The dilemma of **XBRL-XML versus XBRL-JSON** regarding **linkage of financial information**

Motivation

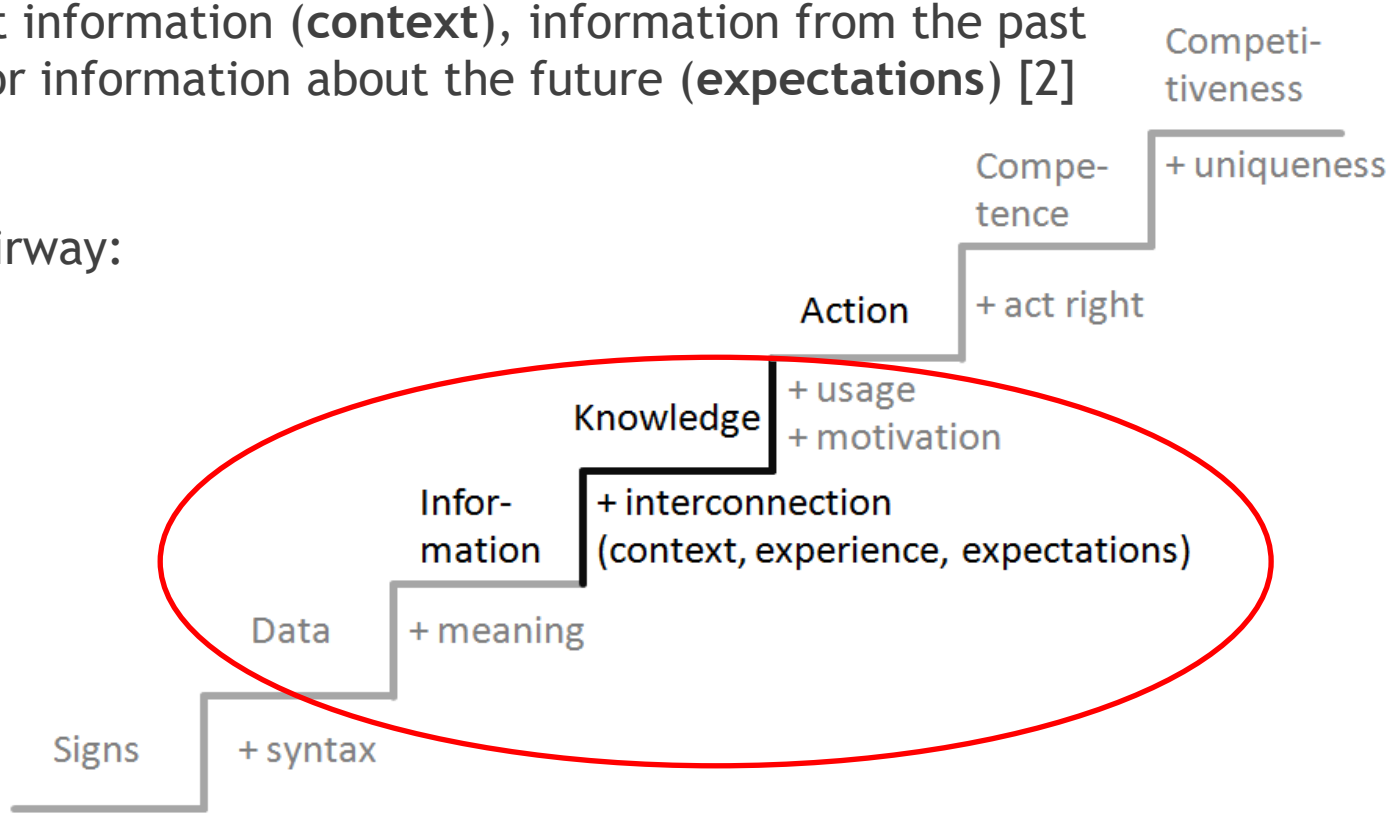
- Current discussion about **JSON as another underlying data format for XBRL** (XBRL-JSON) in the context of the Open Information Model
- JSON is deemed to **ease integration and ETL** and thus, **linkage of information** [1]
- Does it solve data integration and linkage problems **better then XBRL on the basis of XML (XBRL-XML)?**

Theoretical background

- Basic underlying **assumption**:

  Knowledge = **Information interconnected** with other information be it with related current information (**context**), information from the past (**experience**) or information about the future (**expectations**) [2]

- Knowledge-stairway:



