CMS

Overview and general concepts
FINGRID – System Vendors

CGI
October 2018
Agenda

CMS Background
CMS overview
Concepts
  • Traceability
  • Security
B2B market interface
Liberalisation, smart meter roll out and the Energy Transition are driving the need for data platforms in central markets

- **Central markets are primarily data platforms** to exchange all types of data and to support central market facilitation for market parties to enable fair competition and create innovative services accelerating smart grids
- Driven by de-regulation and the move to a low carbon economy, utilities companies must migrate to **new digital business models**
- Central markets **across the world are at different phases** of digital transformation. With the energy transition the consumer moves center stage energy companies will need increase **consumer participation**.

1. **Liberalisation of markets**
   - Possibility to **switch** between suppliers
   - **Split up** in regulated grid operations and commercial activities
   - Regulated tasks put in place to **facilitate the market**

2. **Introduction of smart meters**
   - Huge increase in data (exchange, big data)
   - Services Innovation: it changes the current way of working
   - Data analytics for existing market parties

3. **Energy transition and consumer participation**
   - Introduction of renewable energy sources
   - Electrification of society (e.g. electric vehicles)
   - Consumers become producers as well.
   - Increased dataflow between consumers, grid and energy service companies.
   - Central Market Facilitators will add services to energy service companies

**CGI CENTRAL MARKET SOLUTION**
Central Market Facilitates optimises the information exchange

(Market) parties that exchange information

- Transmission System Operators provide Security of Supply (SoS).
- Distribution System Operators: operate MV- and LV networks;
- Metering companies appointed to collect, validate and distribute meter data
- Energy suppliers buy and resell energy
- Traders trade energy on behalf of energy retailers
- Producers generate energy

Without central market facilitation there will be n:n information exchange relations

Centralisation Market Facilitation

Centralizing market facilitation offers a number of benefits to the market.

- **Level Playing Field**: CMF reduces the sunk cost (of connecting to all market parties) when entering the market
- **Transparency**: CMF provides for equal access to information for all market parties (small/large, incumbents/new)
- **Consistency**: The market processes are equal for each client and network area.
- **Cost reduction**: market parties reduce cost by centralizing functionality with a central organization.
Smart Meter rollout – Some examples
Requires big data solutions for central markets

**Finland**
- 3.5 million smart meters
- 5 million hourly read time series
- Moving to 15 minutes readings by 2020
- All residential time series data is used in daily imbalance settlement

**Denmark**
- 3.5 million smart meters
- 2 million hourly read time series growing to 4 million by end 2018
- Moving to 15 minutes readings by 2020
- Residential time series data will gradually be used in daily imbalance settlement as of November 2017 (currently based on profile even though smart metered)

**Sweden**
- Following the Danish model

**AEMO / Australia**
- Move to 5 minute readings for all Settlements

**Netherlands**
- Moving to 8 million smart meters (electricity) on 15 minute readings
- Moving to 7 million smart meters (gas), hourly read

Metering data increases ~10,000-fold from 1/year to 96/day
The large scale introduction of DER and the drive to electrification are driving the Energy Transition.

Hierarchical system | unidirectional | Predictable

Trading Exchange → BRP → Supplier

Generation → TSO → DSO → Connection point → Customer
The large scale introduction of DER and the drive to electrification are driving the Energy Transition.

Hierarchical system | unidirectional | Predictable

Trading Exchange → BRP → Supplier
Generation → TSO → DSO → Connection point → Customer

Changes to system of systems, both centralised and decentralised

Central balanced and …

… distributed balanced
### CGI’s Central Market Solutions (CMS)

