More frequent measurement data delivery

Workshop 24.09.2024

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Datahub

Welcome

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Agenda

DAY 1

Time	Topic	Duration	Presenter
10:00	**Welcome**	**10:05**	**Marko**
10:05	Workshop Introduction	10:15	Marko/Remco
10:15	Onsite Sandbox testing	11:45	All
11:45	**Break**	**12:45**	***All***
12:45	Workshop August recap	13:00	Marko
13:00	Batch Interface - Guidelines	13:15	Remco
13:15	Workshop Batch Interface Guidelines	14:15	All
14:15	Conclusion Batch Interface	14:45	All
14:45	**Break**	**15:00**	
15:00	Survey	15:45	Marko/Remco
15:45	**Meeting end**	**16:00**	**Laura/Remco**

Workshop Introduction

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Continuous metering data delivery, introduction

- 2021 Finnish coverment set the degree 767/2021 “Valtioneuvoston asetus sähköntoimitusten selvityksestä ja mittauksesta”, luku 6 § 5 (electricity delivery reporting and metering):
  - *Metering grid area company’s IT systems shall be able to handle the measurement data collection of the registered measurement data from new remote metering device to the measurement reading system at least every six hours.*
- In the end of 2023, Fingrid Datahub, together with CGI, has started the investigation of ways to resolve the continuous metering data delivery and technologies to support it and also utilizing the current datahub system and its technologies as far as possible.
- Fingrid Datahub **has made survey** to the market about possibilities to go to more frequent/continuous measurement data delivery in the end of 2023.
- Fingrid datahub established this market working group to give market parties and stakeholders to **bring up the more detailed business needs** for more frequent metering data delivery and based on those to **line the working model in Finnish market** and define the interface specification. Member companies of this working group are wished to be able to **trial run their systems against the existing solution** implemented by CGI as far as it is possible at this stage.

Introduction

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Continuous metering data delivery - workgroup members

- Market members: https://palvelut.datahub.fi/fi/kehitys-ja-yhteistyo/kehitystyoryhma#mittaustiedon-tiheampi-toimitus
- Datahub team:
  - Marko Juslin – product manager, chairman, DH dev team
  - Laura Markkanen – specialist, business architect, DH dev team
  - Otto Kuuranne – specialist, interfaces, Fingrid ICT
  - Tuomas Aunola – specialist, DH dev team
  - Remco Nederpel – integration technologies, CGI NL
  - Gerold Slagter - solution architect, CMS MDM solution, CGI NL
  - Menno Muller – product owner, CMS solution, CGI NL
  - Jan Loman - specialist, CMS solution, CGI FIN

Members of the working group for more frequent delivery of metering data:

- Vesa Hulttinen, Hansen Technologies Finland Oy
- Jussi Kolehmainen, Caruna Oy
- Anssi Knuuttila, Rejlers Finland Oy
- Elina Kontro, Landis+Gyr Oy
- Jami Kosunen, TietoEvry Oy
- Ville Kuusela, Solteq Oyj
- Jari Rusanen, Loiste Oy
- Lari Saarinen, Aidon Oy
- Pyry Suomala, Helen Oy
- Anssi Vanhatalo, Elenia Oyj
- Mikko Vähäsaari, Savon Voima Verkko Oy
- Jaakko Kemppainen, Enerim Oy

Onsite Sandbox Testing

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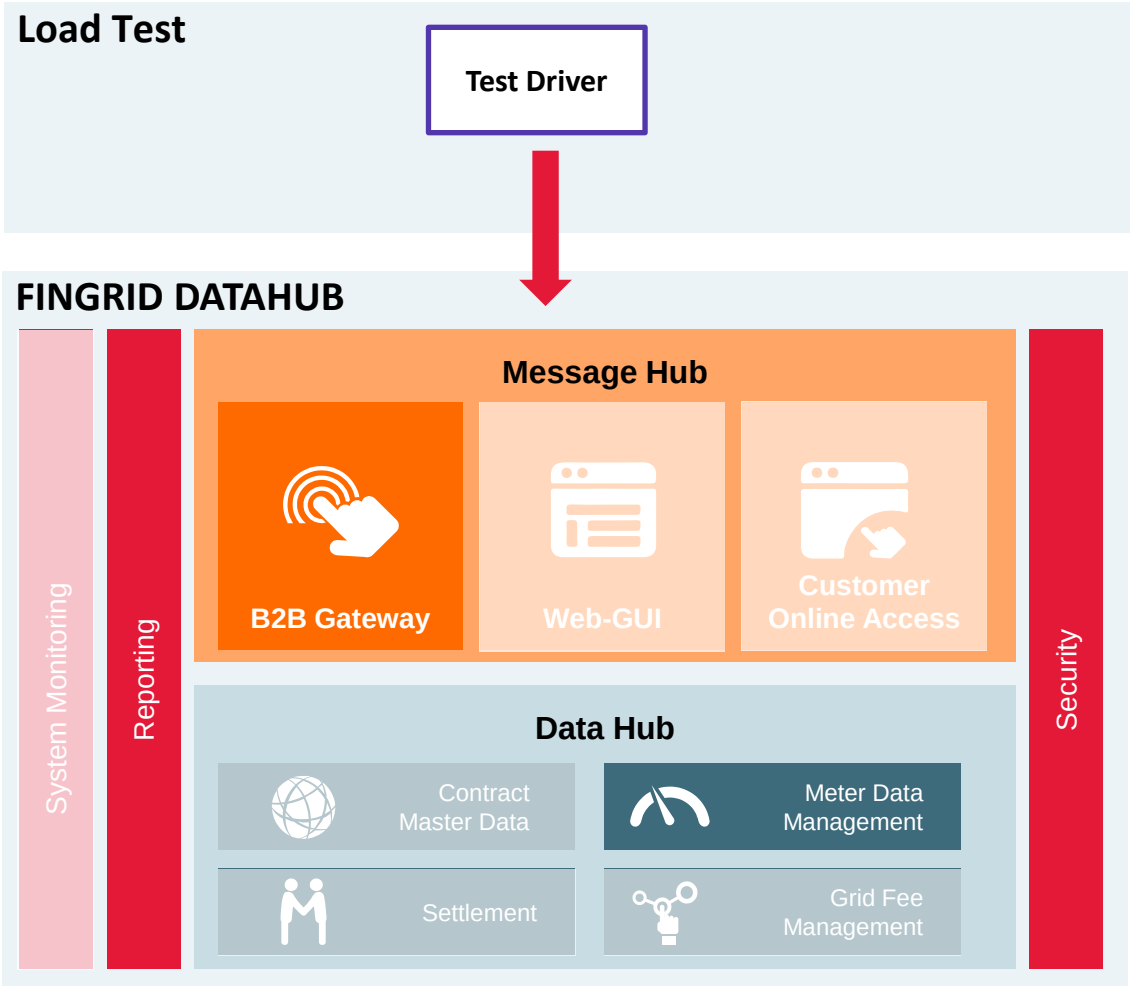
Concept solution PoC

Onsite Sandbox Testing

- NodeJS script.
- Utilizing multiplex feature of HTTP/2
- Static timeseries event in JSON (unique identifier per event)
- Scaling via:
  - #workers (related to #CPUs)
  - #Client connections (related to receiver maximum)
  - #Multiplex (related to HTTP/2 limitations)

- Authorization service (not in scope POC)
- High performant, light weight REST Service (request/reply)
- JSON schema validation
- Authorization token validation
- Scaling via:
  - B2B Gateway - 4 instances (autoscaling is possible)
  - Kafka – 3 node cluster
- Transformation to internal MDM batch format



Event Format

Onsite Sandbox Testing

```
{
  "mrid": "8803565d-5242-4016-96eb-900f4080e856",
  "cdt": "2024-04-03T08:21:56Z",
  "mp": "640502010245201095",
  "mptype": "F01",
  "sep": "6430076050014",
  "jep": "6430076050014",
  "mga": "0000562140649364",
  "mgai": "0000562140649364",
  "mgao": "0000562140649364",
  "ind": "23",
  "ch": [
    {
      "res": "PT15M",
      "product": {
        "id": "8716867000030",
        "unit": "KWH"
      },
      "dir": "E17",
      "vol": {
        "dt": "2024-04-03T08:21:56Z",
        "qty": 0,
        "qq": "string"
      }
    }
  ]
}
```

- Unique event identifier
- Create date time of event
- Meteringpoint/ allocation point identifier
- Meteringpoint type
- Sending market party identifier
- [conditional] Juridical market party identifier
- [conditional] Gridarea
- [conditional] Grid area infeed
- [conditional] Grid area outfeed
- Industry (energy type)