From data to knowledge – an example

A report to a financial supervisory authority contains the **figure 1.000.000,00€**	**= data**
+ **context** (e.g. "eligible own funds" (EOF) as part of balance sheet)	= **information**
+ **link** to other **current information** (e.g. "solvency capital requirement" (SCR) of 800.000,00€) → 1.000.000,00€ (EOF) / 800.000,00€ (SCR) = 125,0% **SCR-ratio**	= **knowledge part I**
+ **link** to **information from the past** (e.g. "eligible own funds (eof) of 1.500.000,00€ in the previous year (p.y.); 1.500.000,00€ (EOF p.y.) / 800.000,00€ (SCR p.y.) = 187,5% SCR-ratio p.y.) → **drop of SCR-ratio** from 187,5% p.y. to 125,0% current year	= **knowledge part II**
+ **link** to **information about the future** (Trend analysis could indicate a drop of further 500.000,00€ or at least another 33% of "eligible own funds" in the next year) → the SCR-ratio would **fall below 100%**	= **knowledge part III**

Contacting the company and **investigating** the cause could be a sustainable supervisor's decision = **action**

Influence of data formats on “knowledge”

- XBRL on technical basis of XML (**XBRL-XML**): No explicit support for linkage of filings from different financial entities or reporting periods [3]
- That is, no **business-rules-validation** (formulae linkbase) and **visualization** (table linkbase) across the borders of a **single filing** for one **single entity** and one **single reporting period**
- **Loss of meta-data** about data-quality (formulae linkbase) and layout (table linkbase) during DWH-ETL (Extract, Transform, Load) [4]

- XBRL on the basis of JSON (**XBRL-JSON**): Provides **tighter, smaller chunks of information**
- Similar, if not identical, to **data types** used in common programming languages (in contrast to XBRL-XML which requires parsing and mapping) [1]
- **Compatible to document-oriented databases** (NoSQL) like MongoDB, CouchDB without breaking up its structure [5], thus less intermediate steps to integrate data and
- **Less complexity** while processing, e.g. during **ETL**
- **JSON-LD** (for “Linked Data”) simplifies integration from different domains by **adding a globally valid meaning to facts** (via @context-attribute using common namespace-URLs and schemas (like http://schema.org))

Code example of XBRL-XML and XBRL-JSON

- "Profit"-statement in **XML** [1]:

```
<xbrli:contextRef id="c1">
    <xbrli:entity>
      <xbrli:identifier scheme="http://standards.iso.org/iso/17442">12345</xbrli:identifier>
    </xbrli:entity>
    <xbrli:period>
      <xbrli:startDate>2015-01-01</xbrli:startDate>
      <xbrli:endDate>2015-12-31</xbrli:endDate>
    </xbrli:period>
</xbrli:contextRef>

<xbrli:unit id="u1">
    <xbrli:measure>iso4217:USD</xbrli:measure>
</xbrli:unit>

<gaap:Profit contextRef="c1" unitRef="u1" decimals="-6" >12000000
</gaap:Profit>
```

compared to

- "Profit"-statement in **JSON** [1]:

```
{
  "oim:concept": "gaap:Profit",
  "oim:accuracy": -6,
  "oim:unitNumerator": [ "iso4217:USD" ],
  "oim:period": "2015-01-01/2016-01-01",
  "oim:entity": "lei:12345",
  "value": "12000000",
  "numericvalue": 12000000,
}
```

Inter- and Intra-Linkage

- Considering the previous slides **XBRL-JSON** seems to be **the easy solution** for integration and linkage (But remember the goal: **knowledge by linkage**!)
- **Two kinds of linkage:**
  - **Inter-linkage**: information stems from **different domains, taxonomy-frameworks or namespaces**
    - **Neither structured** in the **same way nor** using the **same data model** or **semantic expressions**
    - **Context** of information is **different** and different facts might have the same name or the other way around.
    - **Dictionary** of information is regularly very **different**
  - **Intra-linkage**: interconnection of information **within the same domain/taxonomy-framework/namespace**
    - **Use-cases**: integration of **filings from several financial entities** or filings from one and the same financial entity **for several reporting periods**
    - **NSA-perspective**: Integration is **prerequisite for benchmarking** among supervised companies and for **variation analyses** about one company over time
    - **Dictionary** of information among reporting entities is **identical**

Pros and Cons regarding Inter-linkage

		XBRL-XML **XML**	XBRL-JSON **JSON**
Inter-Linkage	Pros **Pros**	1. Usage of namespaces allows semantic distinction between data points 2. Re-Use of schema files among taxonomies allows for a consolidated data model to some degree	1. Usage of contexts (in JSON-LD specification for Linked Data) 2. Easy to understand due to common data types 3. Easy to load and consolidate due to document-oriented databases and flexible (noSQL-)data-models
	Cons **Cons**	1. Deviations between data models interfere derivation of a consolidated data model 2. Each data model/XML schema depends on a dedicated shredding and ETL process	1. Semantic context information only provided when using JSON-LD specification 2. No schema-based dictionary

