



# LV DERMS CSIP AUS External Party API Procedure

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Ensure latest version prior to use.

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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 [IEEE2030.5:2023SEP2](#) 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

Title	Document No.
IEEE Standard for Smart Energy Profile Application Protocol	IEEE 2030.5:2023
IEEE 2030.5:2023 Schema <a href="#">2030.5-2023_downloads.zip</a>	IEEE 2030.5:2023Schema
CSIP-AUS v1.1 XML Schema <a href="https://csipaus.org/ns/">https://csipaus.org/ns/</a>	CSIP-AUS v1.1 XML Schema
Common Smart Inverter Profile <a href="#">CSIP Implementation Guide v2.0 (sunspec.org)</a>	Sunspec CSIP Implementation Guide
Common Smart Inverter Profile (CSIP) – Australia version 1.1A	<a href="#">Common Smart Inverter Profile Australia - Australian Renewable Energy Agency (ARENA)</a>
CSIP-AUS Schema <a href="#">CSIPAUS.org - Common Smart Inverter Profile for Australia</a>	CSIP-AUS Schema
LV DERMS Utility Interconnection Handbook	ST-0002
Common Smart Inverter Profile – Australia with test procedures <a href="#">SA HB 218:2023</a>	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
SIT	<a href="https://dermst.powercor.com.au:30101">https://dermst.powercor.com.au:30101</a>
UAT	<a href="https://dermsu.powercor.com.au:30101">https://dermsu.powercor.com.au:30101</a>
PROD	<a href="https://dermsp.powercor.com.au:30101">https://dermsp.powercor.com.au:30101</a>

## 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

SI	Difference	Description	Suggested Change for DER Clients
1	Stricter Payload Validation	<p>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.</p> <p>It's important to note CSIP-AUS extension fields must be defined after the IEEE2030.5 elements in the sequence order.</p>	<p>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.</p> <p>See section 10.1 for sample payloads.</p> <p>Additionally, it is recommended to validate all payloads against IEEE2030.5 and CSIP-AUS XSDs.</p> <p>XSD schema validation files are available in</p> <ul style="list-style-type: none"> <li>• <a href="#">2030.5-2023_downloads.zip</a></li> <li>• <a href="https://csipaus.org/ns/">https://csipaus.org/ns/</a></li> </ul>
2	CSIP AUS Namespace Validation (xml:ns2)	<p>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.</p>	<p>DERClients should define the CSIP-AUS xml namespace as: xmlns:ns2="https://csipaus.org/ns.</p> <p>All CSIP-AUS extension fields should include the opening tag &lt;ns2&gt;</p> <p>See section 10.1 for sample payloads.</p>
3	Empty DERC and DDERC Payload Validation	<p>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")).</p>	<p>When receiving a 204 response, DERClients should expect to receive a completely empty response payload.</p> <p>See section 8. For more information.</p>
4	Hardcoded Endpoints	<p>The GE Utility Server utilises hardcoded endpoints, such as /api/v2/dcap rather than /dcap</p>	<p>Use the endpoint URLs documented here and those discovered during the initial '/dcap' request.</p>
5	Use of <localTime>	<p>The time provided by our Utility Server in the /timeLink resource won't be adjusted for our local time zone. Instead, it will always be in Coordinated Universal Time (UTC). This is because</p>	<p>DER Clients should implement the &lt;currentTime&gt; or UTC time for time synchronisation purposes.</p>

SI	Difference	Description	Suggested Change for DER Clients
		<p>UTC is the standard time reference for both the server and connected devices (DER clients). Consequently, the &lt;tzOffset&gt; value will always be 0.</p> <p>Note: we may revisit this implementation choice in the future and update the &lt;localTime&gt; to be Australia Eastern Daylight Time. Therefore, we recommend that &lt;tzOffset&gt; is ignored for this eventuality.</p>	<p>Clients should ignore &lt;tzOffset&gt; for controls and telemetry between the utility server and the client aggregator.</p>
6	LFDI Generation Requirements	<p>The CPPALUE Utility Server has its own LFDI generation requirements.</p>	<p>See section 13 of this document for CPPALUE LFDI generation requirements.</p>
7	In-Band Registration	<p>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.</p> <p>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.</p>	<p>See section 11 of this document for sample workflows and request/responses for the CPPALUE in-band registration implementation.</p>
8	Subscription/Notification	<p>The CPPALUE implementation does not currently support subscription/notification. Support for subscription/notification will come soon.</p>	<p>n/a</p>
9	MirrorMeterReadings <timeperiod>	<p>The current version of our Utility Server does not support the &lt;timePeriod&gt; for mirrorMeterReadings</p> <p>This is expected to be supported a future version of the GE Utility Server.</p>	<p>DER Clients must include a &lt;lastUpdateTime&gt; tag with each mirrorMeterReading. This tag should reflect the end time of the data being reported.</p> <p>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 &lt;lastUpdateTime&gt; tag should be set to 4:00 PM on October 26th (1710744900).</p> <p>Additionally, a future version of the Utility Server will support a &lt;timePeriod&gt; tag. While not required now, including this tag with the same time period as your readings will ensure compatibility when this feature is added.</p>
10	HexBinary8 object datatype support for bitmap values	<p>The CPPALUE Utility server expects even length characters for all bitmap and hexbinary values.</p>	<p>When providing any hexBinary or bitmap value with an odd number of characters, please provide a leading 0.</p>

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## 8. Troubleshooting and FAQs

### FAQ and Common Errors

#### 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 cause for any connection issues, please execute the below commands and raise a query to the relevant team based on whether you are troubleshooting a Production or Non-Production site issue:

- **Production Environment and Real Customer Issues:** Contact DER Optimisation team at [DER\\_Optimisation@powercor.com.au](mailto:DER_Optimisation@powercor.com.au)
- **Non-Production/Onboarding Issues:** Contact the OEM Onboarding team at [OEM\\_Onboarding@powercor.com.au](mailto: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
Telnet dermsp.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 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.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.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.