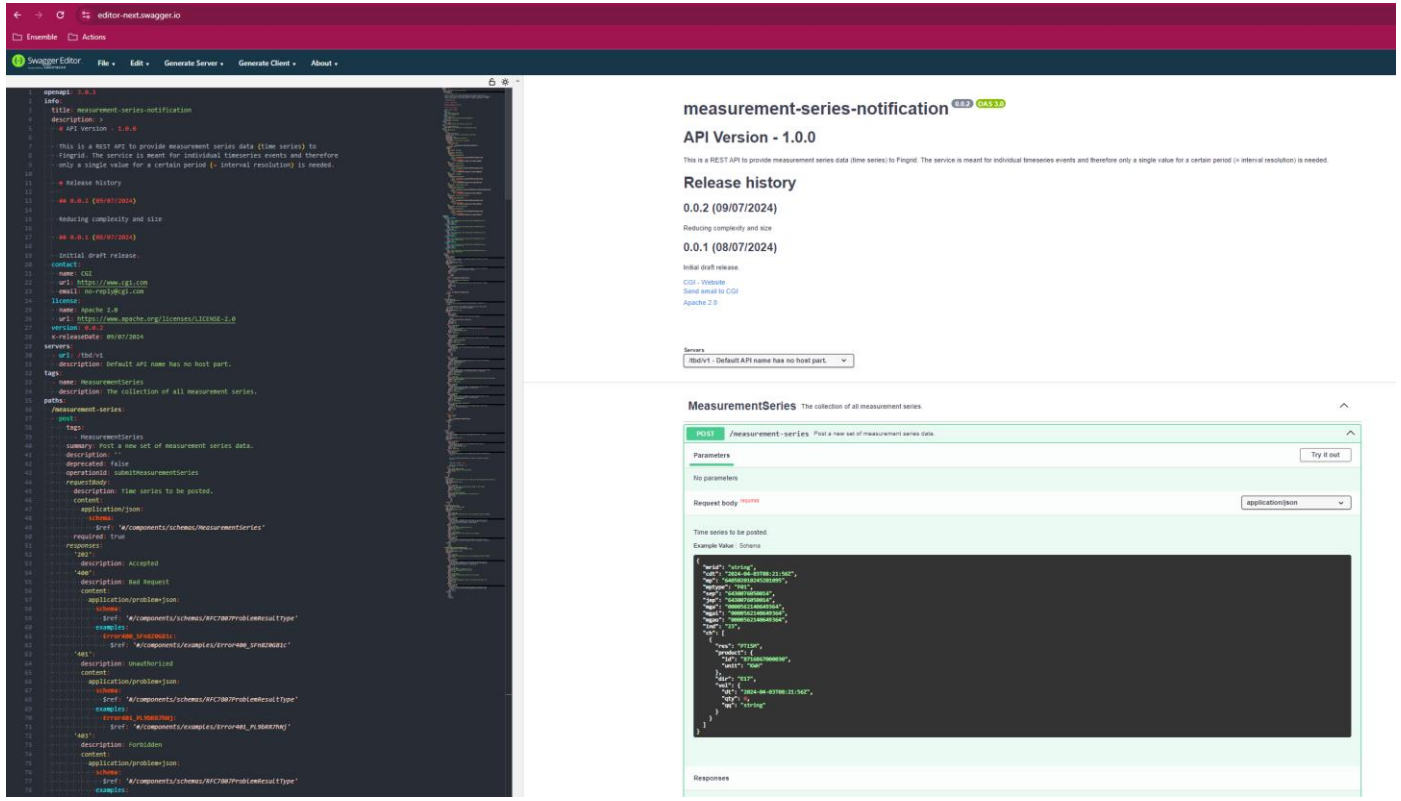
- Resolution
- Product + unit
- Direction (production | consumption)
- Timestamp of volume
- Volume quantity
- Volume quality

Event OpenAPI specification

Onsite Sandbox Testing

- Open API specification is added to v2 of the test-driver-pack: MeasurementSeries_v0.0.2.json)

- The API specification van be viewed in https://editor-next.swagger.io/



Sandbox Connectivity Information

Onsite Sandbox Testing

- IP: [IP address or IP Range the participant will send their requests from]
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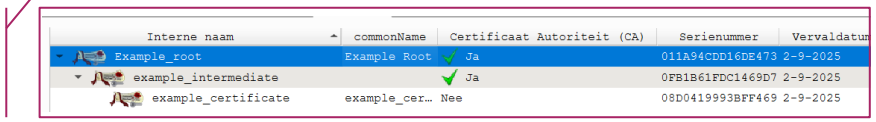
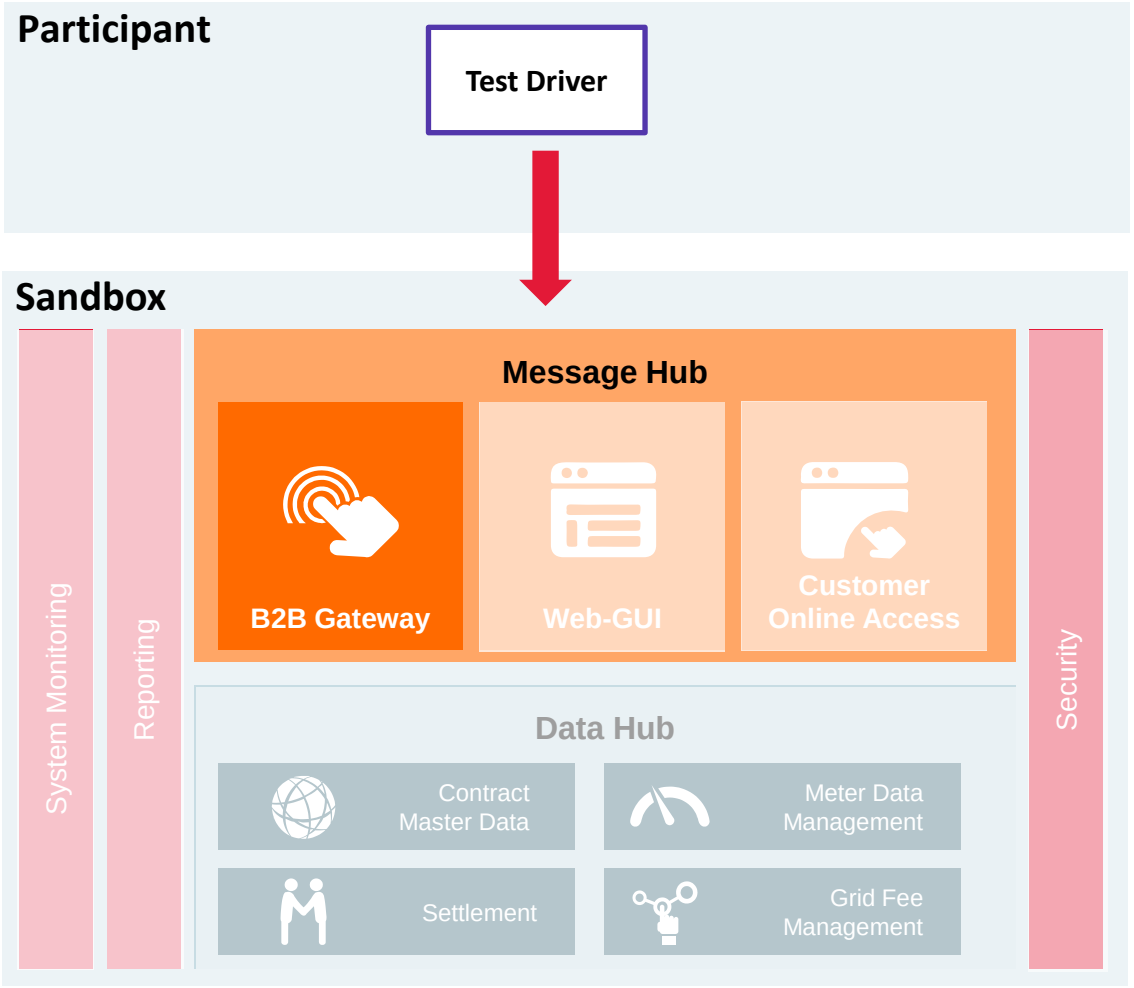


- Host: https://cms-tec-poc01-seg.azurewebsites.net:443
- URI: /tbd/v1/measurement-series



Sandbox considerations

Onsite Sandbox Testing

For information purposes a description of what the Sandbox is.

- The sandbox is a generic AgileDX-CMS installation in Azure cloud which is used by CGI to perform the Proof of Concepts regarding the continuous delivery of measurement data (Timeseries Event Channel).
- This sandbox does not contain Fingrid specific configurations, reference data and masterdata.
- Besides the Timeseries Event Channel it is not possible to have any other interactions with the sandbox.
- Your data will not be validated against business rules only against the message specification (JSON format)
- Please do not send production data to the sandbox. Sandbox is in the cloud and does not comply with the security requirements from fingrid
- The Timeseries Event Channel is currently in proof of concept phase. Meaning shortcuts have been taken to verify the feasibility of underlying technology but the interface will most likely change upon actual implementation.

Test Driver Package

Onsite Sandbox Testing

- Driver script
- Installation instructions
- Operation instructions

- Sandbox connectivity info (this pack)
- Event OpenAPI specification
- Connectivity template (Sandbox_info_party_xxxxxxx: fill it in for your company and send it in a zip to r.nederpel@cgi.com)

- Postman example

Package will be uploaded to teams

Workshop August Recap

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Continuous metering data delivery, recap of workshop 1, d 1

- First day of the workshop was about getting acquainted with the participants, getting familiar with the topics and getting the first thoughts out there regarding vision, requirements and definitions.

- When just focusing on being compliant with the new legislation for publishing measurement data within 6 hours it is agreed upon that the existing batch channel would probably suffice when a consensus between datahub and DSOs is reached on new guidelines on how to bundle the measurements and possibly after some optimization on datahub.

- Having the measurement data near-real-time in datahub has not yet view on strong business needs, the participants agree on the potential it could have in the future developments.

