
# LV DERMS CSIP AUS External Party API Procedure

**CitiPower Pty Ltd, Powercor Australia Ltd and United Energy Services Pty Ltd**

**PR-0014**

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The master document is controlled electronically.
Ensure latest version prior to use.

# Document Control

| Version | Amendment Overview | Author |
|---|---|---|
| 1 | Initial Version | |
| 1.1 | Sections 8 & 9 updated to include reference to mandatory sequence validation. | |
| 1.2 | IEEE2030.5:2018 and CSIP-AUS Schemas added to references.<br>Formatted Section 5 for consistency<br>Section 7 updated to remove github IEEE schema validation references and replace with IEEE2030.5 website schema.<br>Section 8 trouble shooting added.<br>Updated for additional error handling procedures and reference to IEEE2030.5 website schema standards.<br>Other section renumbered due to inclusion of new section 8<br>Section 13 LFDI requirements modified based on feedback. | |

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# 1. Purpose

This document serves as a technical implementation guide for integrating with the CitiPower, Powercor and United Energy (CPPALUE) Low-Voltage Distributed Energy Resource Management System (LV DERMS) Utility Server.

It is intended to be a companion piece to several existing resources, including the *IEEE2030.5:2018 (SEP2)* standard, the *Common Smart Inverter Protocol (CSIP)*, the Australian CSIP variant *(CSIP-AUS)*, *SA HB 218:2023* and the CPPALUE *LV DERMS Interconnection Handbook*.

The primary purpose of this guide is to outline the process for DER Clients to establish communication with the CPPALUE Utility Server. It will detail known discrepancies between the CPPALUE implementation and those of other Distribution Network Service Providers (DNSP) utility servers. To illustrate the integration process, the document will incorporate sample workflows and provide examples of request and response body structures exchanged between a DER Client and the Utility Server.

It is important to note that this document is progressively being developed and as noted in specific sections is *subject to change* in future iterations.

This document will also be reviewed regularly and amended as required in order to reflect changes in design and construction standards, the application of new technologies, or changes to network operations and field experience.

# 2. Document Scope

This API procedure is intended to be a generic set of definitions and protocols for building and integrating utility DER application software.

The worked example in the document is however focussed on user cases of connecting behind the meter (customer) solar photovoltaic inverters to our GE Utility Server.

# 3. Objective

The objective of the document is to allow external parties to be able to integrate with APIs connect to utility specific LV DERMS utility server.

# 4. Referenced Documents

Table 1: Referenced Documents

| https://sinTitle | Document No. |
|---|---|
| IEEE Standard for Smart Energy Profile Application Protocol | IEEE 2030.5:2018 |
| IEEE 2030.5:2018 Schema 2030.5-2016_downloads.zip/Model Build 20180301/sep.xsd | IEEE 2030.5:2018 Schema |
| CSIP-AUS v1.1 XML Schema https://csipaus.org/ns/ | CSIP-AUS v1.1 XML Schema |
| Common Smart Inverter Profile CSIP Implementation Guide v2.0 (sunspec.org) | Sunspec CSIP Implementation Guide |
| Common Smart Inverter Profile (CSIP) – Australia version 1.1A | Common Smart Inverter Profile Australia - Australian Renewable Energy Agency (ARENA) |
| CSIP-AUS Schema CSIPAUS.org - Common Smart Inverter Profile for Australia | CSIP-AUS Schema |
| LV DERMS Utility Interconnection Handbook | ST-0002 |
| Common Smart Inverter Profile – Australia with test procedures store.standards.org.au/reader/sa-hb-218-2023 | SA HB 218:2023 |

# 5. Definitions

Table 2: Terms and Definitions

| Term | Definition |
|---|---|
| CPPALUE | CitiPower Powercor and United Energy |
| CSIP | Common Smart Inverter Profile |
| CSIP-AUS | Common Smart Inverter Profile - Australia |
| DER | Distributed Energy Resources |
| DERU | Distributed Energy Resources Unit |
| DNSP | Distribution Network Service Provider |
| HTTP | Hypertext Transfer Protocol |
| IANA | Internet Assigned Numbers Authority |
| IEEE2030.5 | A standard for communications between the smart grid and consumers. The standard is built using Internet of Things (IoT) concepts and gives consumers a variety of means to manage their energy usage and generation. |
| LFDI | Long Form Device Identifier |
| LV DERMS | Low Voltage Distributed Energy Resources Management System |
| MRID | Master Resource Identifier |
| NMI | National Metering Identifier |
| PEN | Private Enterprise Number |
| PV | Photovoltaic or photovoltaic cell |
| SEP2 | Smart Energy Profile Version 2.0 |
| SFDI | Short Form Device Identifier |
| SIT | System Integration Testing |
| URI | Uniform Resource Identifier |
| Utility Server | A utility server is generally run by the DNSP and provides an Application Programming Interface (API) that allows devices to send and retrieve data concerning their operation. |

# 6. Utility Server Details

Table 3: Utility Server Details

| Environment Name | URL | IP/IPs |
|---|---|---|
| SIT | https://dermst.powercor.com.au:30101 | 146.178.40.176 and 146.178.41.176 |

# 7. Utility Server Known Differences

This section summarizes the known differences between our CPPALUE implementation of the GE Utility Server and other DNSP Utility Servers. It also provides any recommended actions or changes in DER Client payloads or functionalities to account for these differences.

**Important Note:**

It's important to understand that there are two sources for these known differences:

- Inherent Characteristics of GE Utility Server: Some of the differences stem from the inherent characteristics of the GE Utility Server itself. These are functionalities or behaviours built into the GE Utility Server that will be present regardless of the specific implementation.
- Our CPPALUE Implementation: Other differences are introduced by our own implementation choices within CPPALUE. This means that even other DNSPs that have also implemented the GE Utility Server might have some variations compared to our CPPALUE implementation.

Table 4: Utility Server Known Differences

| Sl | Difference | Description | Suggested Change for DER Clients |
|---|---|---|---|
| 1 | Stricter Payload Validation | The CPPALUE implementation strictly validates checks that all required fields are present and in the correct order. This applies specifically to sequences defined using the XSD:sequence attribute, as required by both IEEE2030.5 and CSIP-AUS/SA HB218:2023. If any mandatory field is missing or if fields are submitted out of order, the Utility Server will reject the entire payload with a 400 Bad Request error.<br><br>It's important to note CSIP-AUS extension fields must be defined after the IEEE2030.5 elements in the sequence order. | Include all IEEE2030.5 mandatory fields (in the correct sequence for XSD: sequence attributes) across all payloads and include any CSIP-AUS extension fields after the IEEE2030.5 fields.<br>See section 10.1 for sample payloads.<br><br>Additionally, it is recommended to validate all payloads against IEEE2030.5 and CSIP-AUS XSDs.<br><br>XSD schema validation files are available in<br>• 2030.5-2016_downloads.zip/Model Build 20180301/sep.xsd<br>• https://csipaus.org/ns/ |
| 2 | CSIP AUS Namespace Validation (xml:ns2) | The CPPALUE Utility Server implementation defines the CSIP-AUS xml namespace as ns2. This is different to other DNSPs which define the CSIP-AUS xml namespace as csipaus. | DERClients should define the CSIP-AUS xml namespace as: xmlns:ns2="https://csipaus.org/ns.<br><br>All CSIP-AUS extension fields should include the opening tag <ns2><br><br>See section 10.1 for sample payloads. |
| 3 | Empty DERC and DDERC Payload Validation | When returning 204 responses, the CPPALUE Utility Server will also return a completely empty payload IEEE2030.5. (Refer section to 5.5.2.5 204 ("No Content")). | When receiving a 204 response, DERClients should expect to receive a completely empty response payload.<br>See section 8. For more information. |
| 4 | Hardcoded Endpoints | The GE Utility Server utilises hardcoded endpoints, such as /api/v2/dcap rather than /dcap | Use the endpoint URLs documented here and those discovered during the initial '/dcap' request. |
| 5 | Use of <localTime> | The time provided by our Utility Server in the /timeLink resource won't be adjusted for our local time zone. | DER Clients should implement the <currentTime> or UTC time for time synchronisation purposes. |