A perfect fit for current and future challenges

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<th>Trends</th>
<th>Implications for Central Market Facilitation</th>
<th>Our Central Market Solutions</th>
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| Shift toward a more sustainable environment | New responsibilities including smart meter data collection and balancing | Handle market processes for DSOs  
Multi-tenant platform to handle market processes automatically in near real-time and register master data changes as single truth, also as service for DSOs |
| Increasing importance of security and privacy of energy data | Potential new roles for TSOs such as gateway administrator | Data model and process flexibility  
Highly flexible data model aimed to support different market models, combined with configurable market processes |
| New technologies to limit investments in physical infrastructure | New services platform provided by TSO’s for DSOs | Real-time insight into meter data quality  
Real-time settlement insight eliminates the need for batch processing of large volumes of data to determine what is missing |
| Short time to market to cope with changes | | Open interfaces  
Designed to easily interface with external market parties and internal systems |
| Regulations to ensure a level playing field and affordable services | Switchable load to ensure energy systems remains safe | Thin head-end, independent of meter manufacturer  
Proven, strategic thin head-end solution is designed to easily support new meters and protocols |
|         | | Monitor and control the smart meter network  
Handle all events and alarms from smart meter gateways and optimize the control on the distribution network |
In more detail | CGI’s Central Market Solutions
Our worldwide central market heritage

- **13 clients worldwide**
- Delivering and supporting:
  - Market changes in the Energy & Utilities industry in the field of Data management, New Market Design and clearing houses (our central market solutions)
  - Meter data management of RT and profiled metered data of 15m connection points in the Netherlands
  - Processing large volumes of interval measurement readings of 3.3m households in Denmark with our CMS within seconds

USA Texas
Electricity retail and wholesale CMO Energy data clearing house (EDCH)
1999 – 2009 in 3 states 2012 – design, development, operation, contract

UK - divers
EGB wholesale electricity CMO 1999 – 2016 design, development, hosting and support for customised BSC systems
Service provider for intelligent meter measurement data
2013 – 2020 design, development, hosting and support for central MDC systems
MOSL: processes and settlement in retail market

Belgium Infrax ATR
Gas & electricity retail & wholesale CMO
2001 – design, development, hosting and support for EDCH

Netherlands EDSN (ECH)
2001 ECH retail gas & electricity
Netherlands EDSN replaced ECH
2009 – date: design, development, hosting and support for a new Dutch data hub (C-AR)
2016 – date: design, development, hosting and support for a measurement data and settlement solution

Denmark Energinet.dk
Electricity retail and wholesale CMO
2010 – 2016 design, development, hosting and support for EDCH

Australia NSW & ACT: GRMS
Gas retail & wholesale CMO
2002 – design, development, hosting and support for EDCH

Western and Southern Australia
Gas retail & wholesale CMO
2004 – design, development, hosting and support for EDCH

Finland, Fingrid
Datashub system will be launched in April 2021. The Datashub is a centralized information exchange system for retail markets that stores data from all of Finland’s 3.5 million places of electricity consumption.

Czech Republic
Wholesale and retail gas & electricity CMO
2001 – 2009 – 2010 – 2014 design, development, hosting and support for EDCH

Iceland netOrka
Electricity retail and wholesale CMO
2006 – design, development, hosting and support for EDCH

EDP Dist
Electricity retail and wholesale CMO
2006 – design, development, hosting and support

France
• 13 clients worldwide
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CGI’s Central Market Solutions (CMS)
Technology and drivers

**Infra support**
- Public Cloud Based on Azure Cloud PaaS services
- Private cloud based on Azure Stack
- Private environment based on either virtual servers or containers

**Technology**
- vaadin
- Java
- Power BI
- kx
- SQL

**Benefits**

**Scalability**
CMS components are each horizontal and vertical scalable providing the required throughput and response times. Cloud services provide further scalabilities options.

**Flexibility**
Data center deployments, be it Cloud, local cloud or full on premise, can be mixed and matched according to needs. Cloud provides maximum flexibility in environment deployment and scalability; ideal for market testing and certifications purposes. On premise or local cloud provide maximum data protection for production data.

**Performance**
Management and processing of high volume metering data is quickly becoming a major challenge in the market. CMS employ KX and KDB to ensure maximum capability and real time insight while reducing the overall TCO.

