

IFC-Bank of Italy Workshop on "Data science in central banking: enhancing the access to and sharing of data"

17-19 October 2023

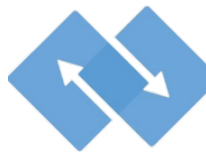
Collaborating on SDMX APIs and open-source software¹

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¹ This contribution was prepared for the workshop. The views expressed are those of the authors and do not necessarily reflect the views of the Bank of Italy, the BIS, the IFC or the other central banks and institutions represented at the event.



Collaborating on SDMX APIs and Open
Source Software



SDMX – the ISO Standard

- **Effective governance**

- Eight international organizations (sponsors)

- **Continuously evolving**

- SDMX 3.0 (latest release) – Improved support for micro/big/geo data

- **Collaborative evolution**

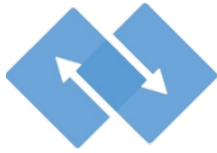
- working groups & task forces, involving national and international organisations (and independent consultants)
- [SDMX 2025 roadmap](#)

- **Comprised of a robust Information model + technical standard for modelling any data & implementing tools.**

- **SDMX in G20 DGI work ([Data Gaps Initiative](#))**

- International Data Cooperation / Data Sharing & Access
- Data Structure Definitions (DSDs) established for several domains





SDMX – The Vision

- **Improve Quality**

- **Standardize and harmonize Data and Metadata exchange** through agreed formats, ensuring consistency and comparability
- **Robust information model** supporting the entire data lifecycle
- Foster Collaboration

- **Promote Efficiency**

- Enhance Data Sharing, ie **support production, exchange and dissemination of statistics** for public good
- Enable automated (machine to machine) data sharing and process automation

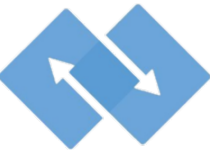
- **Drive Innovation**

- **Facilitate Data Use**

- Web services
- Connectors (Python, R, MS Power BI, ...)

Web Services – the SDMX v2 API

- A RESTful API maintained by SDMX-TWG Task Force 4
 - 9 releases since 2011 (first released with SDMX 2.1)
- The 9th release (with SDMX 3.0 – Sep 2021) features:
 - Enhanced data queries and reference metadata support
 - Restructured resources (breaks backwards compatibility to v1.*)
 - Metadata maintenance (additional HTTP verbs – POST, PUT, DELETE)
 - Schema query “allowed content” in more formats
- Improved clarity and documentation of the API
- Deprecated SOAP API



The structure queries

- Re-organized and enriched
- Supports multiple instances of search terms, wildcarding

The unique identifier:

- Agency ID
- Artefact ID
- Version
- Item ID (for Item Schemes)

`https://host/structure/type/agency/id/version/item?detail&references`

The type of structure:

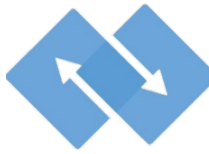
datastructure, metadatastructure, categoryscheme, conceptscheme, codelist, hierarchy, hierarchyassociation, valuelist, agency scheme, dataproviderscheme, dataconsumerscheme, organisationunitscheme, dataflow, metadataflow, reportingtaxonomy, provisionagreement, structuremap, representationmap, conceptschememap, categoryschememap, organisationschememap, reportingtaxonomymap, process, categorisation, dataconstraint, metadataconstraint, structure, transformationscheme, rulesetscheme, userdefinedoperatorscheme, customtypescheme, namepersonalisationscheme, vtlmappingscheme

Amount of information:

allstubs, referencestubs, allcompletestubs, referencecompletestubs, referencepartial, raw, partialraw, full

References to be returned:

none, parents, parentsandsiblings, ancestors, children, descendants, all, a resource type



The data queries

`https://host/data/context/agency/id/version/key?c`

The unique identifier of the context:

- Agency ID
- Artefact ID
- Version

The context of data retrieval:
datastructure, dataflow,
provisionagreement

Key(s) of the series to be returned:
eg M.GR.EUR.SP00

with wildcarding:
eg M.*.EUR.SP00

With support for multiple keys:
eg M.GR.EUR.SP00, M.CY.EUR.SP00

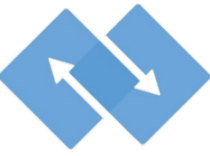
Component-based filters (for any Dimension, Attribute or Measure):

eg `c[REF_AREA]=CH&c[CONF_STATUS]=F`

Support for operators:
eg `c[ICP_ITEM]=sw:01&c[TIME_PERIOD]=ge:2015`

&updatedAfter
&firstNObservations
&lastNObservations
&attributes
&measures
&dimensionAtObservation
&includeHistory

eq Equal
ne Not equal
lt Less than
le Less than or equal to
gt Greater than
ge Greater than or equal to
co Contains
nc Does not contain
sw Starts with
ew Ends with
nd And
or Or



The data queries

https://host/data/context/agency/id/version/key?c

Retrieves what changed since supplied timestamp. Must be percent-encoded (e.g.: 2009-05-15T14%3A15%3A00%2B01%3A00)

Maximum number of observations starting from the first observation

Maximum number of observations counting back from the most recent observation

Id of the dimension at the observation level

The attributes to be returned:
dsd, msd, dataset, series, obs, all, none, {attribute_id}

The measures to be returned:
all, none, {measure_id}

Whether to return vintages

&updatedAfter

&firstNObservations

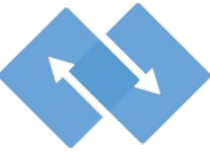
&lastNObservations

&attributes

&measures

&dimensionAtObservation

&includeHistory



Other queries

- Data validity

```
https://host/schema/context/agency/id/version?dimensionAtObservation  
&explicitMeasure
```

- Data availability

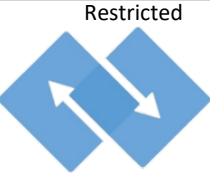
```
https://host/availability/context/agency/id/version/key/componentId?c  
&updatedAfter  
&references  
&mode
```

- Metadata

```
https://host/metadata/metadataset/provider/id/version?detail
```

```
https://host/metadata/metadataflow/agency/id/version/provider?detail
```

```
https://host/metadata/structure/type/agency/id/version/provider?detail
```



SDMX 3.0 RESTful API v2.0.0

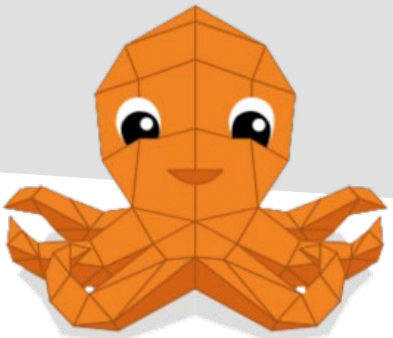
- The normative part of the specification, i.e. the [Open API definition](#)
- The [Developers' documentation](#), including a [cheat sheet](#)
- Request features and report issues on [GitHub](#)
- See the API spec on [SwaggerHub](#)
- The SDMX v2 API in [action](#)

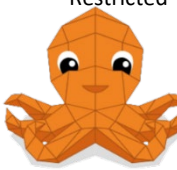
The collage displays four key resources for the SDMX 3.0 RESTful API v2.0.0:

- GitHub Repository:** Shows the source code structure for `sdmx-rest`, including files like `api/sdmx-rest.yaml` and `doc/index.md`.
- GitHub Pull Request:** A screenshot of a pull request titled "Remove superfluous id operator" by user `stratosn`.
- Cheat Sheet:** A document titled "SDMX 3.0 RESTful web services cheat sheet, v2.0.0" listing structure queries and their parameters.
- SwaggerHub API Spec:** The OpenAPI definition for `sdmx-rest` v2.0.0, showing endpoints for data queries, structure queries, and reference metadata queries.



sdmx.io





What is sdmx.io?

sdmx.io is not a single project but an **ecosystem of open source tools, patterns, guidance, learning materials and other resources** like pre-configured containerised environments that make the software quick and simple to deploy.