| SI | Difference | Description | Suggested Change for DER Clients |
|---|---|---|---|
| | | Instead, it will always be in Coordinated Universal Time (UTC). This is because UTC is the standard time reference for both the server and connected devices (DER clients). Consequently, the <tzOffset> value will always be 0.<br>Note: we may revisit this implementation choice in the future and update the <localTime> to be Australia Eastern Daylight Time. Therefore, we recommend that <tzOffset> is ignored for this eventuality. | Clients should ignore <tzOffset> for controls and telemetry between the utility server and the client aggregator. |
| **6** | LFDI Generation Requirements | The CPPALUE Utility Server has its own LFDI generation requirements. | See section 13 of this document for CPPALUE LFDI generation requirements. |
| **7** | In-Band Registration | The CPPALUE implementation differs for in-band registration compared to other CSIP-AUS DNSPs. Currently, only aggregator-mediated devices can register in-band. Direct connection support will be provided in subsequent releases. Sample workflows and request/response examples are provided.<br>The NMI in the connectionpointID field is only used for registration and from the aggregator to the utility server. The CPPALUE utility server will not send the NMI in the connectionpointID field. | See section 11 of this document for sample workflows and request/responses for the CPPALUE in-band registration implementation. |
| **8** | Subscription/Notification | The CPPALUE implementation does not currently support subscription/notification. Support for subscription/notification will come soon. | n/a |
| **9** | MirrorMeterReadings <timeperiod> | The current version of our Utility Server does not support the <timePeriod> for mirrorMeterReadings<br><br>This is expected to be supported a future version of the GE Utility Server. | DER Clients must include a <lastUpdateTime> tag with each mirrorMeterReading. This tag should reflect the end time of the data being reported.<br><br>For example, if a mirrorMeterReading covers a period from 4:00 PM on October 25, 2023 (1710744600) to 4:00 PM on October 26, 2023 (1710744900), the <lastUpdateTime> tag should be set to 4:00 PM on October 26th (1710744900).<br><br>Additionally, a future version of the Utility Server will support a <timePeriod> tag. While not required now, including this tag with the same time period as your readings will ensure compatibility when this feature is added. |
| **10** | HexBinary8 object datatype support for bitmap values | The CPPALUE Utility server expects even length characters for all bitmap and hexbinary values. | When providing any hexBinary or bitmap value with an odd number of characters, please provide a leading 0. |

| SI | Difference | Description | Suggested Change for DER Clients |
|---|---|---|---|
| 11 | FunctionSetAssignments Structure and Primacy Design | The CPPALUE implementation utilises multiple FSA lists, DERPrograms, and Primacy. | OEMs and DERClients are expected to support multiple DERPrograms across multiple FSA lists and respect primacy. |

# 8. Troubleshooting and FAQs

## Why am I getting connectivity issues when trying to connect to the CPPALUE Utility Server?

If you are receiving connectivity issues when trying to connect to the CPPALUE Utility Server, the below commands can assist in troubleshooting and error logging. If still unable to determine the root case for any connection issues, please execute the below commands and share the findings with the OEM onboarding team at:

Email: OEM_onboarding@powercor.com.au

### 1. Telnet test

A telnet test can be used to test if the CPPALUE Utility Server is open and reachable.

```
Telnet dermst.powercor.com.au 30101
Telnet dermsu.powercor.com.au 30101
```

If the telnet test fails, this indicates that the source IP has not been whitelisted for connection to the CPPALUE Utility Server. If unsuccessful, please share the source IP from which the telnet test was attempted.

If the telnet test is successful, this confirms network and IP connectivity to the CPPALUE Utility Server. If successful, please proceed to step 2.

### 2. CURL Command for GET /DCAP request

Once the network connectivity has been confirmed, the below CURL command if triggered from MacOS/Linux is can assist in troubleshooting the LFDI, Certificate, or Device Registration status with the CPPALUE Utility Server

- client.pem: This is the client certificate provided by CHED after signing your CSR
- client-key.pem: This is the private key created when you generated the CSR
- DERMST IEEE 2030.5 Root_2024-05-24.pem: The root CA certificate used to sign our server certificate

Test Command (note must be run from a host whose IP address has been added to the CPPALUE white list)

```
% curl --cert ./client.pem --key ./client-key.pem --cacert ./DERMST\ IEEE\ 2030.5\ Root_2024-05-24.pem
https://dermst.powercor.com.au:30101/api/v2/dcap
```

**Successful response:**

```
<DeviceCapability
          xmlns="urn:ieee:std:2030.5:ns"
          xmlns:ns2="https://csipaus.org/ns" href="/api/v2/dcap">
          <TimeLink href="/api/v2/tm"/>
          <EndDeviceListLink all="1" href="/api/v2/edev"/>
          <MirrorUsagePointListLink all="1" href="/api/v2/mup"/>
</DeviceCapability>
```

**Response if the client certificate is not valid:**

```
curl: (56) OpenSSL SSL_read: error:0A000126:SSL routines::unexpected eof while reading, errno 0
```

**Response if the LFDI has not been registered to the Utility Server:**

```
HTTP/1.1 404 Not Found
```

**Response if firewall whitelist or network issue:**

```
Request timeout
```

## Why is the Utility Server not responding to pings?

The CPPALUE Utility Server does not respond to pings. Attempting to ping the Utility Server will not provide any insight into the connectivity.

## Why am I getting a “Remote end closed connection without response” error?

This error is expected when a valid certificate is not provided as part of the request or when the request was attempted from a non-whitelisted IP.

## What does a 429 Client Error: Too Many Requests error mean?

If the server receives too many simultaneous requests from a client, it will return this error. A client should be capable of retrying with exponential backoff after a short period of time.

## Why am I getting a 404 (Not Found) error for a valid endpoint URL?

The Utility Server returns a 404 (Not Found) error code for both non-existent resources and those for which existence confirmation is withheld. An unexpected 404 error most likely indicates an invalid certificate associated with the requested resource.

## Why am I getting a 404 (Not Found) error for a newly created resource?

If the resource has been recently created (such as a new MUP), it may take a few seconds for the resource to become available. The client should retry after a few seconds.

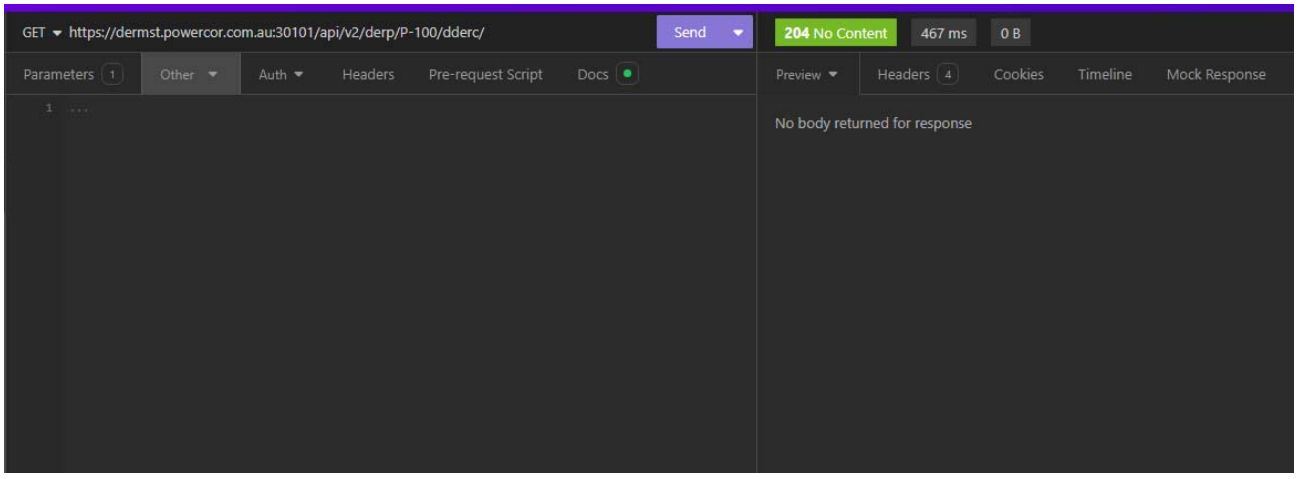
## Why am I receiving a 204 (No Content) response with an empty payload?

A 204 response is returned for resources which do not yet have content. When returning 204 responses, the CPPALUE Utility Server will also return a completely empty payload (as per IEEE2030.5. (Refer section 5.5.2.5 204 ("No Content")). This is likely to occur for GET requests to DERControl or DefaultDERControl resource which do not yet have any defined resources. Sample payload for reference purpose:

## GET DefaultDERControl

Content-Type: application/sep+xml

GET /api/v2/derp/P-100/dderc/




## Why am I getting a 415 (Unsupported Media Type) error?

The Utility Server requires a specific header in all PUT and POST requests. This header, called "Content-Type", must be set to "application/sep+xml". If you don't include this header in your request, you'll likely get a 415 error.

