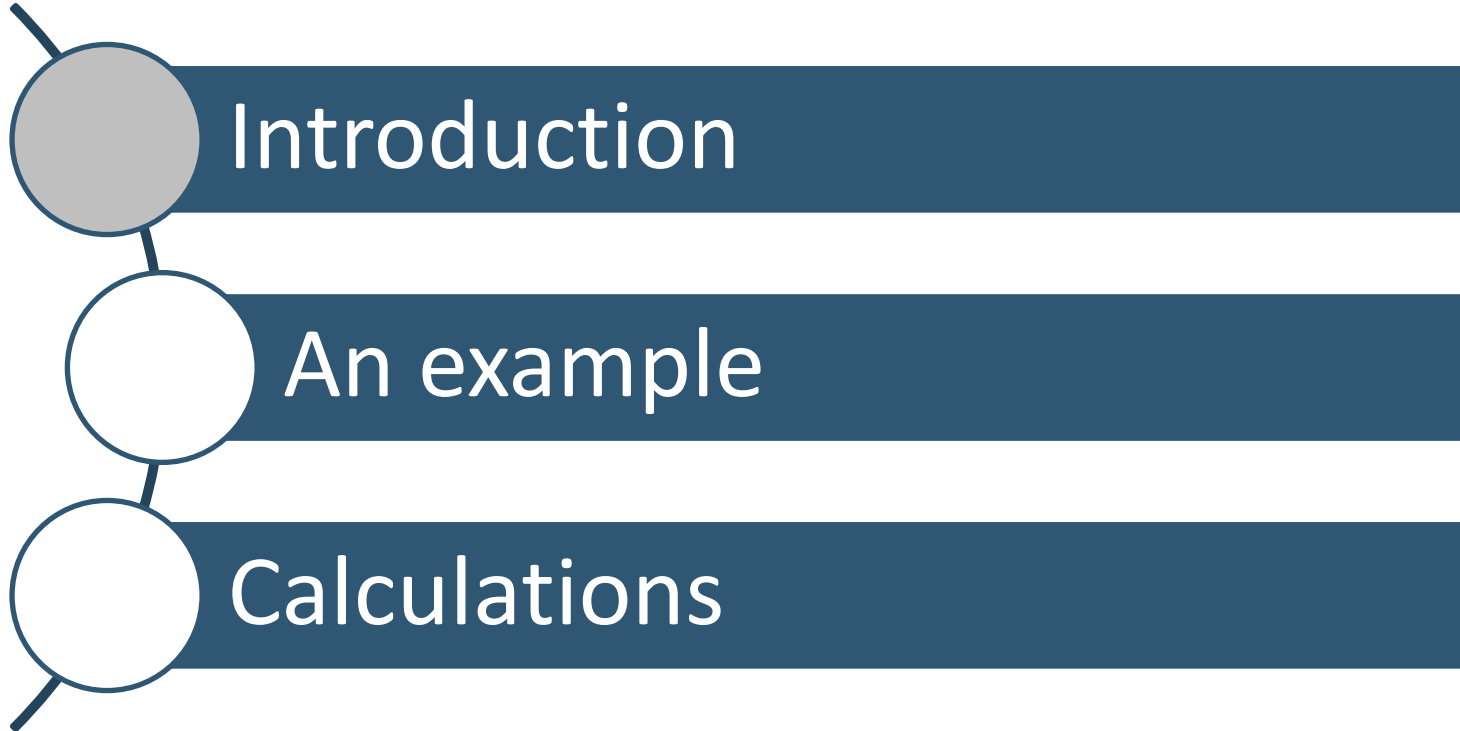# DPM Operations: The new DPM Refit validations & calculation rules

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EUROFILING seminar | 22 June 2022