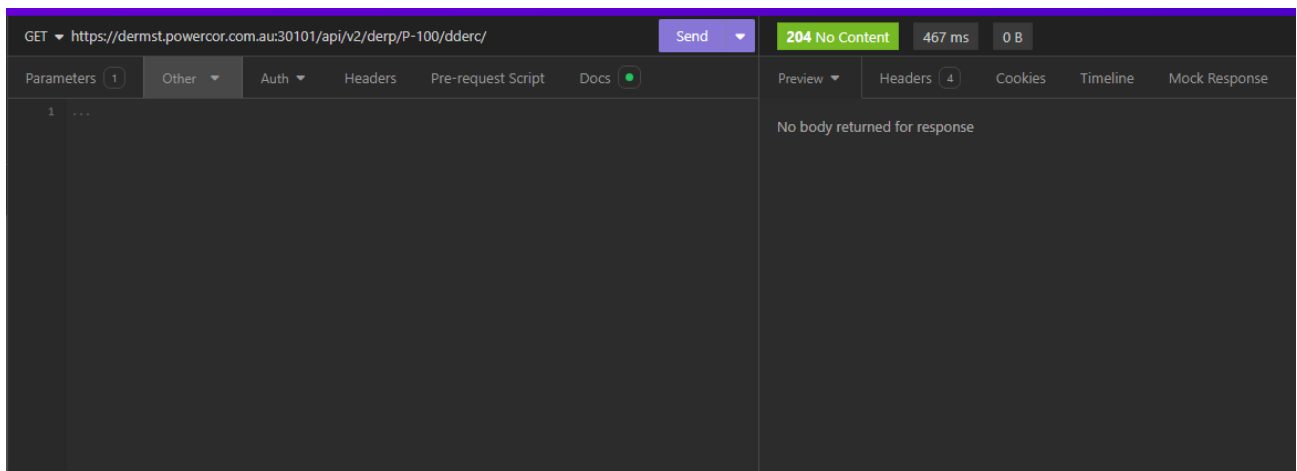
## Why am I receiving a 204 (No Content) response with an empty payload?

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/](https://dermst.powercor.com.au:30101/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/>
- [2030.5-2023\\_downloads.zip](#) . Within this zip file 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 relevant team based on whether you are troubleshooting a Production or Non-Production site issue:

- **Production Environment and Real Customer Issues:** Contact DER Optimisation team at [DER\\_Optimisation@powercor.com.au](mailto:DER_Optimisation@powercor.com.au)
- **Non-Production/Onboarding Issues:** Contact the OEM Onboarding team at [OEM\\_Onboarding@powercor.com.au](mailto: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

## Common Registration Errors

### Why am I getting a failed to create endDevice due to duplicate key edevId for In-Band registration?

When attempting the POST EndDevice request for an in band registration, the server may return a 400 response with the following error message:

```
MDL-ERR-0002: Failed to create EndDevice. Duplicate key edevId[INBAND_EDEV_5e0cd9d1-07da-44d7-ae99-8892912a5cca/7ba7a8a45d2a09cb61a6e920add1042300000001]
```

This occurs when attempting to register an LFDI that has already been registered in the server.

In this scenario, we recommend checking your endDeviceList for the LFDI that you have attempted registration.

If you are unable to find the LFDI or if the LFDI has been incorrectly registered, please contact [der\\_optimisation@powercor.com.au](mailto:der_optimisation@powercor.com.au) with the following information:

- Intended NMI and LFDI combination for registration
- In-band registration payload for POST EndDevice and PUT ConnectionPoint requests
- Screenshot or copy/paste of the HTTP response and error code from the utility server