- Conclusion on day 1 is that a Timeseries Event Channel is desired in time and steps to introduce one should be taken. However, it is expected that most DSOs won't be able to implement the interface prior to 01-01-2026 and will use the existing batch interface to comply with the new legislation.

Continuous metering data delivery, recap of workshop 1, d 2

- The second day was about getting some focus on the consequences of implementing the 2026 legislation. During the workshop part of the day the groups focused on the planning of impacting the current batch interface and the introduction of the new Timeseries Event Channel. There were some differences between the groups regarding the prioritization of the event channel.

- Even though not many DSOs are expected to actually use it to comply to 1.1.2026 legislation it is concluded that Timeseries Event Channel is preferred to be ready prior to 1.1.2026 or at the latest early in 2026. Workgroup did agree a deadline should be introduced for all DSOs to use the new event channel. This is conceptually set at the deadline for the introduction of the generation 2 meters which is in 2031 and might have transition period (e.g. one year) after that.

- This would allow the DSOs to start using the Event Channel between expected introduction in late 2025 and 2031.

Continuous metering data delivery, recap of workshop 1, d 2

- Requirements for the Event Channel aren't clear yet and due to the focus on if the channel is needed and when it is needed there wasn't enough time to really determine the business, system and integration requirements for the interface. To keep the progress the following points are agreed on:
  - Prevent datahub impact on the existing batch channel if possible. By changing the guidelines on how to use the channel system impact can be prevented. Line of thought for the guidelines and the impact on the batch channel:
    - Introduce average message size/ average measurements per message it is possible to keep the total number of messages down even when a day of measurement data is spread out in smaller portions to allow compliancy with the 6 hours.
    - Batch is not meant for single time intervals (e.g. every 15 minutes). So, periods of 3-5 hours are expected to present in the message. There will be no constraint on when these messages can be sent in (1min - 6hours) as long as they are sent in fast enough to comply to 6 hours.
    - Datahub can provide information on the % of measurement data being processed within 6 hours of the reading per DSO. DSO could use this in-formation to decide if they are compliant by comparing the information with their generation 2-meter population

Continuous metering data delivery, recap of workshop 1, d 2

- Workshop in September will be changed to focus on getting the system requirements signed of for batch channel and the timeseries event channel.
  - Draft Technical specification for event channel will be provided with a focus on minimal viable product. This might result in sub optimal working for distribution channel and so on.
  - Survey will be held to get more feedback on planning, distribution and scope.
  - Draft Revised Batch channel guidelines will be provided to propose the new guidelines in order to keep the impact for both DSOs and Datahub to a minimum.

Batch Interface - Guidelines

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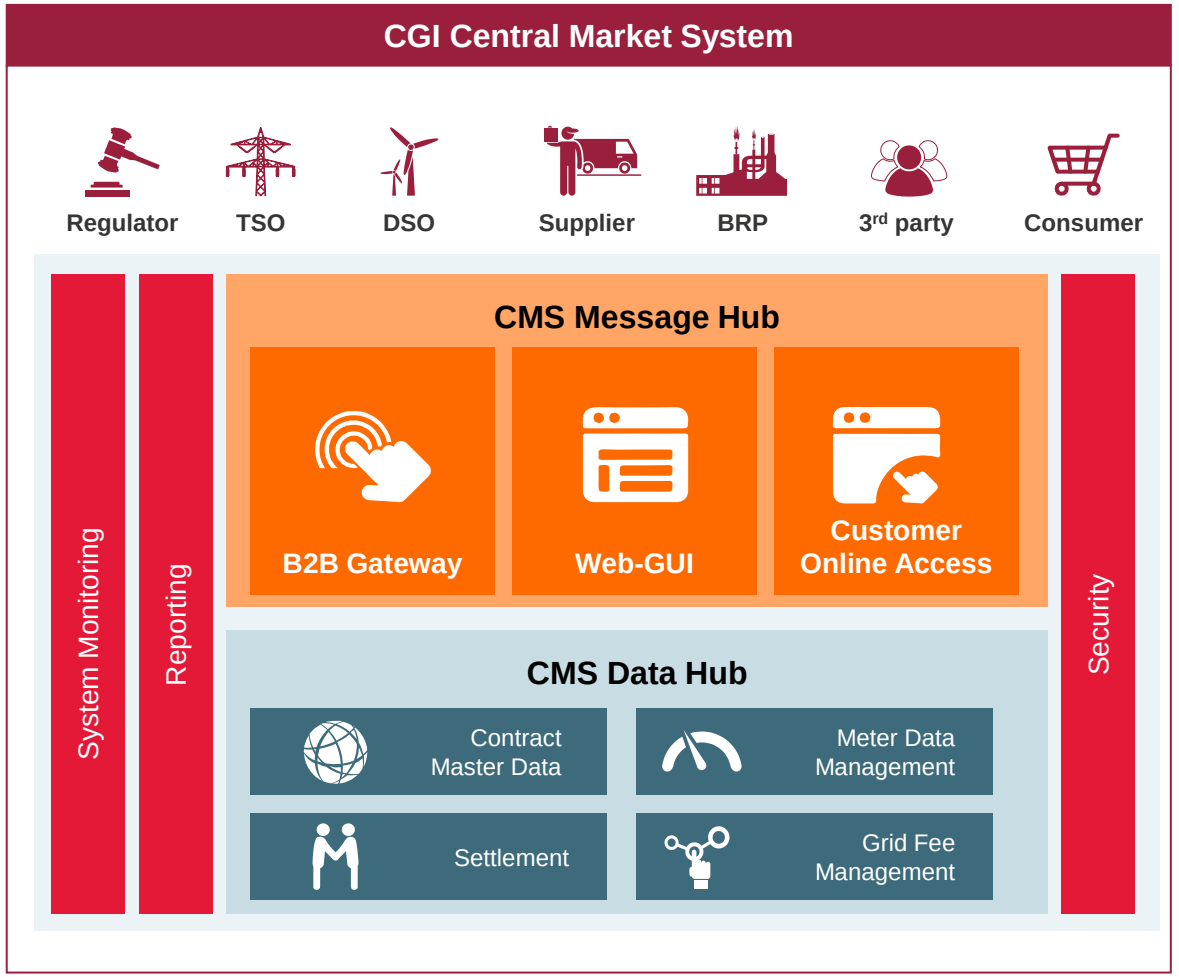
CMS: Integrated solution for messaging, master data, metering data and settlement

Message Hub	• Central point of access to the CMS • Provides multiple communication channels, access control, system security, single sign on, audit logging • Prerequisite to handle alarms
Contract Master Data	• Central register for master data (grid areas, metering points, meters, contracts) • Real-time handling of market processes such as customer switching and moving • Highly flexible data model
Meter Data Management	• Focused on performance, with an underlying engine capable of handling millions of time series events per second • Configurability focuses on validation rules and implementation of a Meter Code as part of the VEE (Validation, Estimation and Editing)
Settlement	• Real-time insight in to metering data quality • Additional component to extend the MDM component • Allows for the configuration of so-called calculation processes
Grid Fee Management	• Calculate and prepare grid related invoice data • Combines charges/prices as master/reference data with calculations from the Settlement module to prepare data for invoicing



Background

Batch Interface Guidelines

- Legislation change requires us to make data available within 6 hours.
- Transition to continuous measurement data delivery cannot be achieved by all DSOs prior to 01.01.2026.
- First step for most DSOs is to be compliant by publishing measurement data more frequent via existing E66 interface

The decree 767/2021 "Valtioneuvoston asetus sähköntoimitusten selvityksestä ja mittauksesta" (Government Decree on the Settlement and Measurement of Electricity Supplies) chapter 6, § 5 states

"network operator's information system processing metering data shall collect the registered measurement data from the new remote metering equipment into the metering data reading system at least every six hours".

According to the Finnish regulator the purpose of the requirement is **to provide measurement data to the end consumer at least within six hours.** As **datahub** can be appointed as point of delivery for measurement data the decree requirement also applies to the datahub system.

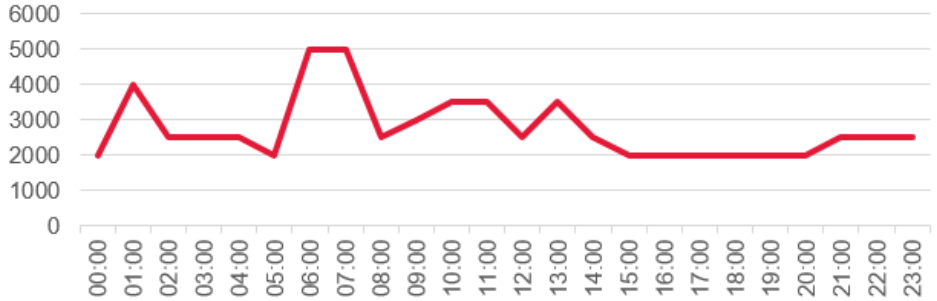
The requirement is limited to the **next generation** of smart meters and comes into force **1.1.2026**.

Batch Interface Characteristics

Batch Interface Guidelines

Production metrics

- Approximately 75.000 E66 messages a day
- Containing 6-7 million transactions.
- Average batch size over the day is 80-100 transactions per message.
- Peak between 06:00 and 8:00; ~2 million transactions (~5000 messages per hour, batch size ~200)



Recommended size:

The recommended size for reporting is defined to be between 500 and 2000 accounting points of daily (24 hourly values) time series.