## Why am I getting a 400 error for a valid endpoint and payload?

The CPPALUE implementation strictly validates checks that all required fields are present and in the correct order. This applies specifically to sequences defined using the XSD:sequence attribute, as mandated by both IEEE2030.5 and CSIP-AUS standards. If any mandatory field is missing or if fields are submitted out of order, the Utility Server will reject the entire payload with a 400 Bad Request error.

It's important to note CSIP-AUS extension fields must be defined after the standard IEEE2030.5 elements in the sequence order.XSD schema validation files are available in:

- https://csipaus.org/ns/
- https://standards.ieee.org/wp-content/uploads/import/download/2030.5-2018_downloads.zip . Within this zip file, visit the Model Build 20180301 folder which contains sep.xsd schema.

See section 10.1 for sample payloads.

### What if I still can't find the root cause of the issue?

If you are unable to determine the root cause of the issue, please capture the following details and raise a query to the OEM Onboarding team at:

Email: OEM_onboarding@powercor.com.au

Troubleshooting Details:

- End Device ID (MRID) for which you are attempting a connection
- Description of what use case you were trying to achieve (submit telemetry, respond to a DERControl, submit a DERCapability payload etc.)
- Description of what issue you faced and whether it was a consistent or intermittent issue
- The date and time in Australia Eastern Time that you had encountered the issue
- URL or endpoint you are trying to access or submit a request to
- A copy/paste of the payload you were trying to submit including any request headers
- A copy/paste of the HTTP response and any error messaging you received

# 9. Example Flow of Communication Interactions

This section provides a summary of DER Client requests that are expected by the Utility Server.

Figure 1 demonstrates the workflow of DER Client requests that are submitted to the Utility Server during the initial device connection and discovery.

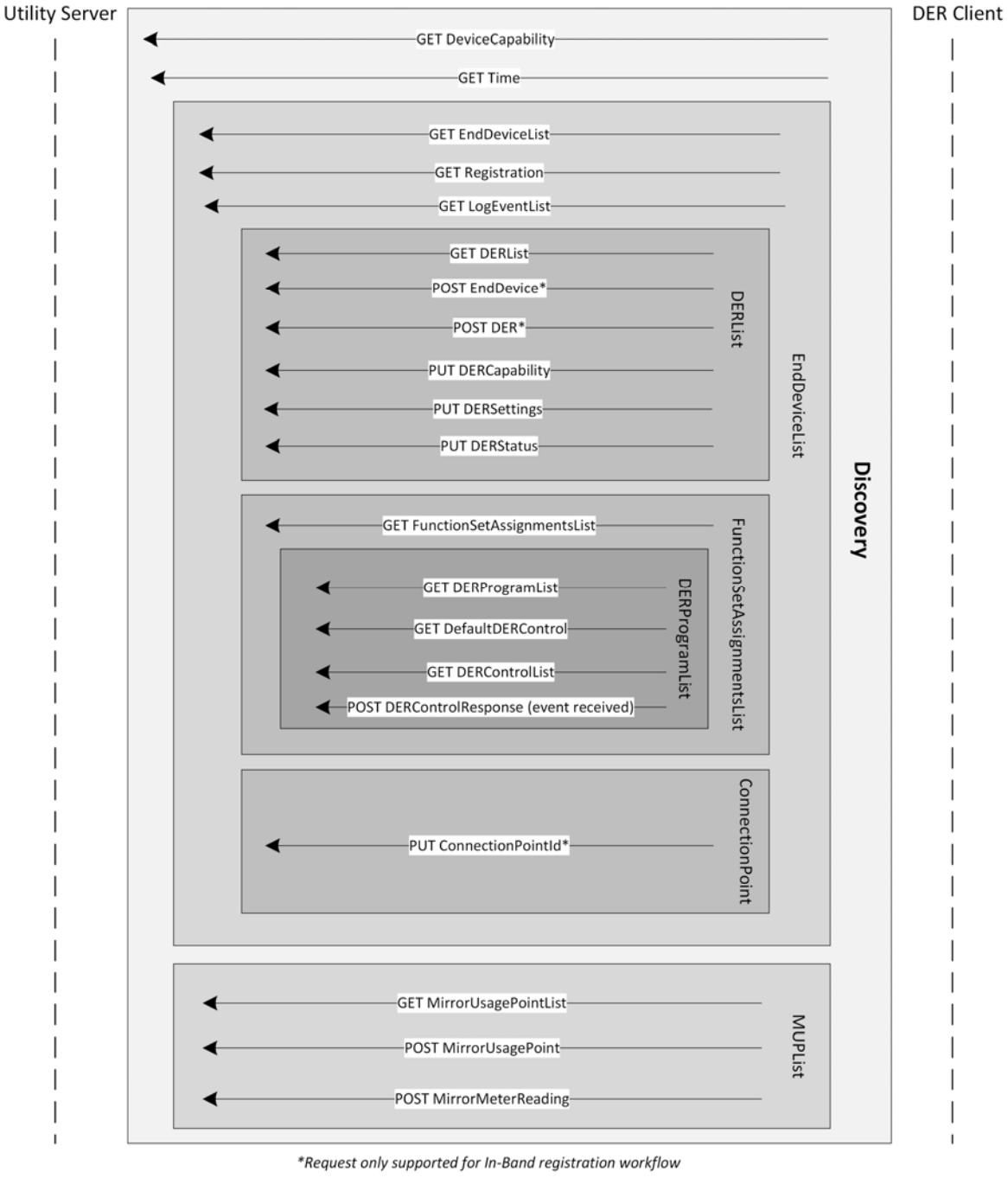



Figure 1: DER Client-Server Interactions - Discovery

Figure 2 demonstrates the workflow of DER Client ongoing requests that are submitted to the Utility Server

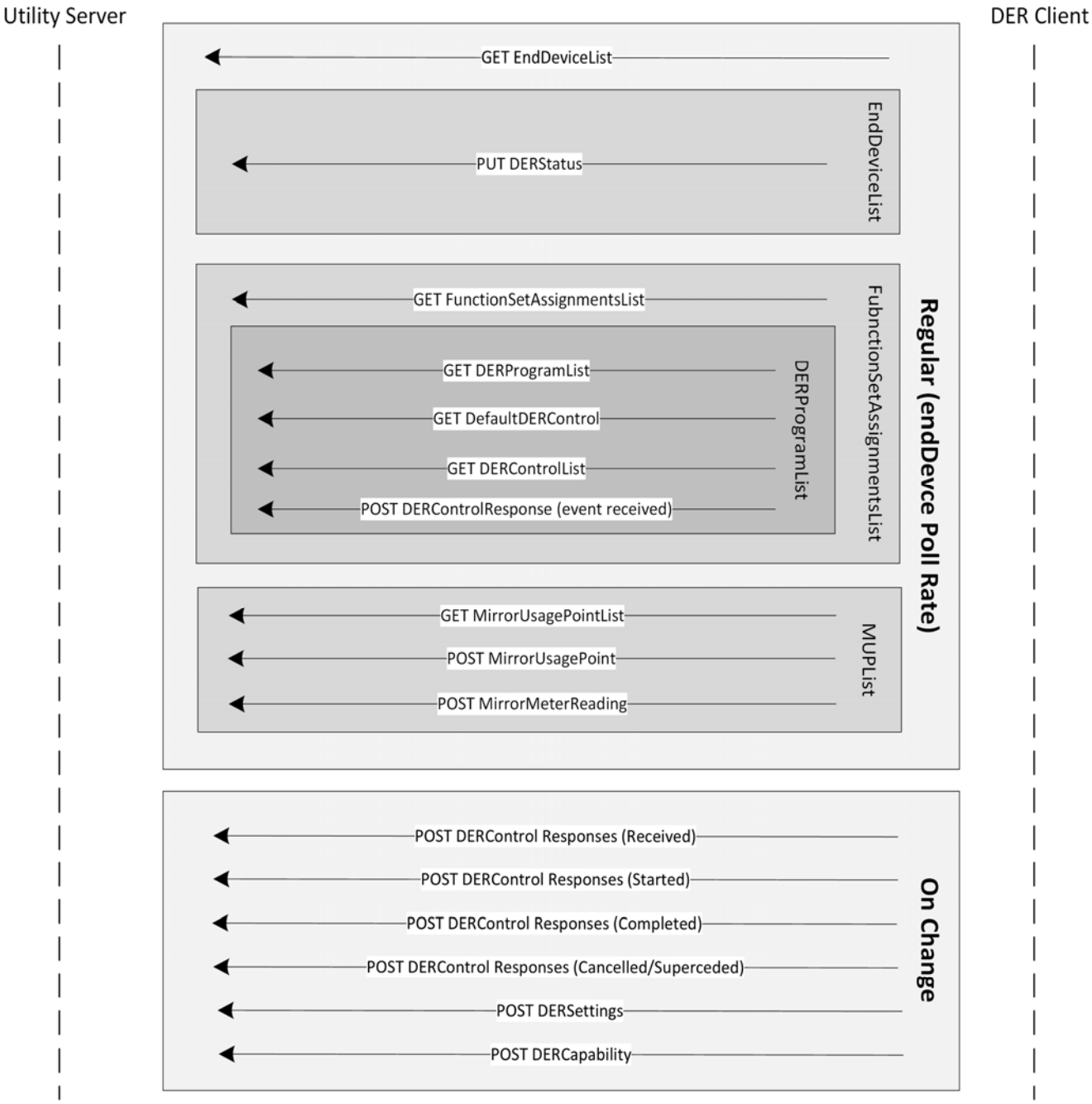



Figure 2: DER Client-Server Interactions - Ongoing

# 10. Sample Request/Response Bodies

This section provides sample requests and response bodies that can be expected from a DER Client to the Utility Server.