**Open technologies**
CMS 2.0 reduces the dependence on proprietary technologies and advances open standards such as Open Data, Java and ANSI SQL, to maximize integration into existing environments.
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 |

### CGI Central Market System

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<th>Regulator</th>
<th>TSO</th>
<th>DSO</th>
<th>Supplier</th>
<th>BRP</th>
<th>3rd party</th>
<th>Consumer</th>
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<td><strong>CMS Message Hub</strong></td>
<td><strong>B2B Gateway</strong></td>
<td><strong>Web-GUI</strong></td>
<td><strong>Customer Online Access</strong></td>
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<tr>
<td><strong>CMS Data Hub</strong></td>
<td>Contract Master Data</td>
<td>Meter Data Management</td>
<td>Settlement</td>
<td>Grid Fee Management</td>
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General concepts
General concepts – B2B interface
## Market Message Interfaces

Unified interface for both UI and B2B

| Unified model for UI and B2B | • Transactional integrity, security, and loose coupling follow the same principles.  
|                             | • Principle design pattern is Send, Peek, De-queue |
| Loose coupling              | • All interaction is initiated by the Market Party (except eSETT).  
|                             | • CMS processes transactions and prepares responses.  
|                             | • Synchronous responses are sent directly  
|                             | • Asynchronous responses are prepared for pick by Market Party |
| Clearly defined handover point | • Explicit transfer of responsibility in both sending and receiving notifications  
|                                | • Explicit procedures in place for sequential handling of transactions |
| Low barrier of entry         | • Transport and web service are based on open and lowest common denominator standards  
|                             | • Web service does not rely in complex standards or interaction patterns |
## Market Message Interface

<table>
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<tr>
<th>Function</th>
<th>Description</th>
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| **Send message** | - Submit one Message with one or more Transactions  
                    - Always Acknowledged to ensure guaranteed handover  
                    - Asynchronous for Meter Data transactions, primarily DH-200 |
| **Process message** | - Similar to Send Message but the message is processed immediately  
                           - Implements single, synchronous transaction  
                           - Used for most DH processes |
| **Peek message**  | - Retrieve the first available message  
                           - Repeated Peeks retrieve the same message to ensure guaranteed handover |
| **Dequeue message** | - Marks the first available message as Processed by the recipient (effectively removing it from the queue)  
                           - Makes the next message available for Peeking  
                           - Dequeue ensure non-repudiation in receipt |
Market Message Technical Interface

• Functional interface:
  • Webservice
  • Webservice operation: Send message, Process Message, Peek Message, Dequeue Message

• Technical interface:
  • Transport protocol is HTTP with TLS 1.2/1.3 over TCP/IP

• Authentication
  • Server side certificate ensures TLS encryption
  • Client side certificate is required for authentication
Message level signing

• Market specification requires message level signing which will be implemented in Fingrid Datahub using WS-Security
• Detailed implementation to follow

• Signing with WS-Security points of attention
  • Ensure sufficient infrastructure resources – Signing requires significant CPU resources on top of TLS
  • Ensure sufficient initial connectivity testing – First time connectivity with signing is significantly more complex and will likely require more testing and implementation time
  • Ensure testing tooling support Signing
Establishing connectivity – Prerequisites and process

• Participants need to be added to the Datahub by Fingrid as organisation and administrative user
• Participant should follow relevant training/Webex
• Participant needs to add B2B user with relevant Client side certificate for:
  • Authentication
  • Signing validation
• Participants should also retrieve the Fingrid Datahub Public Signing key for validation of Datahub messages
• Additional accounts can be setup by the Participant for Web user access

• Each market participant requires separate user accounts and certificates for use of the B2B interface.
• Participants are supplied by the participants
• Certificates have to be trusted by an authority trusted by Fingrid.
  • List to be published at later date.
B2B interface – Process Message

Synchronous interface for market parties
B2B interface – Send Message
Asynchronous interface for market parties (i.e. DH-200)
B2B interface – Notifications Message