---

## Why am I getting an unable to update the ConnectionPointId error for In-Band registration?

When attempting the PUT ConnectionPoint request for in band registration, the server may return a 400 response with the following error message:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<MicroserviceStatusType
  xmlns="com:ge:ieee2030:registration:rest:dto">
  <error>true</error>
  <statusCode>REG-ERR-0011</statusCode>
  <statusMessage>Unable to update the ConnectionPointId in EndDevice[INBAND_EDEV_e68207c5-6cc8-44eb-
b5e7-1590a196af3b], the ConnectionPointId[15151] doesn't exist in the registration
database.</statusMessage>
</MicroserviceStatusType>
```

This occurs if the provided connectionPoint did not have a corresponding valid Solar Pre-Approval (SPA) at the time of attempted registration or if the provided NMI does not belong to the CPPALUE network. This includes SPAs which have expired.

In this scenario, we recommend that the installer checks:

- The exact NMI entered
- Corresponding SPA status = Approved/Closed/Expired
- If SPA is pending or incorrect, the **installer** must resolve before registration can succeed

For further information on In-Band registration, please see Section 11.

Please note it is the responsibility of the installer or customer agent to manage the customer application, including solar pre-approval. The installer can contact the New Energy Services team for assistance with setting up or correcting SPA & application issues. Contact details and additional information on the SPA/connections process are available on our website.

## Why am I “Verification failed” registration error in eConnect/UEConnect?

When attempting to verify a solar site's registration, you may encounter the following error:



Figure 1: Registration Verification Error

This error typically indicates one of the following:

- No registration exists for the site
- Site registration is in progress
