchList xmlns="http://naesb.org/espi" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://naesb.org/espi espiDerived.xsd">
        <resources>https://localhost:8080/DataCustodian/espi/1_1/resource/Batch/Subscription/1
        </resources>
        <resources>https://localhost:8080/DataCustodian/espi/1_1/resource/Authorization/1
        </resources>
        <resources>https://localhost:8080/DataCustodian/espi/1_1/resource/Batch/Bulk/1
        </resources>
</BatchList>
```

NIST smart grid program   engineering laboratory

Retrieve UsagePoints for a Subscription

```xml
<?xml version="1.0" encoding="UTF-8"?>
<feed xmlns="http://www.w3.org/2005/Atom" xmlns:espi="http://naesb.org/espi" xsi:schemaLocation="http://naesb.org/espi espiDerived.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
          <id>urn:uuid:1DA5F5DD-312B-4896-B910-098F59C73965</id>
          <title>Green Button Subscription Feed</title>
          <updated>1899-12-30T00:00:00Z</updated>
          <link rel="self" href=" https://localhost/DataCustodian/espi/1_1/resource/Subscription/1/UsagePoint "/>
          <entry>
                  <id>urn:uuid:C8C34B3A-D175-447B-BD00-176F60194DE0</id>
                  <link rel="self" href="https://services.greenbuttondata.org/DataCustodian/espi/1_1/resource/Subscription/1/UsagePoint/1"/>
                  <link rel="up" href="https://services.greenbuttondata.org/DataCustodian/espi/1_1/resource/Subscription/1/UsagePoint"/>
                  <link rel="related" href="https://services.greenbuttondata.org/DataCustodian/espi/1_1/resource/Subscription/1/UsagePoint/1/MeterReading"/>
                  <link rel="related" href="https://services.greenbuttondata.org/DataCustodian/espi/1_1/resource/Subscription/1/UsagePoint/1/ElectricPowerUsageSummary"/>
                  <link rel="related" href="https://services.greenbuttondata.org/DataCustodian/espi/1_1/resource/LocalTimeParameters/01"/>