Query string parameters

Query string parameters are parameters added to a URI to provide filtering/paging of list items returned in query results.

The list paging mechanism allows GET requests to specify the range of list items to be returned in a query result set. The general syntax of a paged query is as follows:

{URI}?s={y}&1={z}

Where {URI} represents a URI used to address a list resource, (s | l ) represent query string parameters (further defined below) {y}, and {z} represent the respective query string parameter values.

The query string parameters are defined as:

- s (“start”) is used to indicate the first ordinal position in the list to be returned in the query result list as determined by the list’s ordering. The value is specified in decimal. The first ordinal position of the list SHALL be designated with a value of “0” and the maximum possible value is “4294967295.” If this query string parameter is not specified, the default start value SHALL be “0.”
- l (“limit”) is used to set the maximum number of list items (up to 4 294 967 295) to be included in the query result list. The value is specified in decimal. If this query string parameter is not specified, the default limit SHALL be “1.” Servers MAY return a result list smaller than that specified by the client-provided limit.

## 10.1 Initial Device Discovery

### GET Device Capability

GET /api/v2/dcap

```
<DeviceCapability
          xmlns="urn:ieee:std:2030.5:ns"
          xmlns:ns2="https://csipaus.org/ns" href="/api/v2/dcap">
          <TimeLink href="/api/v2/tm"/>
          <EndDeviceListLink all="5" href="/api/v2/edev"/>
          <MirrorUsagePointListLink all="0" href="/api/v2/mup"/>
</DeviceCapability>
```

### GET Time

GET /api/v2/tm

```
<Time
          xmlns="urn:ieee:std:2030.5:ns"
          xmlns:ns2="https://csipaus.org/ns" href="/api/v2/tm">
          <currentTime>1719563681</currentTime>
          <dstEndTime>0</dstEndTime>
          <dstOffset>0</dstOffset>
          <dstStartTime>0</dstStartTime>
          <localTime>1719563681</localTime>
          <quality>5</quality>
          <tzOffset>0</tzOffset>
</Time>
```

## GET EndDeviceList

GET /api/v2/edev?s=0&l=255

```
<EndDeviceList
          xmlns="urn:ieee:std:2030.5:ns"
          xmlns:ns2="https://csipaus.org/ns" all="2" results="2" subscribable="1" href="/api/v2/edev">
          <EndDevice subscribable="0" href="/api/v2/edev/AGG_DER 1">
                    <DERListLink all="1" href="/api/v2/edev/ AGG_DER 1/der"/>
                    <lFDI>09D6385B945C0D602103DB39B0B654B200123456</lFDI>
                    <LogEventListLink all="0" href="/api/v2/edev/1/lel"/>
                    <sFDI>26405452093</sFDI>
                    <changedTime>1719540590</changedTime>
                    <enabled>true</enabled>
                    <FunctionSetAssignmentsListLink all="2" href="/api/v2/edev/1/fsa"/>
                    <postRate>60</postRate>
                    <RegistrationLink href="/api/v2/edev/1/rg"/>
                    <ns2:ConnectionPointLink href="/api/v2/edev/1/cp"/>
          </EndDevice>
          <EndDevice subscribable="0" href="/api/v2/edev/E-Aggregator Test">
                    <DERListLink all="1" href="/api/v2/edev/ E-Aggregator Test/der"/>
                    <lFDI>19D6385B945C0D602103DB39B0B654B200123456</lFDI>
                    <LogEventListLink all="0" href="/api/v2/edev/2/lel"/>
                    <sFDI>69355125059</sFDI>
                    <changedTime>1719540590</changedTime>
                    <enabled>true</enabled>
                    <FunctionSetAssignmentsListLink all="2" href="/api/v2/edev/2/fsa"/>
                    <postRate>60</postRate>
                    <RegistrationLink href="/api/v2/edev/2/rg"/>
                    <ns2:ConnectionPointLink href="/api/v2/edev/2/cp"/>
          </EndDevice>
</EndDeviceList>
```

## GET EndDevice

When connecting to the CPPALUE Utility Server, OEMs will find pre-registered devices waiting for them. These devices, called edevs, differ based on the OEM type:

- Aggregator-based OEMs: You'll see two pre-registered edevs: an Aggregator endDevice (representing the Aggregator instance) and an Aggregator mediated DER endDevice (representing a managed Distributed Energy Resource).
- Direct device OEMs: You'll find a single pre-registered directly connected DER endDevice.

GET /api/v2/edev/E_Aggregator Test

Below edev represents an Aggregator endDevice.

```
<EndDeviceList
          xmlns="urn:ieee:std:2030.5:ns"
          xmlns:ns2="https://csipaus.org/ns" all="2" results="2" subscribable="1" href="/api/v2/edev">
          <EndDevice subscribable="0" href="/api/v2/edev/AGG_DER 1">
                    <DERListLink all="1" href="/api/v2/edev/ AGG_DER 1/der"/>
                    <lFDI>09D6385B945C0D602103DB39B0B654B200123456</lFDI>
                    <LogEventListLink all="0" href="/api/v2/edev/1/lel"/>
                    <sFDI>26405452093</sFDI>
                    <changedTime>1719540590</changedTime>
                    <enabled>true</enabled>
                    <FunctionSetAssignmentsListLink all="2" href="/api/v2/edev/1/fsa"/>
                    <postRate>60</postRate>
                    <RegistrationLink href="/api/v2/edev/1/rg"/>
                    <ns2:ConnectionPointLink href="/api/v2/edev/1/cp"/>
          </EndDevice>
</EndDeviceList>
```

GET /api/v2/edev/AGG_DER_1

Below edev represents an Aggregator mediated endDevice. However, this payload structure should resemble the expected response for a directly connected DER endDevice.

```
<EndDeviceList
          <EndDevice subscribable="0" href="/api/v2/edev/E-Aggregator Test">
                    <DERListLink all="1" href="/api/v2/edev/ E-Aggregator Test/der"/>
                    <lFDI>19D6385B945C0D602103DB39B0B654B200123456</lFDI>
                    <LogEventListLink all="0" href="/api/v2/edev/2/lel"/>
                    <sFDI>69355125059</sFDI>
                    <changedTime>1719540590</changedTime>
                    <enabled>true</enabled>
                    <FunctionSetAssignmentsListLink all="2" href="/api/v2/edev/2/fsa"/>
                    <postRate>60</postRate>
                    <RegistrationLink href="/api/v2/edev/2/rg"/>
                    <ns2:ConnectionPointLink href="/api/v2/edev/2/cp"/>
          </EndDevice>
</EndDeviceList>
```

## GET Registration

GET /api/v2/edev/AGG_DER_1/rg

```
<Registration xmlns="urn:ieee:std:2030.5:ns" xmlns:ns2="https://csipaus.org/ns" pollRate="301"
href="/api/v2/edev/AGG_DER_1/rg">
          <dateTimeRegistered>1682464854</dateTimeRegistered>
          <pIN>123456</pIN>
</Registration>
```

## GET LogEventList

GET /api/v2/edev/AGG_DER_1/lel

```
<LogEventList
          xmlns="urn:ieee:std:2030.5:ns"
          xmlns:ns2="https://csipaus.org/ns" all="0" results="0"/>
```

## GET DERList

GET /api/v2/edev/AGG_DER_1/der?s=0&l=255

```
<DERList
          xmlns="urn:ieee:std:2030.5:ns"
          xmlns:ns2="https://csipaus.org/ns" pollRate="301" all="1" results="1"
href="/api/v2/edev/AGG_DER_1/der">
          <DER subscribable="0" href="/api/v2/edev/AGG_DER_1/der/AGG_DER_1">
                    <DERAvailabilityLink href="/api/v2/edev/AGG_DER_1/der/AGG_DER_1/dera"/>
                    <DERCapabilityLink href="/api/v2/edev/AGG_DER_1/der/AGG_DER_1/dercap"/>
                    <DERSettingsLink href="/api/v2/edev/AGG_DER_1/der/AGG_DER_1/derg"/>
                    <DERStatusLink href="/api/v2/edev/AGG_DER_1/der/AGG_DER_1/ders"/>
          </DER>
</DERList>
```