- An **open-source SDMX software and resource portal**
 - Software releases (FMR, FusionXL, etc.)
 - E-learning courses and webinars
 - Knowledge and use-case articles
 - **Governance in place, incl. Prioritisation and User Advisory Groups**
 - **Officially public**, after the SDMX Sponsors approval
- Share software tools and components based on SDMX
 - Complement existing tools in order to achieve statistical use-cases
 - Interface SDMX with other standards or tools
 - Promote reusability of SDMX software



Collaboration partners and activities

- **IMF:** IMF SDMX Central is powered by FMR11 (since Sep 2023)
- **SIS-CC/Eurostat/BIS:** working closely on achieving SDMX 3.0 compliance
- **OECD/SIS-CC:** .Stat/FMR integration for the National Bank of Belgium (**NBB**) use case
 - FMR Workbench
 - .Stat Suite on sdmx.io
- **NBB:** Launch of FMR Workbench user group (targeting CBs and SIS-CC members)
- **Eurostat:** SDMX Reference Implementation for SDMX 3.0
 - sdmx-core evolution (Java/.Net)
- **Banca d'Italia:** VTL Engine & FMR → exploring the use cases
 - UNSD working with Bdl on the first use case
- **Meaningful Data:** SDMXthon & FMR → exploring the use cases



The use-cases



Statistics production



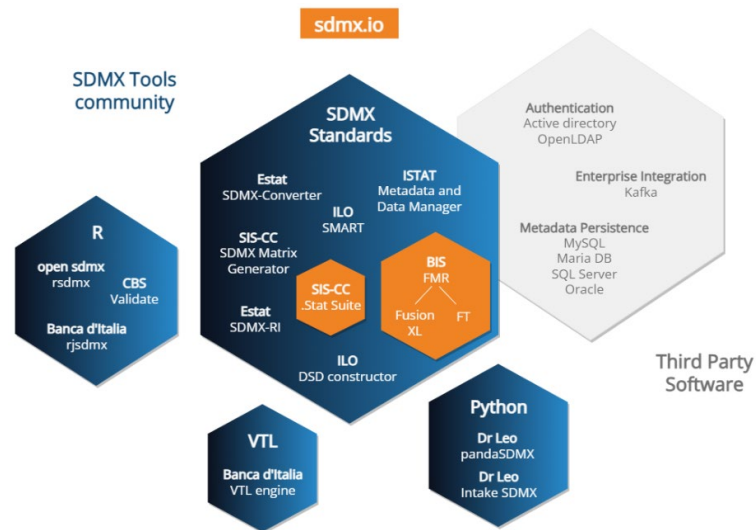
Statistics dissemination



Data domain modeling



Data collection



eLearning Catalogue

sdmx.io's library of learning resources covers a diverse range of topics including how to use software tools, SDMX theory and data modelling best practice.

FMR on GitHub

bis-med-it / fmr

Overview Repositories Projects Packages Teams People Security Insights

Fusion Metadata Registry (FMR)
Updated yesterday

Filter cards Add cards(1 new)

Wish list (42)

- Exporting artefacts to formats not suitable for artefacts of that type
fmr#121 opened by sosna
BIS enhancement
- Cannot update a DSD used by a dataflow referenced in a StructureMap
fmr#108 opened by sosna
BIS enhancement mapping
- Advanced mapping/reading features
fmr#101 opened by stratosn
BIS enhancement mapping
- Prevent defining identical mappings in the same RepresentationMap
fmr#104 opened by sosna
BIS enhancement mapping structure maintenance UI
- Measure array support
fmr#87 opened by glenntav
BIS structure
- Remove Spring from fusion-core
fmr#59 opened by glenntav
BIS medium cost
- UI - new links field
fmr#40 opened by glenntav
low cost structure maintenance UI
- Geographic CodeLists - syntax validation of GeoFeatureSet expressions
fmr#43 opened by glenntav