                  <title>Green Button Sample Data File</title>
                  <content>
                          <UsagePoint xmlns="http://naesb.org/espi">
                                  <ServiceCategory>
                                          <kind>0</kind>
                                  </ServiceCategory>
                                  <ServiceDeliveryPoint>
                                          <name>sample tariff
                                          <tariffProfile>./Tariff
                                  </ServiceDeliveryPoint>
                          </UsagePoint>
                  </content>
                  <published>2013-09-19T04:00:00Z</published>
                  <updated>2013-09-19T04:00:00Z</updated>
          </entry>
          <entry>
                  <id>urn:uuid:C8C34B3A-D175-447B-BD00-176
                  <link rel="self" href="https://services.greenbutto
                  <link rel="up" href="https://services.greenbutton
                  <link rel="related" href="https://services.greenbu
                  <link rel="related" href="https://services.greenbu
                  <link rel="related" href="https://services.greenbu
                  <title>Green Button Sample Data File</title>
                  <content>
                          <UsagePoint xmlns="http://naesb.org/e
                                  <ServiceCategory>
                                          <kind>0</kind>
                                  </ServiceCategory>
                                  <ServiceDeliveryPoint>
                                          <name>sample tariff
                                          <tariffProfile>./Tariff
                                  </ServiceDeliveryPoint>
                          </UsagePoint>
                  </content>
                  <published>2013-09-19T04:00:00Z</published>
                  <updated>2013-09-19T04:00:00Z</updated>