There will be no hard enforcing of these rules by rejecting small messages, but this will be monitored.

When defining the guidelines the focus lies on:

- Minimize impact on Datahub to prevent unnecessary impact on a stable batch interface which might not be used as much in the future.
- Allow DSOs to comply with the new decree which means making sure measurement data for second generation meters is processed by Datahub within 6 hours of the reading datetime.
- Minimize impact for retailers where possible since delivered batch of measurement data are distributed in same batches to retailers.

Guidelines Frequency and period

Batch Interface Guidelines

- Nothing changes for accountingpoints still having a generation 1 meter. Meaning data will be delivered once a day containing data for an entire day

At 02-01-2024 01:00 measurement data for an accounting point is delivered to datahub over the period 01-01-2024 00:00 – 02-01-2024 00:00 with the relevant resolution (15 minutes or 1 hour).

- For accountingpoints having a generation 2 meter it is recommended to deliver the data in period of 2 to 4 hours. Where the delivery should be within 5 hours of the first interval in the period

At 03-01-2024 17:00 measurement data for an accounting point is delivered to datahub over the period 03-01-2024 12:00 – 03-01-2024 16:00 with the relevant resolution (15 minutes or 1 hour)

Guidelines Messages

Batch Interface Guidelines

- To reduce impact on Datahub and minimise the overhead of transporting the information it is recommended to keep the average message size at least the the same as is currently the norm on production

At 03-01-2024 17:00 measurement data for an accounting point is delivered to datahub over the period 03-01-2024 12:00 – 03-01-2024 16:00 with the relevant resolution (15 minutes or 1 hour)

Resolution	Period	# Measurement values	# Accountingpoints
15m	2 hours	8.000	**1.000**
15m	3 hours	8.400	**700**
15m	4 hours	8.800	**550**
1h	2 hours	8.000	**4.000**
1h	3 hours	9.000	**3.000**
1h	4 hours	8.000	**2.000**

Special considerations

Batch Interface Guidelines

- Conform current way of working, measurement data for accountingpoints part of a community need to be grouped in same message.

- This means as long as one accountingpoint in the community has generation 1 meter the measurement data for the entire community will be delivered once a day.

- Updates of measurement data is excluded from the requirements stated in the decree and therefore is not required to be delivered within 6 hours of measurement date.

At 02-01-2024 01:00 measurement data for all accounting points part of the energy community is delivered to datahub over the period 01-01-2024 00:00 – 02-01-2024 00:00 with the relevant resolution (15 minutes or 1 hour).

Workshop Batch Interface Guidelines

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Collecting business requirements

- We will have three groups to have further discussion on the those and add some more based on discussion in the group (15-20 min)
- We will save all records, no need to make summaries of those
- Each group will present their records in English, and we will have open discussion on those.
- DH will re-group the records by themes or matter

Groups

- Groups:

Group 1:
- ~~Kolehmainen J, Caruna (DSO)~~
- Anssi K, Rejlers (MDM vendor)
- Elina K, Landis&Gyris (collection system vendor)
- ~~Jari R, Kajave (DSO)~~
- Pyry S, Helen (supplier/DSO?)
- Gerold
- Marko

Group 2:
- Anssi V, Elenia (DSO)
- Vesa H, Hansen (MDM vendor)
- Jami K, TietoEvry (vendor)
- Remco
- Laura
- Menno

Group 3:
- Mikko V, Savon Voima (DSO)
- ~~Ville K, Solteq (MDM vendor)~~
- Lari S, Aidon (collection system vendor)
- Jaakko K, Enerim (vendor)
- Jan
- Tuomas A

Conclusion - Batch Interface

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Conclusion – Batch Interface

- Decisions
- Actions
- Next steps

Survey

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Wrap up

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Thanks!

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More frequent measurement data delivery

Workshop 25.09.2024

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Welcome

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Agenda

DAY 2

Time	Topic	Duration	Presenter
09:00	**Welcome**	**09:05**	**Remco**
09:05	Onsite Sandbox testing	10:15	Remco
10:15	Tell & Share	10:30	Remco
10:30	**Break**	**10:45**	
10:45	Recap Day 1/ Focus Day 2	11:00	Remco/Laura
11:00	Timeseries Event Channel MVP	11:30	Remco
11:30	**Break**	**12:30**	
12:30	Workshop Timeseries Event Channel	14:30	All
14:30	Conclusions & Wrap up Day 2	14:55	Marko/Remco
14:55	**Meeting end**	**15:00**	**Marko/Remco**

Onsite Sandbox Testing

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Concept solution PoC

Onsite Sandbox Testing

- NodeJS script.
- Utilizing multiplex feature of HTTP/2
- Static timeseries event in JSON (unique identifier per event)
- Scaling via:
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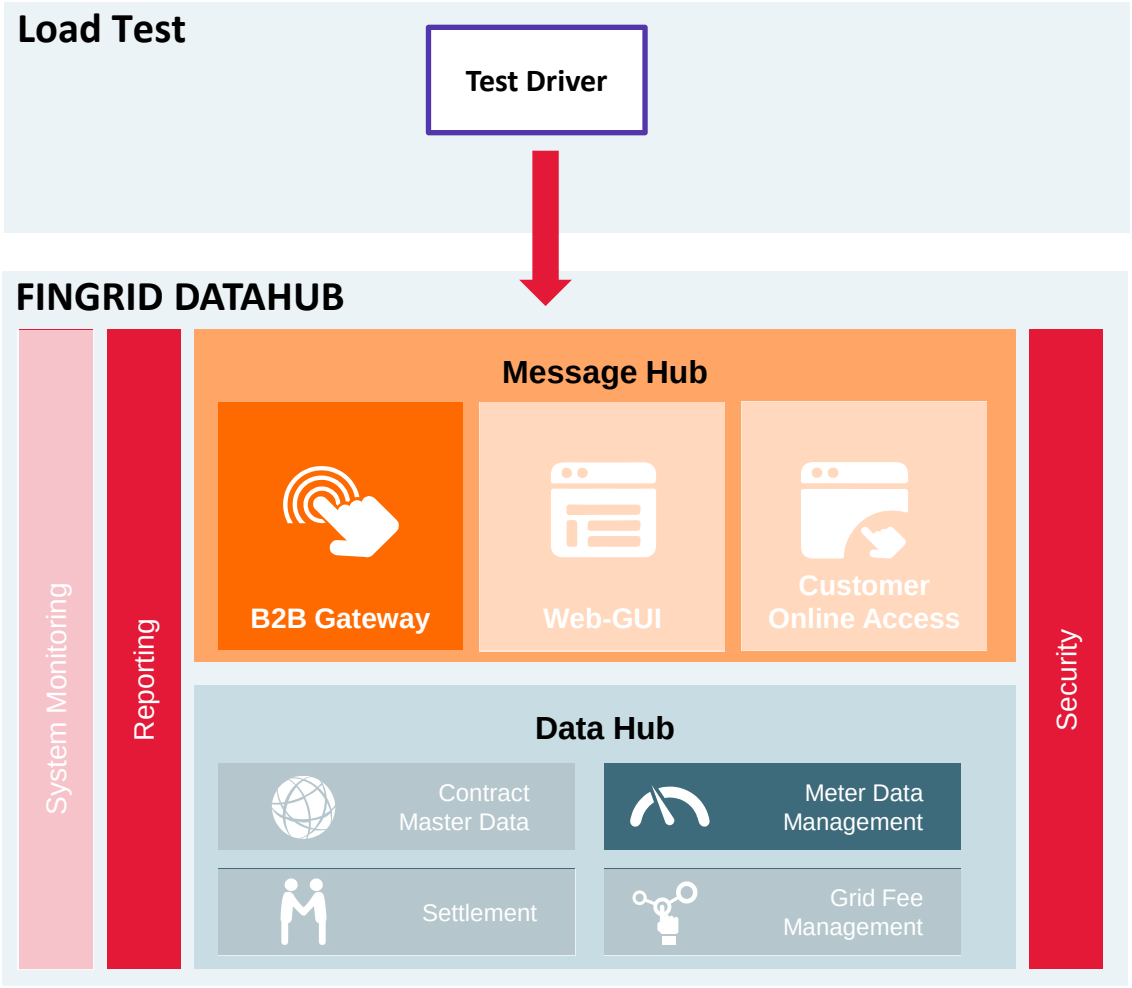
- Transformation to internal MDM batch format