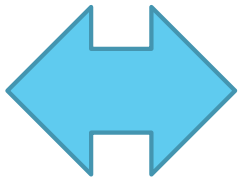
Pros and Cons regarding Intra-linkage

		XBRL-XML **XML**	XBRL-JSON **JSON**
Intra-Linkage	Pros **Pros**	1. Given Data Model including dimensions allows taxonomy-driven derivation of analytical data models 2. Consolidation of information is less error-prone since business validations guarantee a minimum-standard for data quality 3. Business validations (formulae linkbase) and rendering instructions (table linkbase) can potentially be used in a DWH/BI-Solution if they could be stored and processed 4. XML-based ETL processes already implemented on receivers' sides	1. Lightweight ETL process due to simple data model 2. Modeling of an integrated target-data-model needless due to potential use of document-oriented databases

		XBRL-XML **XML**	XBRL-JSON **JSON**
Intra-Linkage	Cons **Cons**	1. Taxonomical meta-data for business validations and rendering instructions are at risk to get lost during ETL process	1. Taxonomical meta-data for business validations and rendering instructions not provided in uniform technical syntax at all, thus less data quality expectable and, as to that, nothing to transfer to a DWH/BI-Solution 2. Minimum content and comparability of filings cannot be assured due to lack of a strict model and schema files 3. Effort to switch from proven XML-based validation and ETL processes on receivers' side

Conclusion (1/2)

- Number and character of pros and cons slightly indicates that **XBRL-JSON** has an overall **advantage over XBRL-XML** related to **inter-linkage** of information (Disclaimer: No quantitative clarification yet)
- **Advantage of JSON**'s flexibility **vanishes if intra-linkage** is required
  - Based on the same reporting framework
  - **Adequate and sensible to use a uniform strict data model**
    - **Assure consistency between filings** (among entities and among time) and
    - a certain **level of data quality**



- **XBRL-XML**: Provides a **strict data model**
- Supports application of **business validations and rendering instructions for filings.**
- No reason obvious why one should give up this additional information in advance.
- Hence **XBRL-XML is recommended for intra-linkage of financial filings**

Conclusion (2/2)

- "Micro"-linkage before "macro"-linkage
  - In general, before mashing up financial information from several heterogeneous sources, it seems logical that **information from one and the same source** (e.g. companies reporting to a financial supervisory authority under the same reporting framework) **should be properly integrated first** (including all the useful meta-data which XBRL currently provides)
- **Dilemma**: XBRL-JSON very **lightweight-approach** but overlooks the relevance of **intra-linkage** and **proven meta-data** of "good old" XBRL-XML
- **Advice**: Keep and/or **improve the XBRL-XML ecosystem for the purpose of information linkage!**
  - **Disclaimer**: XBRL-JSON has been examined only with regard to integration of financial information. It is explicitly not the intention of this paper to lessen the potential benefits of JSON for other purposes in general.

Outlook - approach

Approach for **“improvement”**:

- **Retain relevant meta-data** (like business validations or rendering instructions) through linkage/ETL processes and allow for this meta-data to be **applied to more than one single file**
  - Beyond the **borders of one report per entity and period**

Practical benefits:

- **Aggregated standard-report-templates** making combined use of table- and formulae-linkbase-metadata **across companies/periods**
- **Business validations** checking figures **across entities and/or time** throwing warnings when figures are suspicious in a certain context
  - e.g. 50% decrease of own funds **from previous to current year**
  - e.g. SCR-ratio deviates more than 30% from the **average of peers**

Outlook – technical solution

Potential **technical solution:**

- **DWH-databases** should **natively understand and interpret XBRL business validations** and
- **BI-Tools** "on top" should **natively understand and interpret XBRL rendering instructions,** each **"out of the box"**
  - **Without** depending on **additional tools** or **bespoke ETL solutions**).

- Task for further research [6]

Contact

Christian Beelitz

E-Mail: contact@christian-beelitz.de

Mobile: 0178/1676465

References

1. Paul Warren (2016) xBRL-JSON: making XBRL easier. https://www.xbrl.org/xbrl-json-making-xbrl-easier/
2. North K (2010) Wissensorientierte Unternehmensführung: Wertschöpfung Durch Wissen. Springer-Verlag
3. Garcia R, Gil R (2010) Triplificating and linking XBRL financial data. In: Proceedings of the 6th International Conference on Semantic Systems. ACM, Graz, Austria, pp 1–8
4. Spies M (2010) An ontology modelling perspective on business reporting. Information Systems 35(4): 404–416
5. Quackit (2017) List of JSON Databases. http://www.quackit.com/json/tutorial/list_of_json_databases.cfm. Accessed 29 Mar 2017
6. Gräning A, Felden C, Piechocki M (2011) Status Quo und Potenziale der eXtensible Business Reporting Language für die Wirtschaftsinformatik. WIRTSCHAFTSINFORMATIK 53(4): 225–234. doi: 10.1007/s11576-011-0282-2