- Site registration is in an error state

Recommended steps:

1. **In-band registered site:** Re-initiate in-band registration via the OEM application
2. **Out-of-band registered site:** Re-submit the LFDI in the eConnect/UEConnect portal
3. Click **Verify** again

If the error persists, please reach out to the corresponding OEM for any issues with registration.

## 9. Example Flow of Communication Interactions

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

Figure 2 demonstrates the workflow of DER Client requests that are submitted to the Utility Server during the initial device connection and discovery.

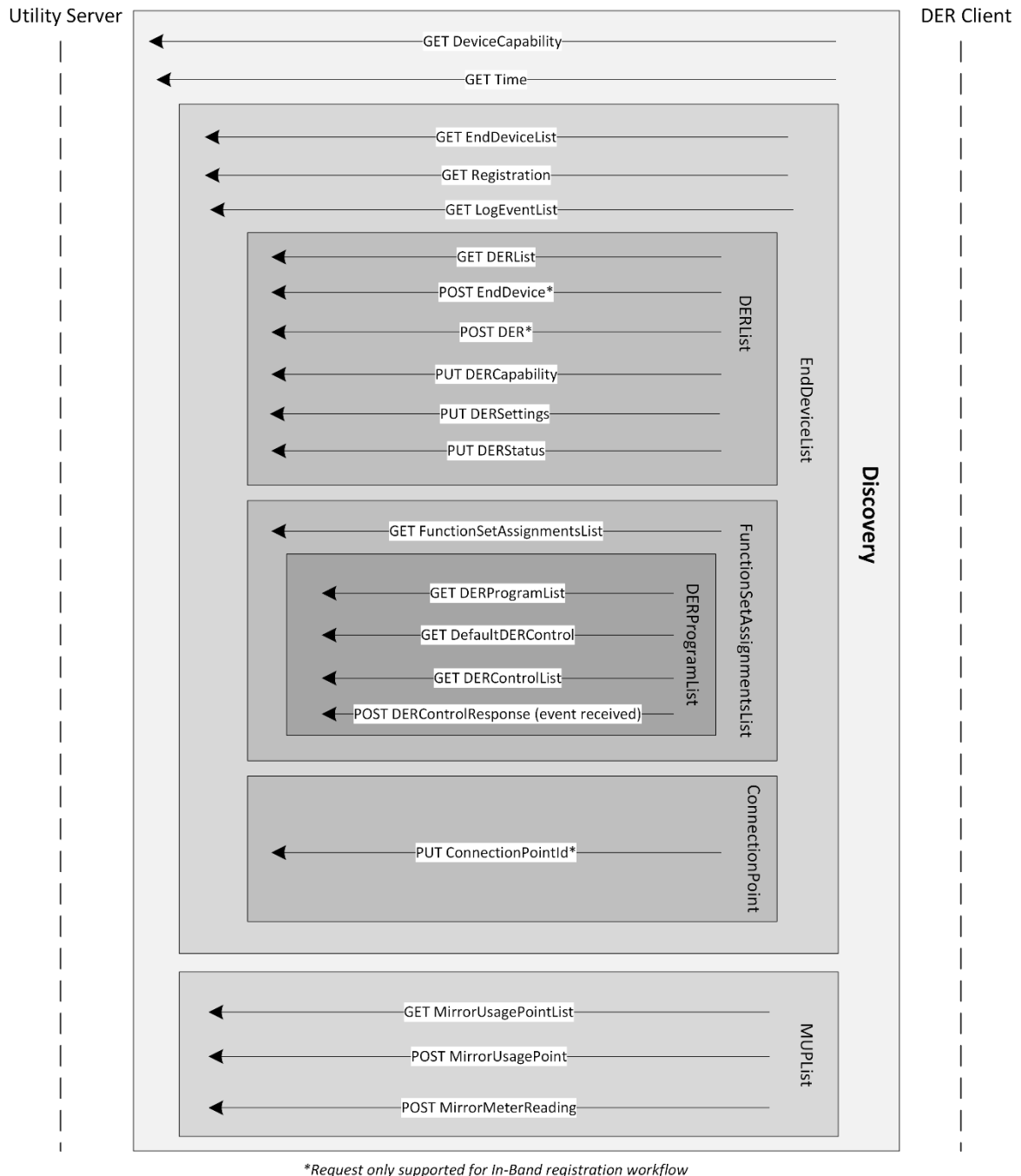


Figure 2: DER Client-Server Interactions - Discovery

Figure 3 demonstrates the workflow of DER Client ongoing requests that are submitted to the Utility Server

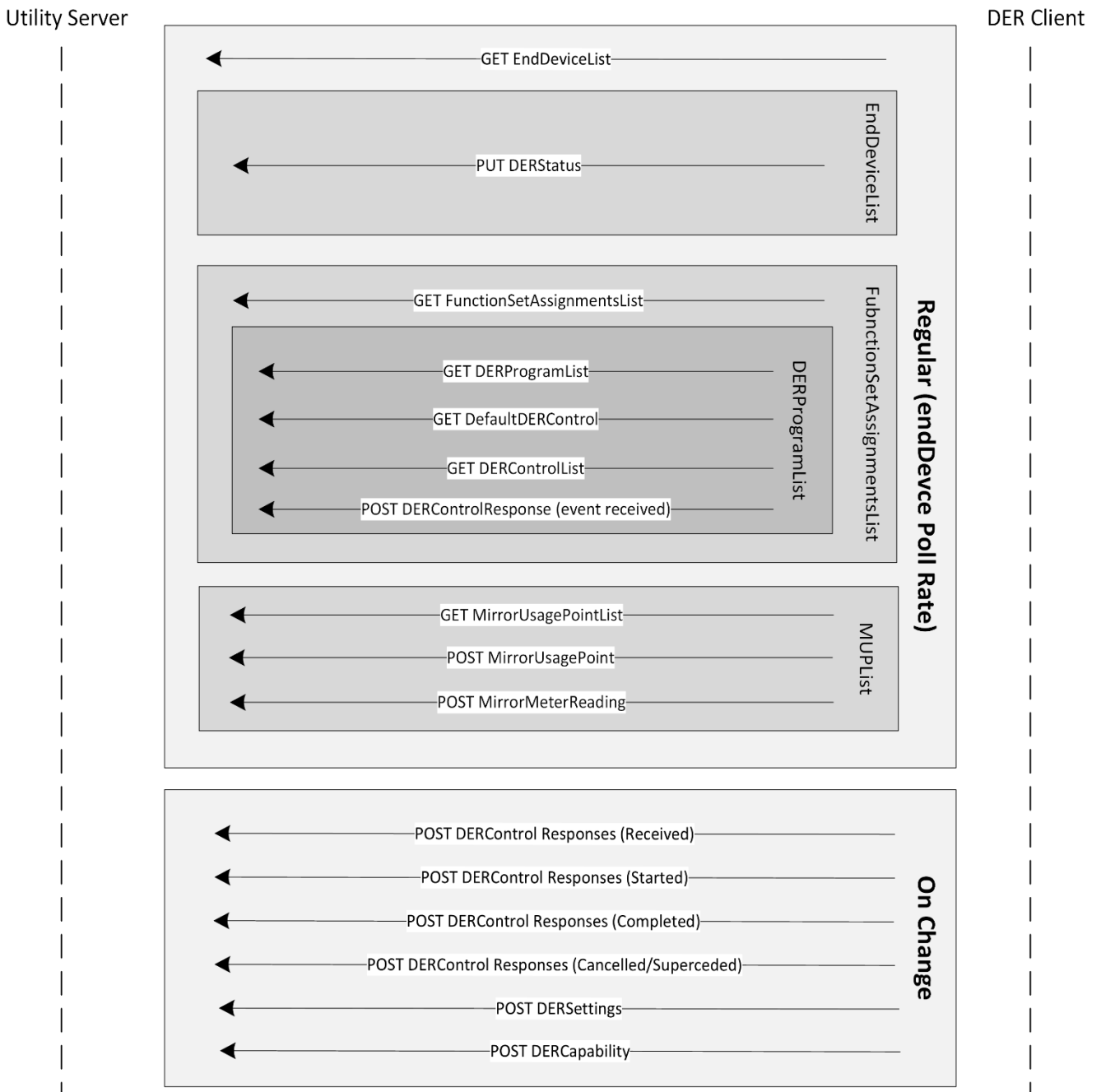


Figure 3: DER Client-Server Interactions - Ongoing

---

## 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:

$$\{\text{URI}\}?s=\{y\}\&1=\{z\}$$

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" pollRate="300" href="/api/v2/tm">
  <currentTime>1772504092</currentTime>
  <dstEndTime>1772964000</dstEndTime>
  <dstOffset>0</dstOffset>
  <dstStartTime>1762074000</dstStartTime>
  <localTime>1772475292</localTime>
  <quality>5</quality>
  <tzOffset>-28800</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/236/der"/>
    <LFDI>FA306E82679FF6EF9103650B3696DDC600000159</LFDI>
    <LogEventListLink all="0" href="/api/v2/edev/236/lel"/>
    <sFDI>671596482949</sFDI>
    <changedTime>1733541563</changedTime>
    <enabled>true</enabled>
    <FunctionSetAssignmentsListLink all="2" href="/api/v2/edev/236/fsa"/>
    <postRate>300</postRate>
    <RegistrationLink href="/api/v2/edev/236/rg"/>
    <ns2:ConnectionPointLink href="/api/v2/edev/236/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/236

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