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Event OpenAPI specification

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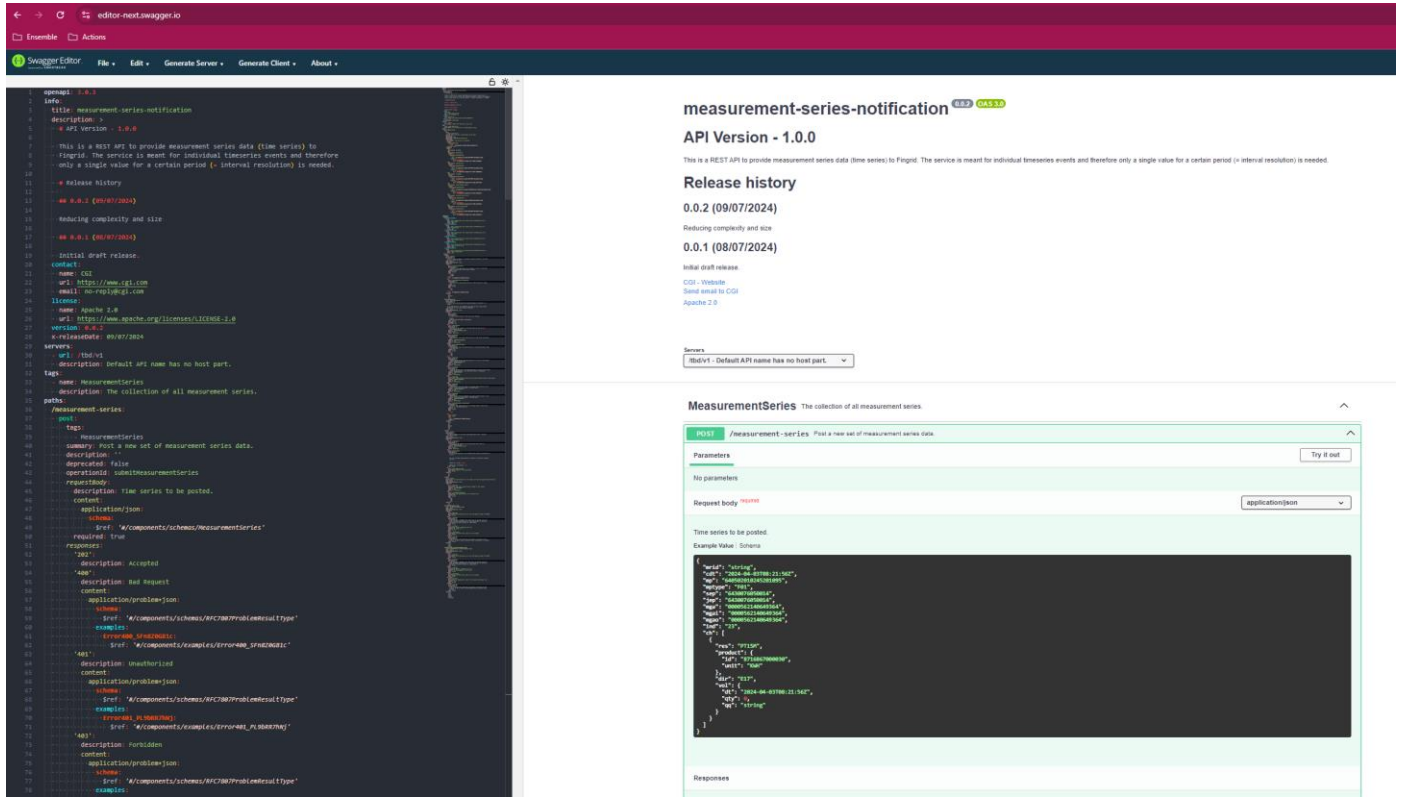

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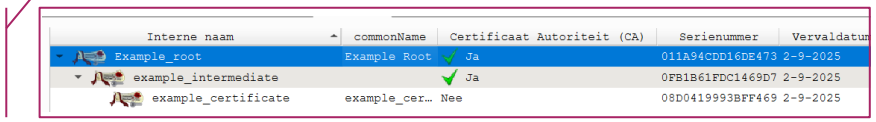

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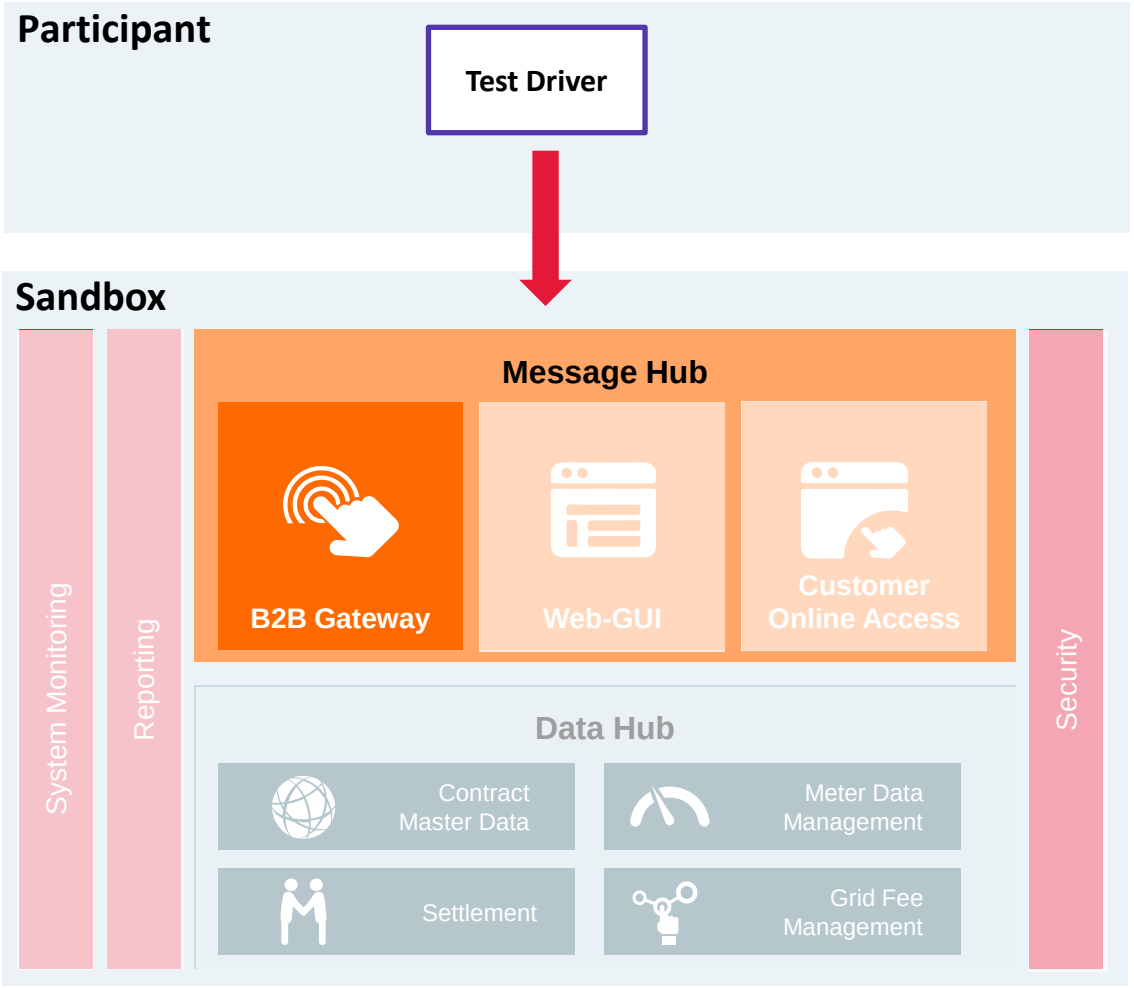

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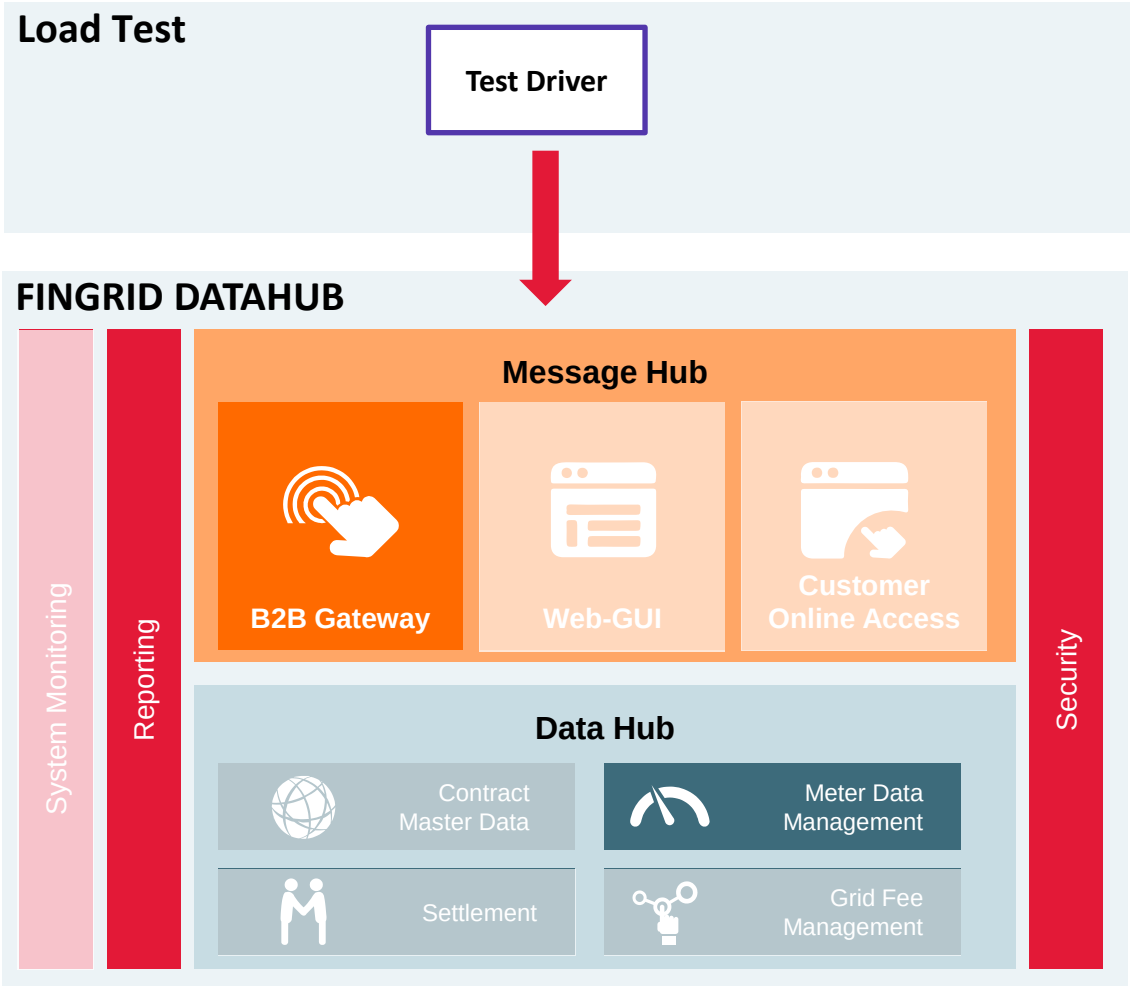