## GET FunctionSetAsignmentsList

GET /api/v2/edev/AGG_DER_1/fsa?s=0&l=255

```
<FunctionSetAssignmentsList
          xmlns="urn:ieee:std:2030.5:ns"
          xmlns:ns2="https://csipaus.org/ns" all="2" results="1" subscribable="1"
href="/api/v2/edev/AGG_DER_1/fsa">
          <FunctionSetAssignments subscribable="1" href="/api/v2/edev/AGG_DER_1/fsa/2">
                    <DERProgramListLink all="2" href="/api/v2/edev/AGG_DER_1/fsa/2/derp"/>
                    <ResponseSetListLink all="0" href="/api/v2/rsps"/>
                    <TimeLink href="/api/v2/tm"/>
                    <mRID>DE045D141A8B335F96AFDE5AFECDBA09</mRID>
                    <description>FSA 2</description>
                    <version>1</version>
          </FunctionSetAssignments>
</FunctionSetAssignmentsList>
```

## 10.2 Send DER Connection Status, Operational Mode & Capabilities and Settings

### GET DERList

GET api/v2/edev/AGG_DER_1/der

```
<DERList
          xmlns="urn:ieee:std:2030.5:ns"
          xmlns:ns2="https://csipaus.org/ns" pollRate="300" all="1" results="1"
href="/api/v2/edev/AGG_DER_1/der">
          <DER subscribable="0" href="/api/v2/edev/AGG_DER_1/der/AGG_DER_1">
                    <DERAvailabilityLink href="/api/v2/edev/AGG_DER_1/der/AGG_DER_1/dera"/>
                    <DERCapabilityLink href="/api/v2/edev/AGG_DER_1/der/AGG_DER_1/dercap"/>
                    <DERSettingsLink href="/api/v2/edev/AGG_DER_1/der/AGG_DER_1/derg"/>
                    <DERStatusLink href="/api/v2/edev/AGG_DER_1/der/AGG_DER_1/ders"/>
          </DER>
</DERList>
```

### PUT DERStatus

PUT /api/v2/edev/AGG_DER_1/der/AGG_DER_1/ders

Content-Type: application/sep+xml

```
<DERStatus
          xmlns:ns2="https://csipaus.org/ns"
          xmlns="urn:ieee:std:2030.5:ns">
          <alarmStatus>00000000</alarmStatus>
          <genConnectStatus>
                    <dateTime>1685300234</dateTime>
                    <value>07</value>
          </genConnectStatus>
          <operationalModeStatus>
                    <dateTime>1685300234</dateTime>
                    <value>2</value>
          </operationalModeStatus>
          <readingTime>1685300234</readingTime>
          <storConnectStatus>
                    <dateTime>1685300234</dateTime>
                    <value>00</value>
          </storConnectStatus>
</DERStatus>
```

If successful, the Utility Server responds with HTTP response: HTTP/1.1 204 No Content.

### PUT DERCapability

PUT /api/v2/edev/AGG_DER_1/der/AGG_DER_1/dercap

Content-Type: application/sep+xml

**Note: below PUT DERCapability request body is provided as an illustrative example and not all DERCapability ratings are expected as mandatory. Please provide only the ratings which are applicable to the connected device.**

**Please also note that the CSIP-AUS extension field <ns2:doeModesSupported> is placed after the IEEE2030.5 fields. As per the IEEE2030.5 and CSIP-AUS XSDs, CSIP-AUS extension fields must be placed after the IEEE2030.5 fields.**

```
<DERCapability
          xmlns:ns2="https://csipaus.org/ns"
          xmlns="urn:ieee:std:2030.5:ns">
          <modesSupported>00100008</modesSupported>
          <rtgMaxW>
                    <multiplier>0</multiplier>
```

```
                    <value>5000</value>
          </rtgMaxW>
          <rtgMaxWh>
                    <multiplier>0</multiplier>
                    <value>13680</value>
          </rtgMaxWh>
          <type>83</type>
          <ns2:doeModesSupported>05</ns2:doeModesSupported>
</DERCapability>
```

If successful, the Utility Server responds with HTTP response: HTTP/1.1 204 No Content

## PUT DERSettings

PUT /api/v2/edev/AGG_DER_1/der/AGG_DER_1/derg

Content-Type: application/sep+xml

**Note: below PUT DERSettings request body is provided as an illustrative example and not all DERSettings settings are expected as mandatory. Please provide only the settings which are applicable to the connected device.**

**Please also note that the CSIP-AUS extension field <ns2:doeModesEnabled> is placed after the IEEE2030.5 fields. As per the IEEE2030.5 and CSIP-AUS XSDs, CSIP-AUS extension fields must be placed after the IEEE2030.5 fields.**

```
<DERSettings
xmlns:ns2="https://csipaus.org/ns"
xmlns="urn:ieee:std:2030.5:ns">
          <setGradW>0</setGradW>
          <setMaxA>
                    <multiplier>0</multiplier>
                    <value>20</value>
          </setMaxA>
          <setMaxW>
                    <multiplier>0</multiplier>
                    <value>5000</value>
          </setMaxW>
          <updatedTime>1483257600</updatedTime>
          <ns2:doeModesEnabled>05</ns2:doeModesEnabled>
</DERSettings>
```

If successful, the Utility Server responds with HTTP response: HTTP/1.1 204 No Content

## 10.3 Send DER Telemetry

### GET MirrorUsagePointList

GET /api/v2/mup?s=0&l=255<MirrorUsagePointList

```
<MirrorUsagePointList
xmlns="urn:ieee:std:2030.5:ns"
xmlns:ns2="https://csipaus.org/ns" all="3" results="3" href="/api/v2/mup">
          <MirrorUsagePoint href="/api/v2/mup/329a31fb-d0d7-4f9b-86ba-957326d7b7e4">
                    <mRID>E9ED264B65</mRID>
                    <description>Test Measurement Point 1</description>
                    <roleFlags>0A</roleFlags>
                    <serviceCategoryKind>0</serviceCategoryKind>
                    <status>0</status>
                    <deviceLFDI>A13014073172012974310973731917330000 1234</deviceLFDI>
                    <postRate>60</postRate>
          </MirrorUsagePoint>
          <MirrorUsagePoint href="/api/v2/mup/0992ad14-70a0-49f4-8122-c2f6674419eb">
                    <mRID>D9BA271CCA</mRID>
                    <description>Test Measurement Point 2</description>
                    <roleFlags>0A</roleFlags>
                    <serviceCategoryKind>0</serviceCategoryKind>
                    <status>0</status>
                    <deviceLFDI>A834064649354499865196999053296200001234</deviceLFDI>
                    <postRate>60</postRate>
          </MirrorUsagePoint>
          <MirrorUsagePoint href="/api/v2/mup/43284b9b-a1a2-4496-aec8-afe00f23939f">
                    <mRID>CE88A447706E999F9231194500059417</mRID>
                    <description>Site Measurements</description>
                    <roleFlags>49</roleFlags>
                    <serviceCategoryKind>0</serviceCategoryKind>
                    <status>1</status>
                    <deviceLFDI>A241315135881876141610291597317000001234</deviceLFDI>
                    <postRate>300</postRate>
          </MirrorUsagePoint>
</MirrorUsagePointList>
```

### POST MirrorUsagePoint

POST /api/v2/mup

Content-Type: application/sep+xml

```
<MirrorUsagePoint
xmlns="urn:ieee:std:2030.5:ns">
          <mRID>CE88A447706E999F9231194500059416</mRID>
          <description>Site Measurements</description>
          <roleFlags>49</roleFlags>
          <serviceCategoryKind>0</serviceCategoryKind>
          <status>1</status>
          <deviceLFDI>BB2546FE9620455E89D54AC4580DB6C100001234</deviceLFDI>
          <postRate>300</postRate>
</MirrorUsagePoint>
```

If successful, the Utility Server responds with HTTP response: HTTP/1.1 204 No Content