```
<EndDevice
  xmlns="urn:ieee:std:2030.5:ns"
  xmlns:ns2="https://csipaus.org/ns" subscribable="0" href="/api/v2/edev/236">
  <DERListLink all="1" href="/api/v2/edev/236/der"/>
  <LFDI>FA306E82679FF6EF9103650B3696DDC600000159</LFDI>
  <LogEventListLink all="0" href="/api/v2/edev/236/lel"/>
  <sFDI>671596482949</sFDI>
  <changedTime>1733541563</changedTime>
  <enabled>true</enabled>
  <FunctionSetAssignmentsListLink all="2" href="/api/v2/edev/236/fsa"/>
  <postRate>300</postRate>
  <RegistrationLink href="/api/v2/edev/236/rg"/>
  <ns2:ConnectionPointLink href="/api/v2/edev/236/cp"/>
</EndDevice>
```

---

## GET Registration

GET /api/v2/edev/236/rg

**Note:** Although the CPPALUE server returns a registration link (href and payload), this functionality is not actively used. Validation of the /rg content is optional and unenforced.

```
<Registration
  xmlns="urn:ieee:std:2030.5:ns"
  xmlns:ns2="https://csipaus.org/ns" pollRate="300" href="/api/v2/edev/236/rg">
  <dateTimeRegistered>1727847132</dateTimeRegistered>
  <pIN>123456</pIN>
</Registration>
```

## GET LogEventList

GET /api/v2/edev/236/lel

**Note:** Although the CPPALUE server returns a logeventlist (href and payload), this functionality is not currently used and logevent data is not validated.

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

## GET DERList

GET /api/v2/edev/236/der?s=0&l=255

```
<DERList
  xmlns="urn:ieee:std:2030.5:ns"
  xmlns:ns2="https://csipaus.org/ns" pollRate="300" all="1" results="1" href="/api/v2/edev/236/der">
  <DER subscribable="0" href="/api/v2/edev/236/der/236">
    <DERAvailabilityLink href="/api/v2/edev/236/der/236/dera"/>
    <DERCapabilityLink href="/api/v2/edev/236/der/236/dercap"/>
    <DERSettingsLink href="/api/v2/edev/236/der/236/derg"/>
    <DERStatusLink href="/api/v2/edev/236/der/236/ders"/>
  </DER>
</DERList>
```

## GET FunctionSetAssignmentsList

GET /api/v2/edev/236/fsa?s=0&l=255

```
<FunctionSetAssignmentsList
  xmlns="urn:ieee:std:2030.5:ns"
  xmlns:ns2="https://csipaus.org/ns" pollRate="300" all="2" results="2" subscribable="1"
href="/api/v2/edev/236/fsa">
  <FunctionSetAssignments subscribable="1" href="/api/v2/edev/236/fsa/2">
    <DERProgramListLink all="3" href="/api/v2/edev/236/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/236/fsa/1">
    <DERProgramListLink all="1" href="/api/v2/edev/236/fsa/1/derp"/>
    <ResponseSetListLink all="0" href="/api/v2/rsps"/>
    <TimeLink href="/api/v2/tm"/>
    <mRID>5B58B532F06F361382ECF6F2FECDBA09</mRID>
    <description>null - 236 FSA</description>
    <version>0</version>
  </FunctionSetAssignments>
</FunctionSetAssignmentsList>
```

---

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

### GET DERList

GET /api/v2/edev/236/der?s=0&l=255

```
<DERList
  xmlns="urn:ieee:std:2030.5:ns"
  xmlns:ns2="https://csipaus.org/ns" pollRate="300" all="1" results="1" href="/api/v2/edev/236/der">
  <DER subscribable="0" href="/api/v2/edev/236/der/236">
    <DERAvailabilityLink href="/api/v2/edev/236/der/236/dera"/>
    <DERCapabilityLink href="/api/v2/edev/236/der/236/dercap"/>
    <DERSettingsLink href="/api/v2/edev/236/der/236/derg"/>
    <DERStatusLink href="/api/v2/edev/236/der/236/ders"/>
  </DER>
</DERList>
```

### PUT DERStatus

PUT /api/v2/edev/236/der/236/ders

Content-Type: application/sep+xml

**Note: The CPPALUE server strictly validates checks that all required fields are present and in the correct order and format. 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 or in the wrong format, the Utility Server will reject the entire payload with a 400 Bad Request error.**

Refer to Section 8 for more information.

```
<DERStatus
  xmlns="urn:ieee:std:2030.5:ns">
  <genConnectStatus>
    <dateTime>1771473225</dateTime>
    <value>06</value>
  </genConnectStatus>
  <operationalModeStatus>
    <dateTime>1771473219</dateTime>
    <value>2</value>
  </operationalModeStatus>
  <readingTime>1771473219</readingTime>
</DERStatus>
```

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

### PUT DERCapability

PUT /api/v2/edev/236/der/236/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="urn:ieee:std:2030.5:ns"
  xmlns:ns2="https://csipaus.org/ns">
  <modesSupported>00</modesSupported>
  <rtgMaxVA>
    <multiplier>0</multiplier>
    <value>6000</value>
  </rtgMaxVA>
  <rtgMaxVar>
```

```
        <multiplier>0</multiplier>
        <value>3600</value>
    </rtgMaxVar>
    <rtgMaxVarNeg>
        <multiplier>0</multiplier>
        <value>-3600</value>
    </rtgMaxVarNeg>
    <rtgMaxW>
        <multiplier>0</multiplier>
        <value>6000</value>
    </rtgMaxW>
    <type>0</type>
</DERCapability>
```

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

## PUT DERSettings

PUT /api/v2/edev/236/der/236/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">
  <modesEnabled>0010000C</modesEnabled>
  <setGradW>27</setGradW>
  <setMaxW>
    <multiplier>0</multiplier>
    <value>1500</value>
  </setMaxW>
  <updatedAtTime>1711620155</updatedAtTime>
  <ns2:doeModesEnabled>03</ns2:doeModesEnabled>
</DERSettings>
```

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

## 10.3 Send DER Telemetry

### 10.3.1 UOM and RoleFlag Requirements

The CPPALUE server requires a valid UOM code to determine the telemetry type of an inbound payload, and a valid RoleFlags value to classify the reading as either site-level or device/inverter-level. A description field alone is insufficient for type resolution. Refer to the table below for supported UOM codes and RoleFlags values.

Table 5

Monitoring Data	RoleFlag	UOM	Phase Code
Site Real Power (Watts)	03	38	
Site Reactive Power (VArS)	03	63	
Device/Inverter Real Power (Watts)	49	38	
Device/Inverter Reactive Power (Vars)	49	63	
Frequency 33 (Hertz)	49	33	
Site Voltage (Single Phase)	03	29	129 – AN
Site Voltage (3 Phase)	03	29	129 – AN 65 – BN 33 – CN
Device/Inverter Voltage (Single Phase)	49	29	129 – AN
Device/Inverter Voltage (Three Phase)	49	29	129 – AN 65 – BN 33 – CN

### GET MirrorUsagePointList

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