          </entry>
</feed>
```
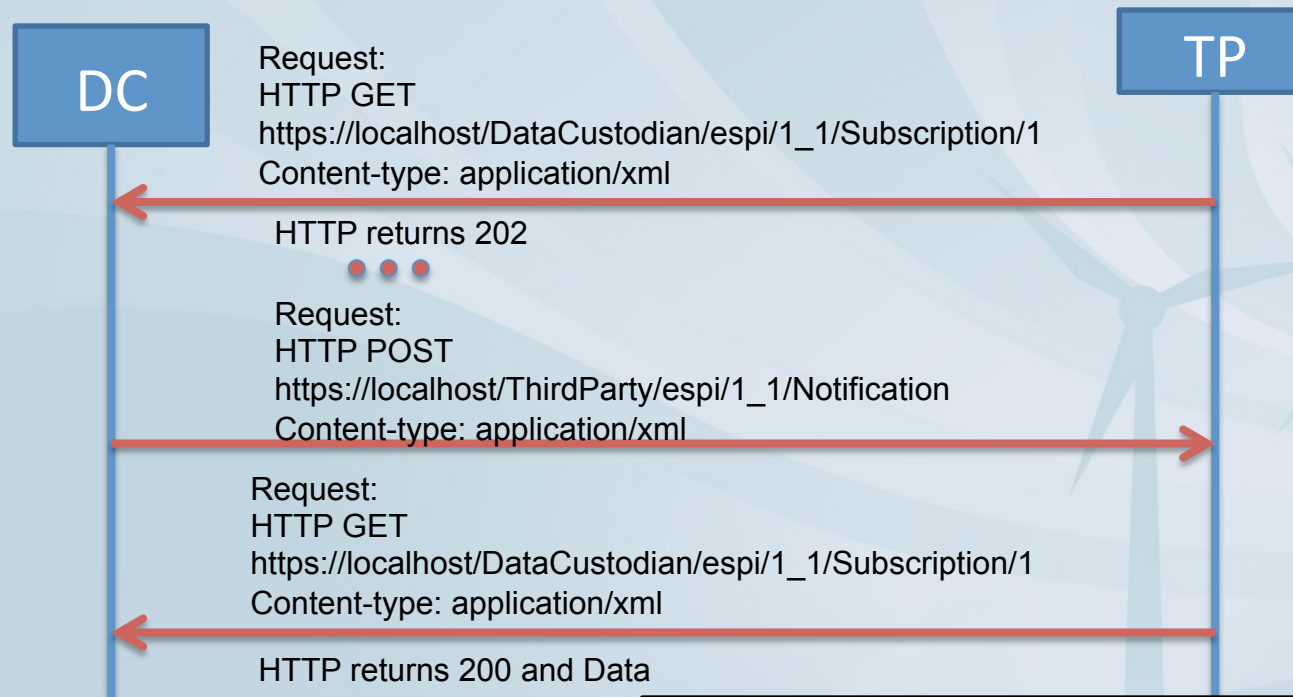
DC

TP

HTTP GET
https://localhost/DataCustodian/espi/1_1/
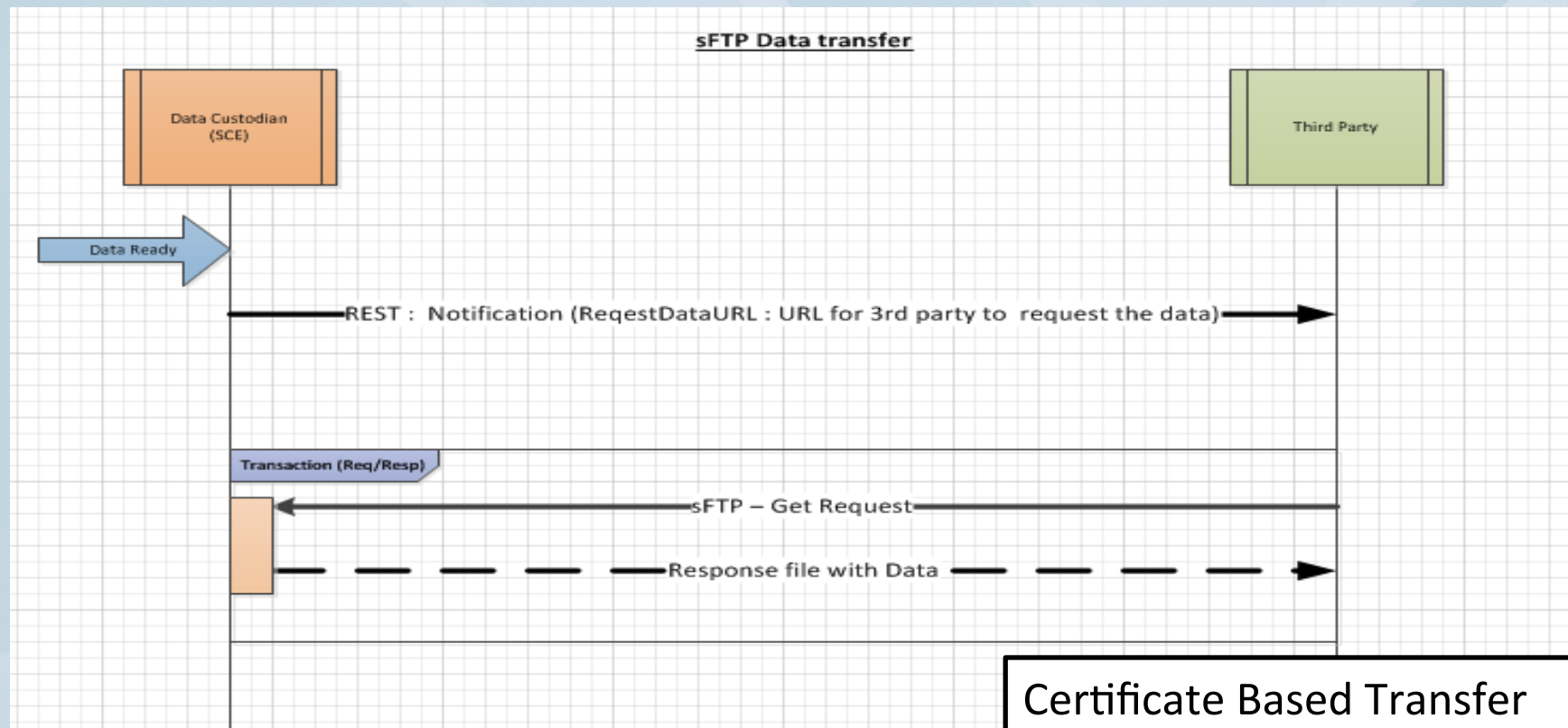↳resource/Subscription/{subscriptionID}/UsagePoint
Content-type: application/atom+xml

Authorization: Bearer {client_access_token | {access_token}]
Ref: GreenButtonAuthorization.docx: Appendix B

Ref: GreenButtonCDMWorkshop: Slide 21

Deferred Response when DC does not have data ready

DC

TP

Request:
HTTP GET
https://localhost/DataCustodian/espi/1_1/Subscription/1
Content-type: application/xml

HTTP returns 202

Request:
HTTP POST
https://localhost/ThirdParty/espi/1_1/Notification
Content-type: application/xml

Request:
HTTP GET
https://localhost/DataCustodian/espi/1_1/Subscription/1
Content-type: application/xml

HTTP returns 200 and Data

Authorization: Bearer {client_access_token | {access_token}]
Ref: GreenButtonAuthorization.docx: Appendix B

- ThirdParty makes asynchronous request
- DataCustodian does not have the data ready – returns HTTP 202
- Some time later (when ready no guarantees or time limit) DataCustodian sends Notification with original URL in BatchList
- DataCustodian provides the result
  Ref: GreenButtonCDMWorkshop: Slide 17

SFTP Data Transfer

sFTP Data transfer

Data Custodian (SCE) — Third Party

Data Ready

REST : Notification (ReqestDataURL : URL for 3rd party to request the data)

Transaction (Req/Resp)

sFTP — Get Request

Response file with Data

Certificate Based Transfer

- When data is ready, data custodian will notify third party with Multiple URLS (1)

- Third party will make call (sFTP) based on the URL(s) provided

- Data custodian will respond with the data as part of response to sFTP get call

Ref: GreenButtonCDMWorkshop: Slide 18

SFTP for Bulk Transfer

- Pertinent to the SFTP discussion are the concepts that each Third Party has a defined relationship with the Data Custodian.