204 location: /api/v2/mup/65febbfb-7d96-4571-a62c-2715732ce252

## GET MirrorUsagePoint

GET /api/v2/mup/8f3605c5-1954-4ea7-885b-591143e94b1c

```
<MirrorUsagePoint
xmlns="urn:ieee:std:2030.5:ns"
xmlns:ns2="https://csipaus.org/ns" href="/api/v2/mup/65febbfb-7d96-4571-a62c-2715732ce252">
          <mRID>CE88A447706E999F9231194500059416</mRID>
          <description>Site Measurements</description>
          <roleFlags>49</roleFlags>
          <serviceCategoryKind>0</serviceCategoryKind>
          <status>1</status>
          <deviceLFDI>BB2546FE9620455E89D54AC4580DB6C100001234</deviceLFDI>
          <postRate>300</postRate>
</MirrorUsagePoint>
```

## POST MirrorMeterReading

POST /api/v2/mup/8f3605c5-1954-4ea7-885b-591143e94b1c

Content-Type: application/sep+xml

```
<MirrorMeterReading
          xmlns="urn:ieee:std:2030.5:ns">
          <mRID>CE88A447706E999F9231194500059416</mRID>
          <description>Site Real Power(W)</description>
          <lastUpdateTime>1719560791</lastUpdateTime>
          <nextUpdateTime>1717656029</nextUpdateTime>
          <version>0</version>
          <Reading>
                    <qualityFlags>00</qualityFlags>
                    <value>4322</value>
                    <timePeriod>
                              <duration>300</duration>
                              <start>1718674845</start>
                    </timePeriod>
          </Reading>
          <ReadingType>
                    <commodity>1</commodity>
                    <kind>37</kind>
                    <dataQualifier>2</dataQualifier>
                    <flowDirection>19</flowDirection>
                    <phase>128</phase>
                    <powerOfTenMultiplier>0</powerOfTenMultiplier>
                    <uom>38</uom>
          </ReadingType>
</MirrorMeterReading>
```

If successful, the Utility Server responds with HTTP response: HTTP/1.1 201 Created

201 location: /api/v2/upt/65febbfb-7d96-4571-a62c-2715732ce252/mr/CE88A447706E999F9231194500059416

## GET MeterReading

GET /api/v2/upt/8f3605c5-1954-4ea7-885b-591143e94b1c/mr/123456

```
<MeterReading
          xmlns="urn:ieee:std:2030.5:ns"
          xmlns:ns2="https://csipaus.org/ns">
          <mRID>CE88A447706E999F9231194500059416</mRID>
          <description>Site Real Power(W)</description>
          <version>0</version>
          <ReadingLink href="/api/v2/upt/65febbfb-7d96-4571-a62c-
2715732ce252/mr/CE88A447706E999F9231194500059416/r"/>
          <ReadingTypeLink href="/api/v2/upt/65febbfb-7d96-4571-a62c-
2715732ce252/mr/CE88A447706E999F9231194500059416/rt"/>
</MeterReading>
```

## POST MirrorUsagePoint

POST /api/v2/mup

The CPPALUE Utility Server also supports mirrorMeterReadingLists as well as setting of the <ReadingType> fields in the initial /mup creation request

```
<MirrorUsagePoint
          xmlns="urn:ieee:std:2030.5:ns">
          <mRID>1012</mRID>
          <description>DER [Inverter A]</description>
          <roleFlags>49</roleFlags>
          <serviceCategoryKind>0</serviceCategoryKind >
          <status>1</status>
          <deviceLFDI>BB2546FE9620455E89D54AC4580DB6C100001234</deviceLFDI>
          <MirrorMeterReading>
                    <mRID>100001</mRID>
                    <description>Site Active Power</description>
                    <ReadingType>
                              <accumulationBehaviour>4</accumulationBehaviour>
                              <dataQualifier>2</dataQualifier>
                              <intervalLength>300</intervalLength>
                              <powerOfTenMultiplier>0</powerOfTenMultiplier>
                              <uom>38</uom>
                    </ReadingType>
          </MirrorMeterReading>
          <MirrorMeterReading>
                    <mRID>100002</mRID>
                    <description>Site Voltage</description>
                    <ReadingType>
                              <accumulationBehaviour>4</accumulationBehaviour>
                              <dataQualifier>2</dataQualifier>
                              <intervalLength>300</intervalLength>
                              <powerOfTenMultiplier>0</powerOfTenMultiplier>
                              <uom>29</uom>
                    </ReadingType>
          </MirrorMeterReading>
</MirrorUsagePoint>
```

If successful, the Utility Server responds with HTTP response: HTTP/1.1 204 No Content

204 location: /api/v2/mup/91dbfb84-e4f8-48bf-8e8e-903b2ef04190

## GET MirrorUsagePoint

GET /api/v2/mup/dbf576bc-c5ca-4b30-9c97-e686dafa7d98

**Note: Individual mirrorMeterReadings and readingType fields are not returned for a GET MUP request**

```
<MirrorUsagePoint
          xmlns="urn:ieee:std:2030.5:ns"
          xmlns:ns2="https://csipaus.org/ns" href="/api/v2/mup/91dbfb84-e4f8-48bf-8e8e-903b2ef04190">
          <mRID>1012</mRID>
          <description>DER [Inverter A]</description>
          <roleFlags>49</roleFlags>
          <serviceCategoryKind>0</serviceCategoryKind>
          <status>1</status>
          <deviceLFDI>0FC67A8B629F3BB0769ABD6C6F6B3433C7BD7BAB</deviceLFDI>
          <postRate>300</postRate>
</MirrorUsagePoint>
```

## POST MirrorMeterReadingList

POST /api/v2/mup/91dbfb84-e4f8-48bf-8e8e-903b2ef04190

```
<MirrorMeterReadingList
          xmlns="urn:ieee:std:2030.5:ns"
```

```
          xmlns:ns2="https://csipaus.org/ns" all="2" results="2">
          <MirrorMeterReading>
                    <mRID>100001</mRID>
                    <description>Site Active Power</description>
                    <lastUpdateTime>1708930228</lastUpdateTime>
                    <nextUpdateTime>1708930528</nextUpdateTime>
                    <Reading>
                              <qualityFlags>0021</qualityFlags>
                              <timePeriod>
                                        <duration>300</duration>
                                        <start>1708929928</start>
                              </timePeriod>
                              <value>34</value>
                    </Reading>
          </MirrorMeterReading>
          <MirrorMeterReading>
                    <mRID>100002</mRID>
                    <description>Site Voltage</description>
                    <Reading>
                              <qualityFlags>0021</qualityFlags>
                              <timePeriod>
                                        <duration>300</duration>
                                        <start>1708929928</start>
                              </timePeriod>
                              <value>12</value>
                    </Reading>
          </MirrorMeterReading>
</MirrorMeterReadingList>
```

If successful, the Utility Server responds with HTTP response: HTTP/1.1 201 Created
201 location: /api/v2/upt/91dbfb84-e4f8-48bf-8e8e-903b2ef04190/mr

## GET MeterReadingList

GET /api/v2/upt/91dbfb84-e4f8-48bf-8e8e-903b2ef04190/mr {'s': 0, 'l': 255}

```
<MirrorMeterReadingList
          xmlns="urn:ieee:std:2030.5:ns"
          xmlns:ns2="https://csipaus.org/ns" all="2" results="2">
          <MirrorMeterReading>
                    <mRID>100001</mRID>
                    <description>Site Active Power</description>
                    <lastUpdateTime>1708930228</lastUpdateTime>
                    <nextUpdateTime>1708930528</nextUpdateTime>
                    <Reading>
                              <qualityFlags>0021</qualityFlags>
                              <timePeriod>
                                        <duration>300</duration>
                                        <start>1708929928</start>
                              </timePeriod>
                              <value>34</value>
                    </Reading>
          </MirrorMeterReading>
          <MirrorMeterReading>
                    <mRID>100002</mRID>
                    <description>Site Voltage</description>
                    <Reading>
                              <qualityFlags>0021</qualityFlags>
                              <timePeriod>
                                        <duration>300</duration>
                                        <start>1708929928</start>
                              </timePeriod>
                              <value>12</value>
                    </Reading>
          </MirrorMeterReading>
</MirrorMeterReadingList>
```

## 10.4 Receiving and Responding to DERControls

**Note: The following information clarifies the expected structure of data for FunctionSetAssignmentsList and DERProgram enrollment, but it doesn't necessarily reflect the final number of DER programs a DER can be enrolled in.**