```
<MirrorUsagePointList
xmlns="urn:ieee:std:2030.5:ns"
xmlns:ns2="https://csipaus.org/ns" all="2" results="2" href="/api/v2/mup">
  <MirrorUsagePoint href="/api/v2/mup/329a31fb-d0d7-4f9b-86ba-957326d7b7e4">
    <mRID>E9ED264B65</mRID>
    <description>Site Readings</description>
    <roleFlags>03</roleFlags>
    <serviceCategoryKind>0</serviceCategoryKind>
    <status>0</status>
    <deviceLFDI>A130140731720129743109737319173300001234</deviceLFDI>
    <postRate>60</postRate>
  </MirrorUsagePoint>
  <MirrorUsagePoint href="/api/v2/mup/0992ad14-70a0-49f4-8122-c2f6674419eb">
    <mRID>D9BA271CCA</mRID>
    <description>Device Readings</description>
    <roleFlags>49</roleFlags>
    <serviceCategoryKind>0</serviceCategoryKind>
    <status>0</status>
    <deviceLFDI> A130140731720129743109737319173300001234</deviceLFDI>
    <postRate>60</postRate>
  </MirrorUsagePoint>
</MirrorUsagePointList>
```

---

## POST MirrorUsagePoint

POST /api/v2/mup

Content-Type: application/sep+xml

```
<MirrorUsagePoint
xmlns="urn:ieee:std:2030.5:ns">
  <mRID>E9ED264B65</mRID>
  <description>Site Readings</description>
  <roleFlags>03</roleFlags>
  <serviceCategoryKind>0</serviceCategoryKind>
  <status>1</status>
  <deviceLFDI> A130140731720129743109737319173300001234</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/329a31fb-d0d7-4f9b-86ba-957326d7b7e4

## GET MirrorUsagePoint

GET /api/v2/mup/329a31fb-d0d7-4f9b-86ba-957326d7b7e4

```
<MirrorUsagePoint
xmlns="urn:ieee:std:2030.5:ns"
xmlns:ns2="https://csipaus.org/ns" href="/api/v2/mup/65febbfb-7d96-4571-a62c-2715732ce252">
  <mRID>E9ED264B65</mRID>
  <description>Site Readings</description>
  <roleFlags>03</roleFlags>
  <serviceCategoryKind>0</serviceCategoryKind>
  <status>1</status>
  <deviceLFDI>A130140731720129743109737319173300001234</deviceLFDI>
  <postRate>300</postRate>
</MirrorUsagePoint>
```

## POST MirrorMeterReading

POST /api/v2/mup/329a31fb-d0d7-4f9b-86ba-957326d7b7e4

Content-Type: application/sep+xml

```
<MirrorMeterReading
xmlns="urn:ieee:std:2030.5:ns">
  <mRID>CE88A447706E999F923119450005006</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/up/65febbfb-7d96-4571-a62c-2715732ce252/mr/CE88A447706E999F923119450005006

---

## 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>Site Readings</description>
  <roleFlags>03</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>Site Readings</description>
  <roleFlags>03</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/mrs=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>
```

### 10.3.2 MirrorUsagePoint Management

**Initial Creation:** New MUPs should be created upon device/client registration.

**MUP Re-creation:**

- Our server periodically terminates MirrorUsagePoints (MUPs) that have been inactive for 72 hours as part of a resource management process.
- If your client attempts to POST data to a terminated MUP, it will receive a 404 or 400 error.
- When this occurs, the client application should create new MUPs to resume communication

**Preferred Structure:** We recommend a maximum of two MUPs per device: one for SITE readings and one for INVERTER/DER readings.

**Multiple MUPs:** While our server supports multiple MUPs for SITE and INVERTER/DER readings if client requirements necessitate (e.g., 5 SITE and 5 DER), this is not our preferred configuration.

**OEM MUP Pool Management:** OEM clients are responsible for managing their MUP pools. Devices consistently exceeding the expected MUP count may be subject to review and potential termination of older or unused MUPs.

#### Managing an OEM's/client's pool of MUPs

OEMs/Clients have full capability to review and manage their own pool of MUPs. Here are a few recommendations for how to manage your pool of MUPs.

1. When attempting to create new MUPs for a given device, first check if such MUPs already exist in your MUPList
2. If you have MUPs created for the target device, use the existing MUPs and do not create any new MUPs
3. If you do *not* have MUPs already created for my target device, I will *then* create new MUPs

4. If you have more MUPs than you're expecting in your MUP list, or if you have MUPs you no longer need, you can DELETE unneeded MUPs

### MUPs Deletion

MUP deletion can be done by the following request:

```
% curl -request DELETE \ --url /api/v2/mup/{mupId}
```

### MUP Modification:

- OEM's/Clients may update/modify existing MirrorUsagePoints.
- Modifying existing MirrorUsagePoints will result in a 204 response from the server.
- It is expected that MUP modification is conducted infrequently and only by exception.