Status

Individual components

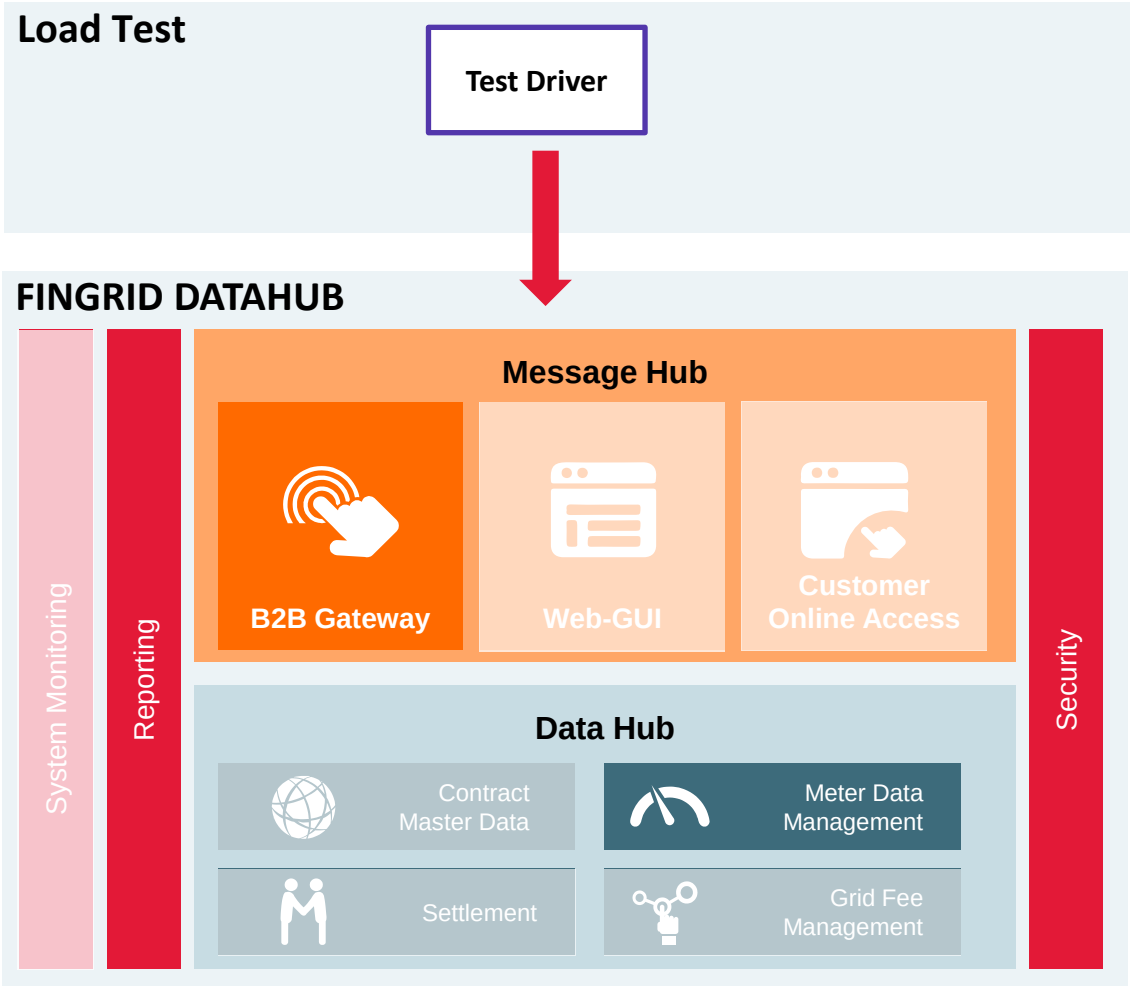
- Test driver is sized and unit tested to deliver up to **50k events per second** at <10ms responsetimes
- Kafka cluster is loadtested to handle to handle **~390 k records per second**
- Rest API has an execution time **<1 ms** for processing the event and routing it internally to Kafka

Complete flow

- Rest API is measured to handle up to **50k messages per second** with 8 instances and on average 2ms processing time per event
  - This included json schema validation
  - This is excluding a token verification and duplicate check
  - Driver measured on average 20ms responsetime per event. Responsetimes are expected to increase cause of traffic over internet in real life scenarios

Preliminary conclusions

- Performance criteria for PoC was set at **50k events per seconds** and currently it is a challenge to reach this consistently (cause is still under investigation)
- Multiplexing (HTTP/2) has less of a positive impact then expected. Parallelization over a single connection is around 10. To reach the required performance 48 workers (client sessions) were started to reach the ~50k per second
- Impact on Datahub regarding the sizing of B2B Gateway seems reasonable and linear scalable up to around 50k events per second.
- Duplicate check is very expensive to do at ingestion. Investigation still ongoing how to do this efficiently



Event Format

PoC Screenshot

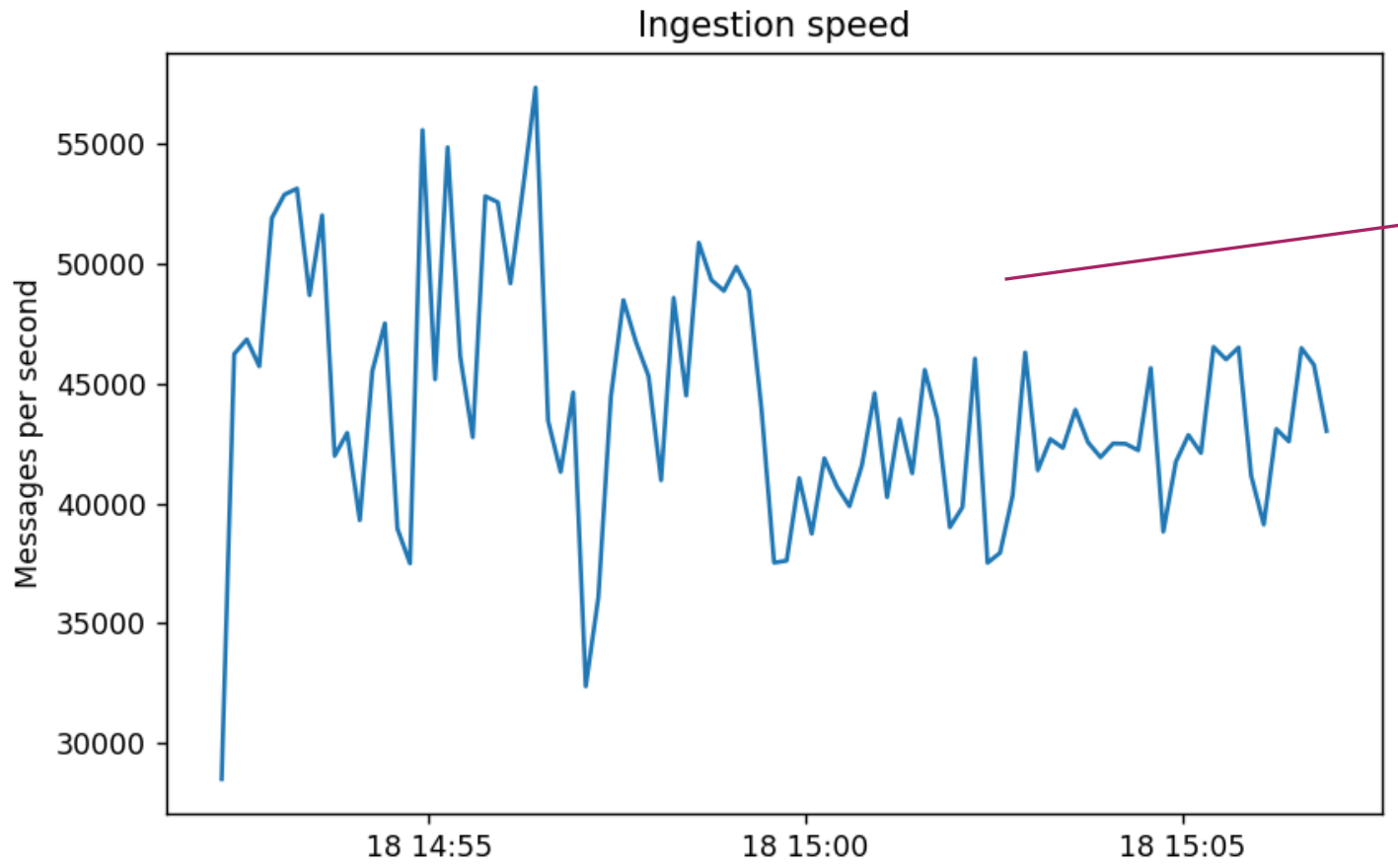

```
{
  "mrid": "8803565d-5242-4016-96eb-900f4080e856",
  "cdt": "2024-04-03T08:21:56Z",
  "mp": "640502010245201095",
  "mptype": "F01",
  "sep": "6430076050014",
  "jep": "6430076050014",
  "mga": "0000562140649364",
  "mgai": "0000562140649364",
  "mgao": "0000562140649364",
  "ind": "23",
  "ch": [
    {
      "res": "PT15M",
      "product": {
        "id": "8716867000030",
        "unit": "KWH"
      },
      "dir": "E17",
      "vol": {
        "dt": "2024-04-03T08:21:56Z",
        "qty": 0,
        "qq": "string"
      }
    }
  ]
}
```