### GET FunctionSetAssignmentList

GET /api/v2/edev/AGG_DER_1/fsa {'s': 0, 'l': 255}

```
<FunctionSetAssignmentsList
          xmlns="urn:ieee:std:2030.5:ns"
          xmlns:ns2="https://csipaus.org/ns" all="2" results="2" subscribable="1"
href="/api/v2/edev/AGG_DER_1/fsa">
          <FunctionSetAssignments subscribable="1" href="/api/v2/edev/AGG_DER_1/fsa/2">
                    <DERProgramListLink all="3" href="/api/v2/edev/AGG_DER_1/fsa/2/derp"/>
                    <ResponseSetListLink all="0" href="/api/v2/rsps"/>
                    <TimeLink href="/api/v2/tm"/>
                    <mRID>DE045D141A8B335F96AFDE5AFECDBA09</mRID>
                    <description>FSA 2</description>
                    <version>1</version>
          </FunctionSetAssignments>
          <FunctionSetAssignments subscribable="0" href="/api/v2/edev/AGG_DER_1/fsa/1">
                    <DERProgramListLink all="0" href="/api/v2/edev/AGG_DER_1/fsa/1/derp"/>
                    <ResponseSetListLink all="0" href="/api/v2/rsps"/>
                    <TimeLink href="/api/v2/tm"/>
                    <mRID>5B58B532F06F361382ECF6F2FECDBA09</mRID>
                    <description>Inverter - AGG_DER_1 FSA</description>
                    <version>0</version>
          </FunctionSetAssignments>
</FunctionSetAssignmentsList
```

### GET DERProgramList

GET /api/v2/edev/AGG_DER_1/fsa/2/derp {'s': 0, 'l': 255}

```
<DERProgramList
          xmlns="urn:ieee:std:2030.5:ns"
          xmlns:ns2="https://csipaus.org/ns" pollRate="300" all="32" results="2" subscribable="1"
href="/api/v2/edev/AGG_DER_1/fsa/2/derp">
          <DERProgram subscribable="0" href="/api/v2/derp/Example_Program_1">
                    <mRID>CDE7A277BB054A1293401CA5FECDBA09</mRID>
                    <description>Example Program 1</description>
                    <version>1</version>
                    <DefaultDERControlLink href="/api/v2/derp/Example_Program_1/dderc"/>
                    <DERControlListLink all="0" href="/api/v2/derp/Example_Program_1/derc"/>
                    <DERCurveListLink all="0" href="/api/v2/derp/Example_Program_1/dc"/>
                    <primacy>2</primacy>
          </DERProgram>
          <DERProgram subscribable="0" href="/api/v2/derp/OEM-Test-Program-3">
                    <mRID>3A4A75BE4D734A0AAB1B62D7FECDBA09</mRID>
                    <description>OEM Test Program 3</description>
                    <version>1</version>
                    <DefaultDERControlLink href="/api/v2/derp/OEM-Test-Program-3/dderc"/>
                    <DERControlListLink all="0" href="/api/v2/derp/OEM-Test-Program-3/derc"/>
                    <DERCurveListLink all="0" href="/api/v2/derp/OEM-Test-Program-3/dc"/>
                    <primacy>2</primacy>
          </DERProgram>
</DERProgramList>
```

### GET DefaultDerControl

GET /api/v2/derp/Example_Program_1/dderc {'s': 0, 'l': 255}

```
<DefaultDERControl
          xmlns="urn:ieee:std:2030.5:ns"
          xmlns:ns2="https://csipaus.org/ns" subscribable="0"
href="/api/v2/derp/Example_Program_1/dderc">
          <mRID>B8216ABB67BB4693938D2382589A229B</mRID>
          <version>0</version>
          <DERControlBase>
                    <ns2:opModExpLimW>
                              <multiplier>2</multiplier>
                              <value>15</value>
                    </ns2:opModExpLimW>
          </DERControlBase>
</DefaultDERControl>
```

## GET DERControlList

GET /api/v2/derp/Example_Program_1/derc {'s': 0, 'l': 255}

```
xmlns="urn:ieee:std:2030.5:ns"
xmlns:ns2="https://csipaus.org/ns" all="1" results="1" subscribable="1"
href="/api/v2/derp/Example_Program_1/derc">
<DERControl subscribable="0" replyTo="/api/v2/rsps/res-ms/rsp" responseRequired="03"
href="/api/v2/derp/Example_Program_1/derc/C174150CE69345A0876CDABAC2532809">
          <mRID>C174150CE69345A0876CDABAC2532809</mRID>
          <version>0</version>
          <creationTime>1710905748</creationTime>
          <EventStatus>
                    <currentStatus>0</currentStatus>
                    <dateTime>1710905748</dateTime>
                    <potentiallySuperseded>false</potentiallySuperseded>
                    <potentiallySupersededTime>1710905748</potentiallySupersededTime>
                    <reason></reason>
          </EventStatus>
          <interval>
                    <duration>3600</duration>
                    <start>1710905741</start>
          </interval>
          <DERControlBase>
                    <ns2:opModExpLimW>
                              <multiplier>4</multiplier>
                              <value>1</value>
                    </ns2:opModExpLimW>
          </DERControlBase>
</DERControl>undefined</DERControlList>
```

## POST DERControlResponse

POST /api/v2/rsps/res-ms/rsp

Content-Type: application/sep+xml

Below DERControlResponse submits a DERControlResponse.status = 1. This denotes “Event received”.

```
<DERControlResponse
          xmlns=”urn:ieee:std:2030.5:ns”>
          <createdDateTime>1709170790</createdDateTime>
          <endDeviceLFDI>0FC67A8B629F3BB0769ABD6C6F6B3433C7BD7BAB</endDeviceLFDI>
          <status>1</status>
          <subject>C174150CE69345A0876CDABAC2532809</subject>
</DERControlResponse>
```

If successful, the Utility Server responds with HTTP response: HTTP/1.1 201 Created

201 Location: /api/v2/rsps/res-ms/rsp/29F7E065BCA64F559FCA12A3D03877C9

POST /api/v2/rsps/res-ms/rsp

Content-Type: application/sep+xml

Below DERControlResponse submits a DERControlResponse.status = 2. This denotes “Event started”.

```
<DERControlResponse
          xmlns=”urn:ieee:std:2030.5:ns”>
          <createdDateTime>1709170791</createdDateTime>
          <endDeviceLFDI>0FC67A8B629F3BB0769ABD6C6F6B3433C7BD7BAB</endDeviceLFDI>
          <status>2</status>
          <subject>C174150CE69345A0876CDABAC2532809</subject>
</DERControlResponse>
```

If successful, the Utility Server responds with HTTP response: HTTP/1.1 201 Created
201 Location: /api/v2/rsps/res-ms/rsp/826EF35C0D644628994EF2E34B1CDF0C

POST /api/v2/rsps/res-ms/rsp
Content-Type: application/sep+xml
Below DERControlResponse submits a DERControlResponse.status = 3. This denotes “Event completed”.

```
<DERControlResponse
          xmlns=”urn:ieee:std:2030.5:ns”>
          <createdDateTime>1709170792</createdDateTime>
          <endDeviceLFDI>0FC67A8B629F3BB0769ABD6C6F6B3433C7BD7BAB</endDeviceLFDI>
          <status>3</status>
          <subject>C174150CE69345A0876CDABAC2532809</subject>
</DERControlResponse>
```

If successful, the Utility Server responds with HTTP response: HTTP/1.1 201 Created
201 Location: /api/v2/rsps/res-ms/rsp/A7B67F6D4A094279A050F4600DF8156C



# 11. In Band Registration Design

The CPPALUE Utility Server currently supports In Band registration for Aggregators only, not for direct connected devices. This section covers the In Band registration workflow and sample request/response bodies for registration.

**Note: This is an early working documentation for the CPPALUE's in band registration implementation. The workflow, endpoint URLs, and sample request/response bodies provided below are illustrative and may be updated in the future.**