## 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/ddercs=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/dercs=0&l=255

```

<DERControlList
  xmlns="urn:ieee:std:2030.5:ns"
  xmlns:ns2="https://csipaus.org/ns" all="2" results="2" subscribable="0"
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/36B154588CBEA2C492972BBD5FE2ACA6">
    <mRID>36B154588CBEA2C492972BBD5FE2ACA6</mRID>
    <version>2</version>
    <creationTime>1772603129</creationTime>
    <EventStatus>
      <currentStatus>1</currentStatus>
      <dateTime>1772604000</dateTime>
      <potentiallySuperseded>>false</potentiallySuperseded>
      <potentiallySupersededTime>1772603129</potentiallySupersededTime>
      <reason></reason>
    </EventStatus>
    <interval>
      <duration>900</duration>
      <start>1772604000</start>
    </interval>
    <DERControlBase>
      <ns2:opModExpLimW>
        <multiplier>1</multiplier>
        <value>2700</value>
      </ns2:opModExpLimW>
    </DERControlBase>
  </DERControl>
  <DERControl subscribable="0" replyTo="/api/v2/rsps/res-ms/rsp" responseRequired="03"
href="/api/v2/derp/FSAST-19349/derc/3C9A5B92A9D68C5367FAA1E154ADDFDA">
    <mRID>3C9A5B92A9D68C5367FAA1E154ADDFDA</mRID>
    <version>1</version>
    <creationTime>1772604017</creationTime>
    <EventStatus>
      <currentStatus>0</currentStatus>
      <dateTime>1772604900</dateTime>

```

```

    <potentiallySuperseded>false</potentiallySuperseded>
    <potentiallySupersededTime>1772604017</potentiallySupersededTime>
    <reason></reason>
  </EventStatus>
  <interval>
    <duration>900</duration>
    <start>1772604900</start>
  </interval>
  <DERControlBase>
    <ns2:opModExpLimW>
      <multiplier>1</multiplier>
      <value>2700</value>
    </ns2:opModExpLimW>
  </DERControlBase>
</DERControl>
</DERControlList>

```

## POST DERControlResponse (Event Received)

POST /api/v2/rsp/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/rsp/res-ms/rsp/29F7E065BCA64F559FCA12A3D03877C9

## POST DERControlResponse (Event Started)

POST /api/v2/rsp/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>1709170790</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/rsp/res-ms/rsp/826EF35C0D644628994EF2E34B1CDF0C

---

## POST DERControlResponse (Event Completed)

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>1709170790</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