  - For automated exchange of information about his relationship there is a special Authorization obtained in Use Case #1
  - We anticipate that when the Data Custodian has data available, it sends an asynchronous Notification to the Third Party.
  - This Notification provides URIs of note that it is assumed the Third Party will want to retrieve.
- For the purposes of Bulk transfer, this URI will be:
  - sftp://hostname:port/DataCustodian/espi/1_1/resource/Batch/Bulk/{bulkId}
  - where {bulkId} is a unique identifier assigned by the Data Custodian and the balance of the URI is presented in the ApplicationInformation. The Third Party would then retrieve the bulk data by using an SFTP client with that URI.
- Used to Retrieve the data SFTP protocols

- Discussion –
  - After authorization of TP, they use Peney test, so what is benefit of access-token?
  - sftp user:pw, user=<tpname>, password=<tp client-credentials access-token>

- Summary
  - sftp://hostname:port/DataCustodian/espi/1_1/resource/Batch/Bulk/{bulkId}
  - sftp user:pw, user=<tpname>, password=<tp client-credentials access-token>

Ref: Authorization.docx Section 2.3.2   Ref: GreenButtonCDMWorkshop: Slide 22

Where is More Technical Information

- Base Standard
  - http://www.naesb.org/ESPI_Standards.asp (working version: espiDerived.xsd)
- Developer Info
  - Download My Data - Content, Generation, and Samples
    https://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/GreenButtonSDK

  - Open Source (DMD/CMD)
    - http://energyos.github.io/OpenESPI-GreenButton-API-Documentation/
    - https://github.com/energyos/OpenESPI-Common-java
    - https://github.com/energyos/OpenESPI-DataCustodian-java
    - https://github.com/energyos/OpenESPI-ThirdParty-java
  - SandBox (alpha)
    - DataCustodian: https:/services.greenbuttondata.org/DataCustodian
    - ThirdParty: ThirdParty https:/services.greenbuttondata.org/ThirdParty
    - Sample Data: https://services.greenbuttondata.org/sample-data.html
    - API Sandbox: http://energyos.github.io/OpenESPI-GreenButton-API-Documentation/API/

- Testing and Certification
  - Data Validation Self-test tool - http://www.greenbuttondata.org/greentest.aspx
  - Green Button Test Plan -
    http://osgug.ucaiug.org/sgsystems/OpenADE/Shared%20Documents/Testing%20and
    %20Certification/GreenButtonTestPlan/GreenButtonTestPlan.docx

Information for YOU!

Thank You

Definitions

- Customer
  - If residential it is individual (customer of record)
  - If commercial it is an entity
- Customer Account
  - Organization of the bill
  - A customer may multiple customer accounts
- Service Account/Agreement
  - Corresponds Customer to a meter
- Customer Information Service Request (CISR)
  - A legal agreement that authorizes a California utility to provide customer information to a thirdparty – paper or online
- Service Point/Location
  - Logical location representing the meter at the premises level
- ESPI
  - RetailCustomer
    - Owner of one or more UsagePoints (has right to authorize)
  - Subscription
    - Authorized access to a (sub) set of UsagePoints of a single RetailCustomer
  - Bulk
    - Authorized access to a collection of UsagePoints governed by individual authorizations to a third party

Open Source Green Button
https://github.com/energyos

Green Button Connect My Data Sandbox
http://services.greenbuttondata.org/

Green Button CMD Live API