Asynchronous interface for Notifications
## Participant Integration Pack

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<tr>
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<th>Details</th>
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| **External Interface Specification** | Interface description providing all details required for setting up and using the web service.  
- Description of operations  
- Request and response descriptions  
- Error codes |
| **WSDL document**                 | Web Service Definition Language description of the web service.  
- Used to integrate with the Datahub system  
- Can be used for system integration and development |
| **XSD documents**                 | Definition of the payload transactions  
- Directly derived from Datahub Events documentation |
Indicative timeline

- Fingrid and CGI are working on a detailed plan to involve market participants and system vendors and provide baseline interface information to the market.
- With the system analysis of the Market Specifications some updates to the Events are ongoing that have an impact to this baseline.

- **2018Q4**
  - Update to Market Specification 1.5 to incorporate implementation improvements

- **2019Q1**
  - First participant pack based on version 1.5.x

- **2019Q2**
  - Update of participant pack to align to version 1.6.x
  - Initial participant/system vendor integration testing (limited group)

- **→**
  - Continued regular updates
General concepts – Traceability
Full traceability of Message to Master Data
CMS ensures traceability from technical transport to Master data

- The **Audit log** maintains a record of all incoming and outgoing messages from both UI and B2B.
- All Market Messages are logged in the **Message Dossier** against the **Audit log** entries for sending and responding.
- The transactions of each message are logged in the **Transaction Dossier** against the received or prepared outgoing Message.
- Each received Transaction starts a **Business Transaction Dossier** that forms the basis for process management.
  - It contains all possible steps for the business process to execute and links each step to the Transaction received and prepared for sending.
  - It also logs whether the prepared Transactions have been accepted by the Recipient.
- Any updates to **Master Data** refer to the **BTD** that initiated the update.
Business Transaction Dossier

The CMS process manager

- It serves as a **long-running workflow process**, identifying steps in the business process and exchange of messages related to steps in the business process.
- It serves as **input for monitoring** and follow-up: status of the process and status of the individual steps is tracked and executed, e.g. when a scheduled step is due.
- It serves **authorization**: only participants being part of the business process (as sender/receiver of one of the steps in the process) are allowed to see the transaction.
- It provides **access to messages**: Only the sender/receiver of a message as part of the business process is allowed to view the message content.
- It allows for **runtime modification of the process**, e.g. when a process has to be cancelled.
- It serves as a **time line on an entity to control any crossing transactions** which could result in rejecting other processes or cancelling it.
- It serves as a **log for all message interaction** as part of the process.
General concepts – Security, Authentication and Authorisation
Security, Authentication and Authorisation
Central management of data authorisation
All market data authorisation is based on Contracts

- A CMS Contract implements data authorisation fulfils the functions Fingrid defines in:
  - Contracts
  - Authorisations
- Access controls are administered at the Metering Point level
- CMS maintains Agreements (relevant Authorisations) for any Organisation with a relation to the Metering Point
- Any Organisation with access to the Metering Point or the underlying data will have a Agreements for a defined period of access.
  - DSO will have DSO Agreements
  - Supplier will have DSO Agreements
  - 3rd Party will have 3rd Party Agreements to which the Customer is also related
- Contracts maintain both the:
  - Contract period and the
  - Authorisation period
- Agreements also maintain contract specific settings such as Metering Point time series forwarding
Org roles – user roles

The MarketRole-Systemfunctions entity defines:

1. The maximum set of SystemFunctions an OrganisationUser of an Organisation is allowed to access
2. The maximum set of SystemFunctions a UserRole of an Organisation is allowed to have

Examples of Tree of roles (each ► is a role)

► Superuser
  ▶ Participant management admin
  ▶ User Management admin
  ▶ Organisation Management admin
  ▶ Configuration management admin
► CallCenterAgent
  ▶ AccountingPoint user
    ▶ view accounting point
  ▶ Customer user
    ▶ view customer
Our commitment to you

We approach every engagement with one objective in mind—to help clients succeed.