## POST DERControlResponse (Event Cancelled)

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

Content-Type: application/sep+xml

Below DERControlResponse submits a DERControlResponse.status = 6. This denotes "Event cancelled".

```
<DERControlResponse
  xmlns="urn:ieee:std:2030.5:ns">
  <createdDateTime>1709170790</createdDateTime>
  <endDeviceLFDI>0FC67A8B629F3BB0769ABD6C6F6B3433C7BD7BAB</endDeviceLFDI>
  <status>6</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.

## 11.1 In-Band Registration Workflow

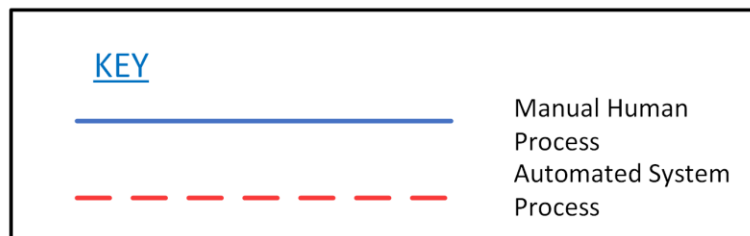
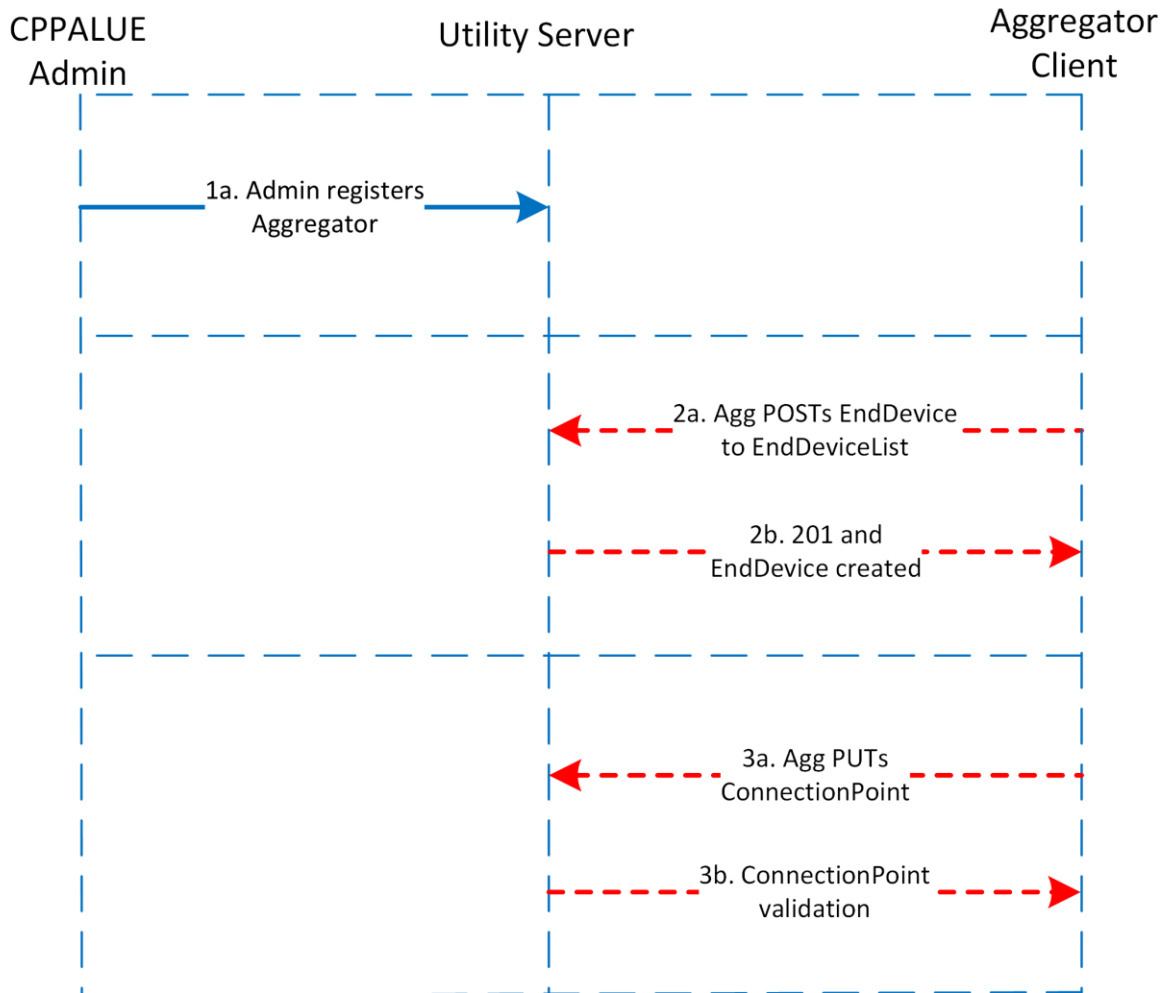


Figure 4: In-Band Registration Workflow

Table 6: In-Band Registration Workflow

Flow	Description
<b>1. Aggregator is registered out-of-band</b>	
1a.	CPPALUE Utility Server Admin registers the Aggregator to the Utility Server via a manual out of band process.
<b>2. Aggregator registers an EndDevice in-band</b>	
2a.	<p>Aggregator POSTS an endDevice to the EndDeviceList to register the EndDevice in-band The payload for the POST edev request by the aggregator to create an in-band EndDevice looks like the following:</p> <p><b>POST EndDevice</b> POST /api/v2/edev Content-Type: application/sep+xml</p> <pre data-bbox="373 770 1433 990">&lt;EndDevice   xmlns="urn:ieee:std:2030.5:ns"   xmlns:ns2="https://csipaus.org/ns" href="#007"&gt;   &lt;lfdi&gt;77459B9B941BCB4714D0C121313C9AC000012345&lt;/lfdi&gt;   &lt;sfdi&gt;1234567890&lt;/sfdi&gt;   &lt;changedTime&gt;1637338408&lt;/changedTime&gt;   &lt;enabled&gt;true&lt;/enabled&gt; &lt;/EndDevice&gt;</pre>
2b.	<p>If successful, the CPPALUE Utility Server creates a new endDevice with a placeholder edevID: HTTP response: HTTP/1.1 201 Created. 201 location: api/v2/edev/INBAND_EDEV_d7ded9e1-8fad-479c-b292-6a8cf60d81f5</p>
<b>3. Aggregator PUTs ConnectionPoint to ConnectionPointLink</b>	
3a.	<p>Aggregator PUTs ConnectionPoint to ConnectionPointLink. In the CPPALUE Utility Server, this is endpoint is implemented as: /edev/{edevId}/cp. The payload for PUT cp by the aggregator to update an in-band EndDevice looks like the following:</p> <p><b>PUT ConnectionPoint</b> PUT /api/v2/edev/ INBAND_EDEV_d7ded9e1-8fad-479c-b292-6a8cf60d81f5/cp Content-Type: application/sep+xml</p> <pre data-bbox="373 1413 1433 1581">&lt;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"&gt;   &lt;ns2:connectionPointId&gt;11234567890&lt;/ns2:connectionPointId&gt; &lt;/ns2:ConnectionPoint&gt;</pre>
3b.	<p>The submitted connection point is verified by the CPPALUE Utility Server. What connection point to use:</p> <p><b>Testing (Non-Production):</b></p> <ul data-bbox="373 1711 1110 1738" style="list-style-type: none"> <li>• A CPPALUE Admin will provide you a test NMI to use for this step</li> </ul> <p><b>Production:</b></p> <ul data-bbox="373 1783 1326 1839" style="list-style-type: none"> <li>• The connection point should be the 11 character NMI that corresponds with the site of installation (10 character NMI plus checksum).</li> </ul> <p>If the NMI validation fails, you'll receive a 400 (Bad Request) or 401 (Unauthorized) response. See section 11.2 for further information.</p> <p>If successful, the Utility Server responds with: HTTP response: HTTP/1.1 204 No Content.</p>

## 11.2 NMI (ConnectionPointID) Whitelist Validation

The NMI Whitelist validation ensures that only NMIs associated with valid, approved Solar Pre-Approvals can be registered through in-band registration. This prevents unauthorised registrations and ensures that only expected solar installations are registered in our Utility Server and enabled for emergency backstop. With this NMI Whitelist Validation, any In-Band registration request triggered without a valid SPA being raised prior will fail with the following response.

HTTP response: HTTP/1.1 400 Bad Request

Error Message:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<MicroserviceStatusType
  xmlns="com:ge:ieee2030:registration:rest:dto">
  <error>true</error>
  <statusCode>REG-ERR-0011</statusCode>
  <statusMessage>Unable to update the ConnectionPointId in EndDevice[INBAND_EDEV_e68207c5-6cc8-44eb-
b5e7-1590a196af3b], the ConnectionPointId[15151] doesn't exist in the registration
database.</statusMessage>
</MicroserviceStatusType>
```

## 12. Data Objects

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

### EndDevice Data Object

Table 7: EndDevice Data Object

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

### ConnectionPoint Data Object

Table 8: ConnectionPoint Data Object

Field	Type	Format	Required	Description
<b>connectionPointId</b>	String		Yes	<p>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.</p> <p><b>Note:</b> 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.</p>

---

## 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**