To do (80)

- Change the way large numbers of validation errors are handled to reduce memory pressure
fmr#238 opened by glenntav
enhancement OECD pain point
- Amend representation map documentation with additional examples
fmr#176 opened by anastasias
question
- Investigate issue with mapping in FMR10
fmr#493 opened by PL-MetaTech
BIS
- Issue with response from dataflow query (MEDAL-related)
fmr#369 opened by sosna
BIS question REST API ver 11.6.1 ver 11.9.0
- Statistics Netherlands FMR pen test results - response needed to the user
fmr#486 opened by glenntav
security
- SDMX-JSON 3.0 data format (excluding hierarchical reference metadata)
fmr#50 opened by glenntav
data format Eurostat Global Registry phase 1 major enhancement OECD
- EU login / authentication support

In progress (8)

- SDMX-ML (XML) 3.0 data format (excluding hierarchical reference metadata)
fmr#53 opened by glenntav
data format Global Registry phase 1 major enhancement medium cost
- Mapping produces invalid output
fmr#544 opened by cesbalco
BIS bug
- Mapping issues
fmr#518 opened by stratosn
BIS bug
- Agree and document FMR structure mapping behaviour
fmr#421 opened by glenntav
BIS
- Metadata time travel
fmr#9 opened by HubertBIS
BIS major enhancement
- SDMX Central - FMR Fusion Excel data format writer MVP
5 of 6 tasks
fmr#510 opened by glenntav
critical IMF UAT IMF SDMX Central migration to FMR
- Problem with loading XLSX in 'Browse Registry'
fmr#380 opened by etokel
bug FusionXL

Unreleased (7)

- Structure - Metadata Constraint SDMX-JSON v2
fmr#31 opened by glenntav
Global Registry phase 1 low cost structure
- Report error if publication table is queried for in sdmx-json format
fmr#540 opened by agent96
- Using V2 Sdmx API. "saveAs" and Zip format creates empty output
fmr#537 opened by PL-MetaTech
bug
- Querying for StructureSet returns unhelpful error message
fmr#539 opened by PL-MetaTech
BIS
- Restore Fusion Security as Authentication Service Option
fmr#553 opened by PL-MetaTech
enhancement IMF ver 11.10.2
- Reference metadata in fusion-json
fmr#509 opened by sosna
BIS data format enhancement MEDAL metadata synchronisation enable...
- SDMX-JSON 2.0.0: Problem with structure of messages containing hierarchies
fmr#507 opened by sosna
BIS bug data format MEDAL metadata synchronisation enable...

Done (233)

- Integration testing improvements (including incorporating format conversion, structure mapping, structure validation test suites)
fmr#241 opened by glenntav
BIS major enhancement
- SDMX-JSON 2.0.0: Wrong output for cube regions
fmr#504 opened by sosna
BIS bug data format MEDAL metadata synchronisation enable...
- FMR API Performance
fmr#492 opened by sosna
BIS data format performance REST API ver 11.10 MEDAL metadata synchronisation enable...
- Constraints causing NullPointerException in FMR 11.10.0
fmr#538 opened by PL-MetaTech
BIS critical ver 11.10.1
- Publish updates to metadata reports to a Kafka topic
fmr#442 opened by sosna
BIS enhancement ver 11.10 MEDAL metadata synchronisation enable...
- Add new format option to Kafka producer
fmr#451 opened by sosna
BIS enhancement ver 11.10 MEDAL metadata synchronisation enable...
- Add meta header to Fusion-JSON to

Automated as: Done Manage

Java 28.5%



Thank you!

Brian.Buffett@bis.org Stratos.Nikoloutsos@bis.org Xavier.Sosnovsky@bis.org