- Unique event identifier
- Create date time of event
- Meteringpoint/ allocation point identifier
- Meteringpoint type
- Sending market party identifier
- [conditional] Juridical market party identifier
- [conditional] Gridarea
- [conditional] Grid area infeed
- [conditional] Grid area outfeed
- Industry (energy type)

- Resolution
- Product + unit
- Direction (production | consumption)
- Timestamp of volume
- Volume quantity
- Volume quality

Smoke test

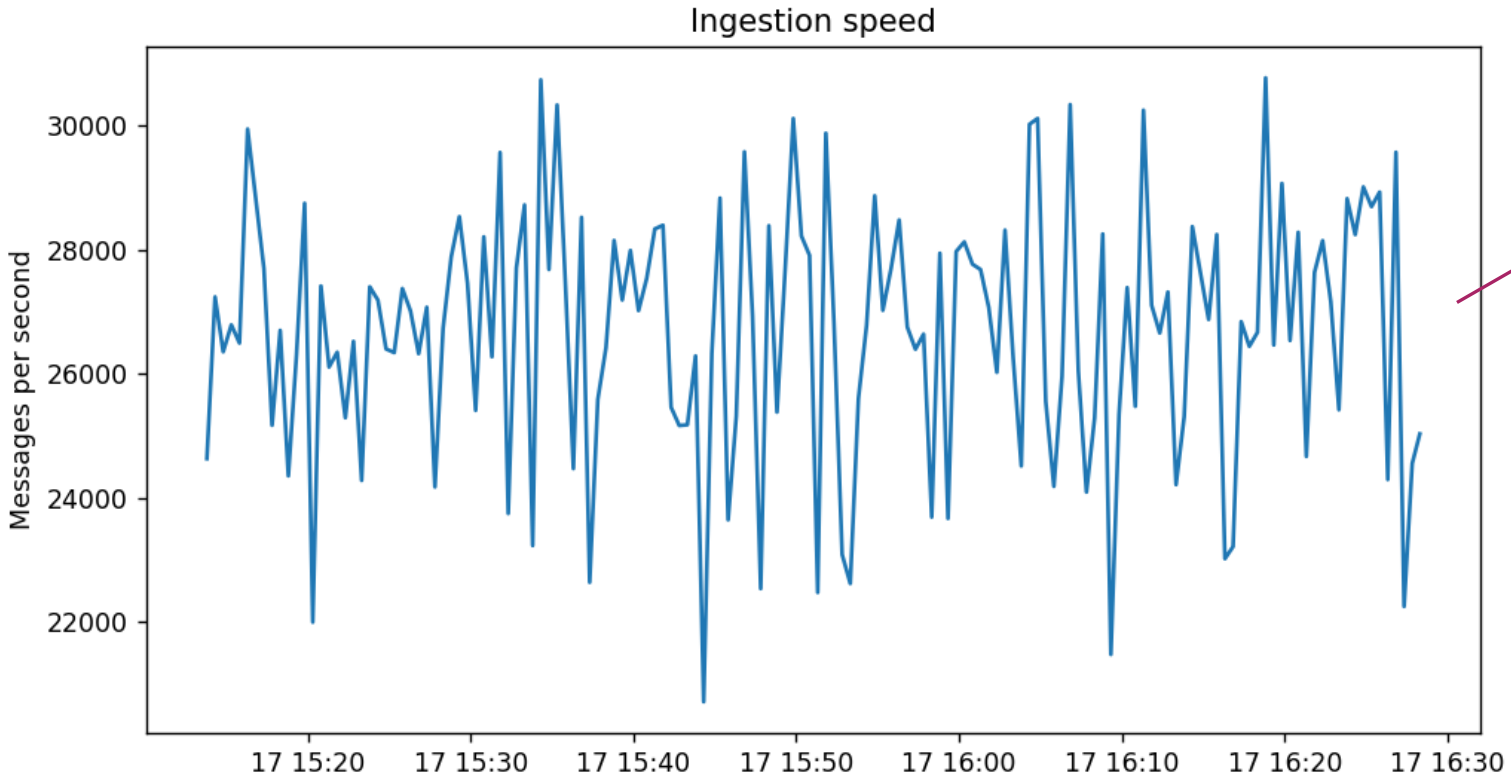
PoC Screenshots



Total Events processed: 39,440,915.
Duration: ~15 min
Average: 44166 events per second.

Production like test

PoC Screenshots



Total Events processed: 119,971,108.
Duration: > 1 hour
Average: 26689 events per second.

Recap Day 1/ Focus Day 2

FINGRID
Datahub

Recap Day 1/ Focus Day 2

Conclusion Day 1

- Testing succesful, 5 participants connected, and including a base load generated by the test driver peaked at 17k events per second
- Batch Guidelines are understood and mostly agreed on. Guideline regarding to communities should be altered. Datahub should facilitate in dealing with communities no matter when and how the measurement data has been delivered. E.g. By start calculating when data is complete in stead of when data is received.
- Good discussions and insights on survey. Needs some clarification.