## 11.1 In-Band Registration Workflow

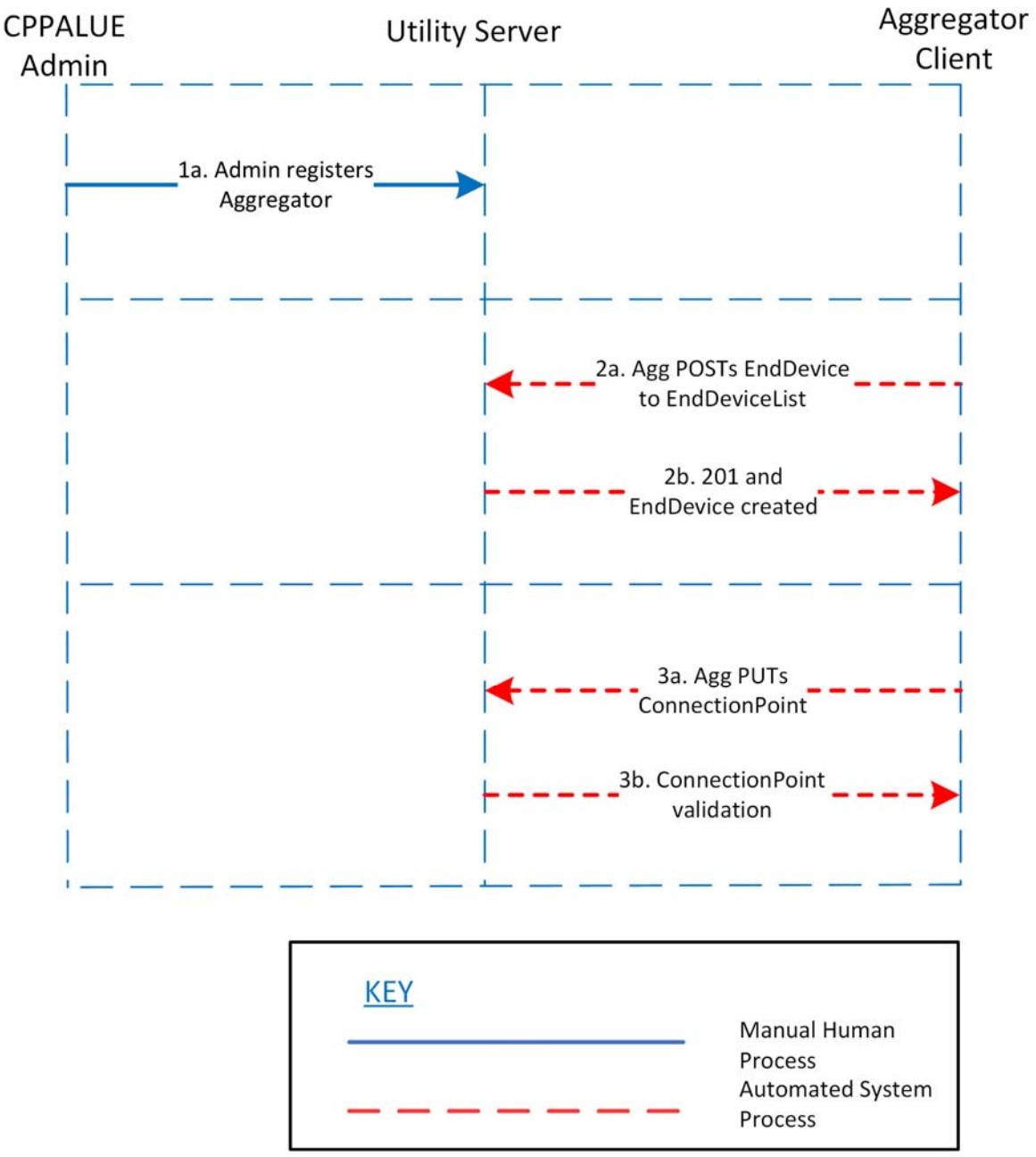



Figure 3: In-Band Registration Workflow

Table 5: In-Band Registration Workflow

| Flow | Description |
|---|---|
| ***1. Aggregator is registered out-of-band*** | |
| **1a.** | CPPALUE Utility Server Admin registers the Aggregator to the Utility Server via a manual out of band process. |
| ***2. Aggregator registers an EndDevice in-band*** | |
| **2a.** | Aggregator POSTS an endDevice to the EndDeviceList to register the EndDevice in-band<br>The payload for the POST edev request by the aggregator to create an in-band EndDevice looks like the following:<br>**POST EndDevice**<br>POST /api/v2/edev<br>Content-Type: application/sep+xml<br>`<EndDevice xmlns="urn:ieee:std:2030.5:ns" xmlns:ns2="https://csipaus.org/ns" href="007"><lFDI>77459B9B941BCB4714D0C121313C9AC000012345</lFDI><sFDI>1234567890</sFDI><changedTime>1637338408</changedTime><enabled>true</enabled></EndDevice>` |
| **2b.** | If successful, the CPPALUE Utility Server creates a new endDevice with a placeholder edevID:<br>HTTP response: HTTP/1.1 201 Created.<br>201 location: api/v2/edev/INBAND_EDEV_d7ded9e1-8fad-479c-b292-6a8cf60d81f5 |
| ***3. Aggregator PUTs ConnectionPoint to ConnectionPointLink*** | |
| **3a.** | Aggregator PUTs ConnectionPoint to ConnectionPointLink. In the CPPALUE Utility Server, this is endpoint is implemented as: /edev/{edevId}/cp.<br>The payload for PUT cp by the aggregator to update an in-band EndDevice looks like the following:<br>**PUT ConnectionPoint**<br>PUT /api/v2/edev/ INBAND_EDEV_d7ded9e1-8fad-479c-b292-6a8cf60d81f5/cp<br>Content-Type: application/sep+xml<br>`<ns2:ConnectionPoint xsi:schemaLocation="urn:ieee:std:2030.5:ns sep.xsd" xmlns="urn:ieee:std:2030.5:ns" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:ns2="https://csipaus.org/ns"><ns2:connectionPointId>11234567890</ns2:connectionPointId></ns2:ConnectionPoint>` |
| **3b.** | The submitted connection point is verified by the CPPALUE Utility Server.<br>What connection point to use:<br>**Testing (Non-Production):**<br>• A CPPALUE Admin will provide you a test NMI to use for this step<br>**Production:**<br>• The connection point should be the 11 character NMI that corresponds with the site of installation (10 character NMI plus checksum).<br>If the NMI validation fails, you'll receive a 400 (Bad Request) or 401 (Unauthorized) response.<br>If successful, the Utility Server responds with:<br>HTTP response: HTTP/1.1 201 Created. |

# 12. Data Objects

This following tables specify the attributes for the data listed in the previous section.

## EndDevice Data Object

Table 6: EndDevice Data Object

| Field | Type | Format | Required | Description |
|---|---|---|---|---|
| **lFDI** | String | | Yes | Long Form Device Identifier. LFDI generation requirements described in the next section. |
| **sFDI** | String | | Yes | Short Form Device Identifier. |
| **changedTime** | Time | | Yes | Time of request or time of change. Submitted in EPOCH time. |
| **enabled** | Boolean | true/false | Yes | Resource status. By default this field should be set to “true”. |

## ConnectionPoint Data Object

Table 7: ConnectionPoint Data Object

| Field | Type | Format | Required | Description |
|---|---|---|---|---|
| **connectionPointId** | String | | Yes | Connection point of the DER. The connection point should be the 11 character NMI that corresponds with the site of installation (10 character NMI plus the checksum). Any additional characters should be stripped from the NMI when submitting to the ConnectionPointLink.<br>**Note:** It is expected that the NMI and connectionPointID is only used for in band registration purposes. It is not expected that DER Clients will use the NMI for other purposes when communicating with the CPPALUE Utility Server. |

# 13. LFDI Generation Requirements

This section describes the CPPALUE Utility Server requirements for LFDI generation.

## 13.1 LFDI: Direct Device and Aggregators

LFDIs for direct connected devices and for aggregator instances must be generated as a hash of the device's X.509 certificate. It must adhere to the following formatting specifications:

- Character set: Hexadecimal characters only (0-9, A-F)
- Length: 40 characters

The LFDI for a given device certificate can be generated with the following openssl command:

- client.pem: This is the client certificate provided by CHED after signing your CSR

```
1. openssl x509 -outform der -in client.pem | sha256sum | head -c 40 | tr '[a-f]' '[A-F]'
```

Alternatively, the LFDI for a given device certificate can be generated with the following PowerShell commands:

- client.pem: This is the client certificate provided by CHED after signing your CSR

```
1. openssl x509 -outform der -in client.pem -out client.der
2. (Get-FileHash client.der).Hash.Substring(0, 40)
```

## 13.2 LFDI: Aggregator Mediated Device

Aggregators and software clients can represent multiple downstream sites or devices while communicating to the Utility Server as a single communicating client. These aggregators require a single certificate regardless of how many downstream devices it might represent. However, all downstream devices require their own LFDI to identify each site.

To generate a LFDI for the downstream devices follow below steps.

**NOTE:** to generate LFDI for Direct devices or Aggregators follow steps illustrated in section 13.1

Downstream devices LFDIs shall be generated by the aggregator using the aggregator manufacturer's Private Enterprise Number (PEN). The PEN shall be used as the last 8 digits of the LFDI with leading zeroes.

If your organisation does not have a PEN, you can request on for free from IANA.

Aggregator Mediated Device LFDIs must adhere to the following formatting specifications:

- Character set: Hexadecimal characters only (0-9, A-F)
- Length: 40 characters

An example LFDI is as follows where [1234] is the PEN:

**4B1AFA32312D2AA600ACF57E76FEBEDA00001234**