Focus Areas

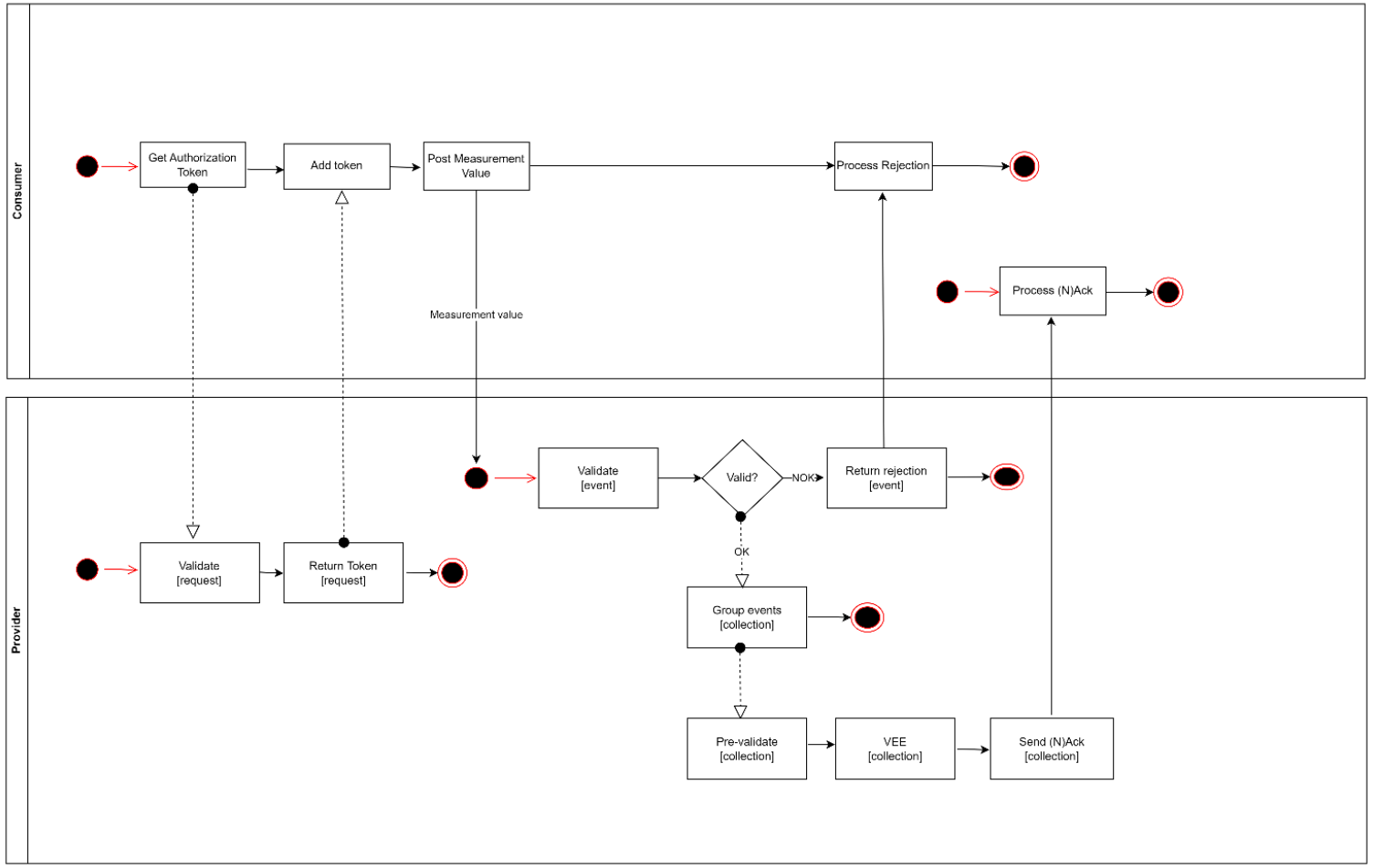
- Survey
- Follow agenda

Timeseries Event Channel MVP

FINGRID
Datahub

BPMN Model

Timeseries Event Channel MVP



QoS

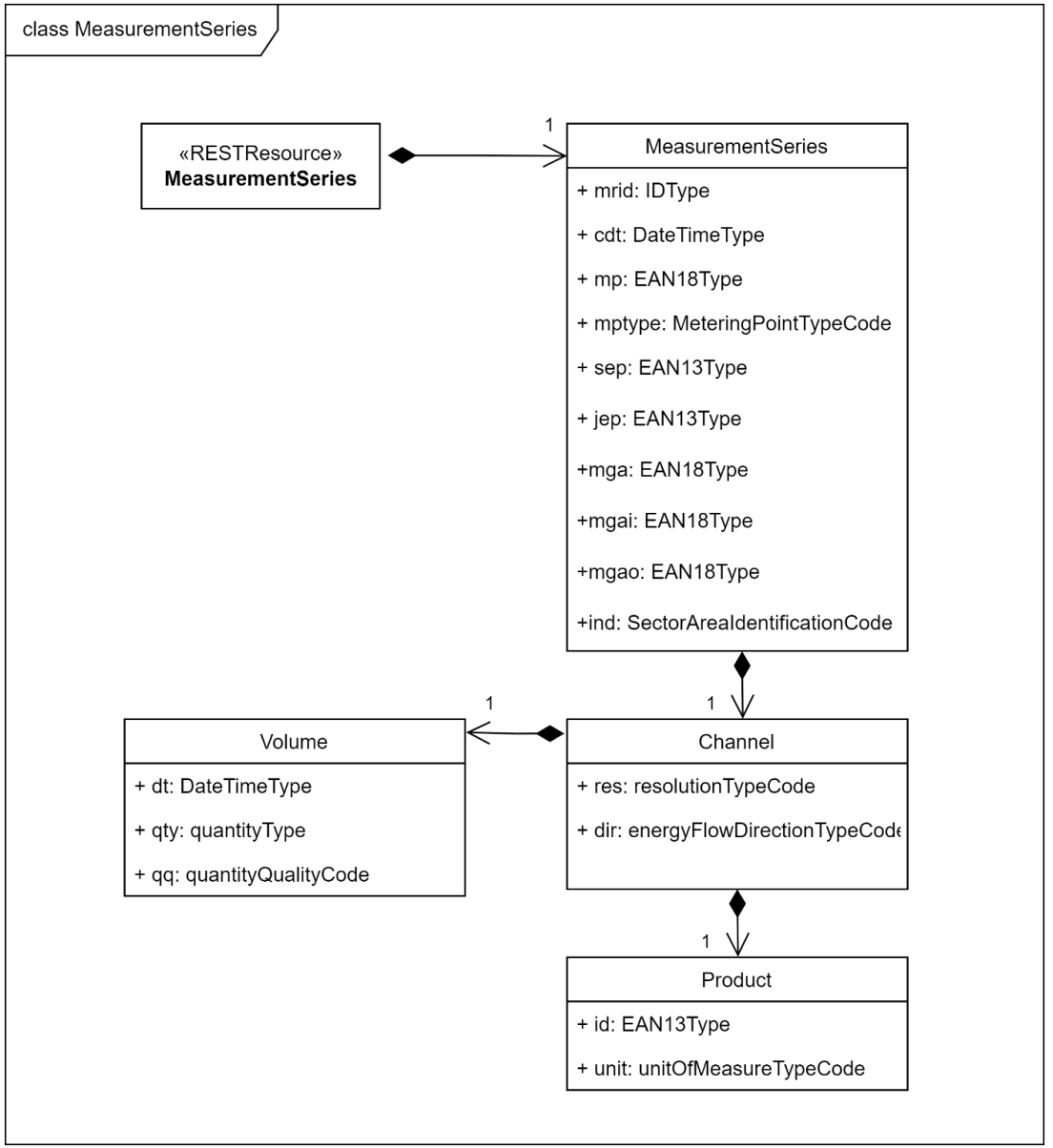
Timeseries Event Channel MVP

Measurement·Series¤	
Service¤	MeasurementSeries¤
Service·ID¤	¤
Description¤	Provide·measurement·values¤
Service·transaction·pattern¤	Notification/Acknowledgement·(REST·operation·POST)¤
Precondition(s)¤	Event·will·be·delivered·by·an·authenticated·consumer.¤
Trigger¤	Notify·submit·measurement·value¤
Postcondition(s)¤	• → Event·will·result·in·a·synchronous·confirmation·(HTTP·status·code·200)·which·means·it·has·been·successfully·received·and·processing·will·continue·in·MDM.¶ or¶ • → Event·will·result·in·a·synchronous·rejection·(see·HTTP·status·codes).¤

MeasurementSeries¤	
REST·API¤	measurement-series-notification¤
Version¤	1.0.0·standard¤
Date¤	24-05-2023¤
Availability·¤	Every·day·of·the·week,·every·day·of·the·hour¤
Average·load¤	500·million·per·day·(6.000·per·second)¤
Peak·load¤	50.000·per·second¤
Period·of·Peak·load¤	1·hour¤
Availability·(outside·SLA)¤	Best·effort¤
Max.·response·time¤	Not·relevant¤
Time-out¤	Not·relevant¤

Class Diagram

Timeseries Event Channel MVP



Communities

Timeseries Event Channel MVP

Communities	Event channel does not (yet) support accounting points in a community	Accounting points part of a community are currently delivered in a single batch message to prevent unnecessary processing in MDM. When using the event channel this grouping cannot be done therefore the overhead would become significant Existing DH-211 – E66 interface can be used to send in measurement values for a community until capability is introduced in the event channel

Communities

Timeseries Event Channel MVP

Acknowledgements	Acknowledgements will be provided with existing functionality which is currently used.	Acknowledgements can be retrieved like is currently done for E66. The acknowledgements are related to the collection of events internally created by datahub and will therefore have limited use of DSOs. In case of rejections, it does provide insight in which accounting point for which interval the transaction was rejected.

Communities

Timeseries Event Channel MVP

Distribution	Distribution rules and method remain unchanged	Existing functionality will be used to prepare messages for retailers. The content of these messages will differ compared to current operation. Events will be internally collected before being processed by MDM. These collections will contain a lot of accounting point with per accounting point a single measurement value. This will result in a single accounting point being distributed in many messages.

Communities

Timeseries Event Channel MVP

Traceability	Individual events will be stored internally for a small period (days) for replay purposed. These won't be visible to participants. Internally the events are grouped before being processed by MDM. These collections are logged in message log.	Due to the number of events datahub is expected to receive it won't be easy to trace an individual event through the system. Via system logging technical errors can be identified and countermeasures can be taken. Rejected transactions will be communicated with the DSO which allows repairs. And missing data will be reported to identify data which still needs to be delivered.

Communities

Timeseries Event Channel MVP

Frontend	No change in existing functionality	Frontend contains functionality to deliver measurement values to datahub. Since Frontend is typically about small amounts of measurement values it not efficient to change this interaction to the event channel.

Workshop Timeseries Event Channel

FINGRID
Datahub

Collecting business requirements

- We will have three groups to have further discussion on the those and add some more based on discussion in the group (15-20 min)
- We will save all records, no need to make summaries of those
- Each group will present their records in English, and we will have open discussion on those.
- DH will re-group the records by themes or matter

Groups

- Groups:

Group 1:
- ~~Kolehmainen J, Caruna (DSO)~~
- Anssi K, Rejlers (MDM vendor)
- Elina K, Landis&Gyris (collection system vendor)
- ~~Jari R, Kajave (DSO)~~
- Pyry S, Helen (supplier/DSO)
- Gerold
- Marko
- Menno

Group 2:
- Anssi V, Elenia (DSO)
- Vesa H, Hansen (MDM vendor)
- Jami K, TietoEvry (vendor)
- Remco
- Laura

Group 3:
- Mikko V, Savon Voima (DSO)
- Ville K, Solteq (MDM vendor)
- Lari S, Aidon (collection system vendor)
- Jaakko K, Enerim (vendor)
- Jan
- Tuomas A

Communities	Event channel does not (yet) support accounting points in a community
Acknowledgements	Acknowledgements will be provided with existing functionality which is currently used.
Distribution	Distribution rules and method remain unchanged
Traceability	Individual events will be stored internally for a small period (days) for replay purposed. These won't be visible to participants. Internally the events are grouped before being processed by MDM. These collections are logged in message log.
Frontend	No change in existing functionality

Thanks!

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