Outline

Introduction

An example

Calculations

DPM validations: Current process
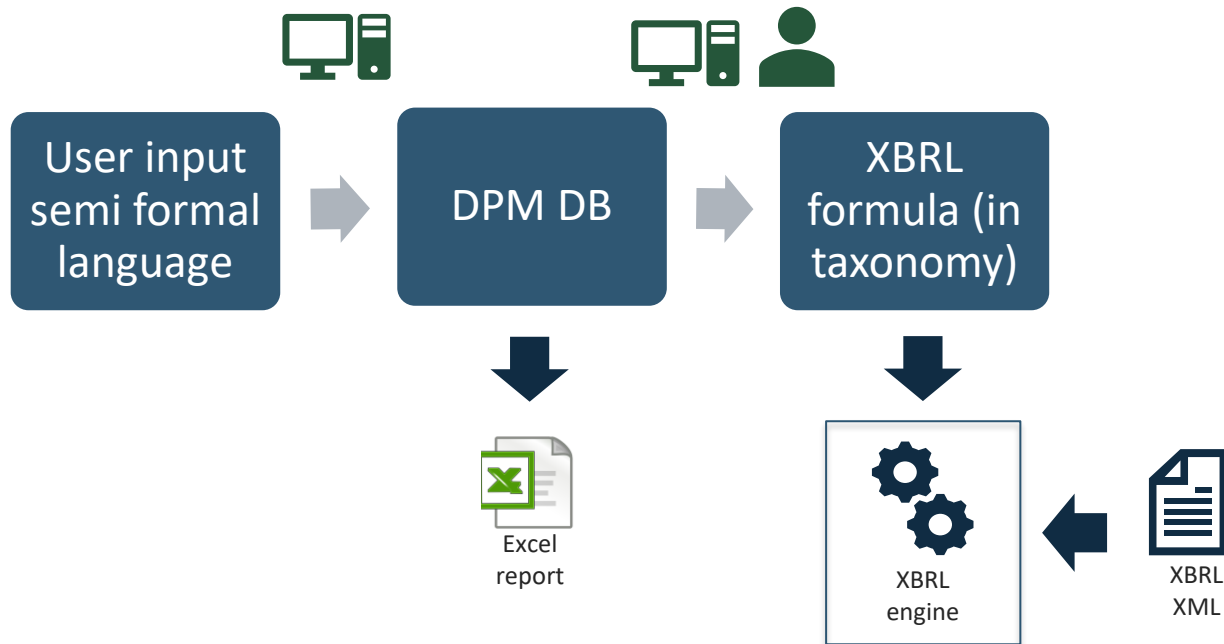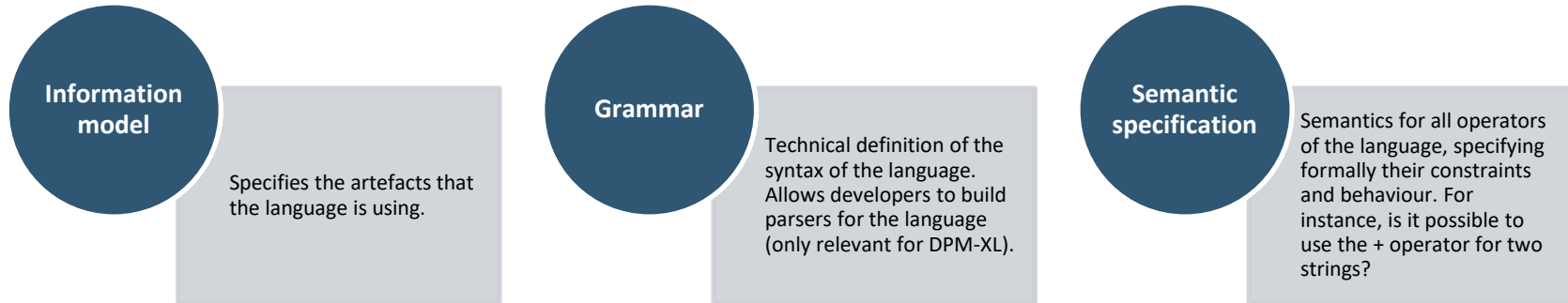
Current situation analysis

- EBA and EIOPA have been using a validation language over the years, but without a formal basis and a proper documentation.

- The **lack of formality** causes some challenges:

  - It is not possible to have full automation when translating to other languages (notably, to XBRL Formula).

  - Although EBA and EIOPA are basically using the same language, there are some differences that further difficult automation and common understanding.

  - There may be ambiguity in the meaning of a validation.

- The language is translated **to XBRL formula**, which also adds challenges:

  - Not all validations can be translated to XBRL.

  - XBRL is very difficult to understand.

  - Performance becomes an issue with big instances.
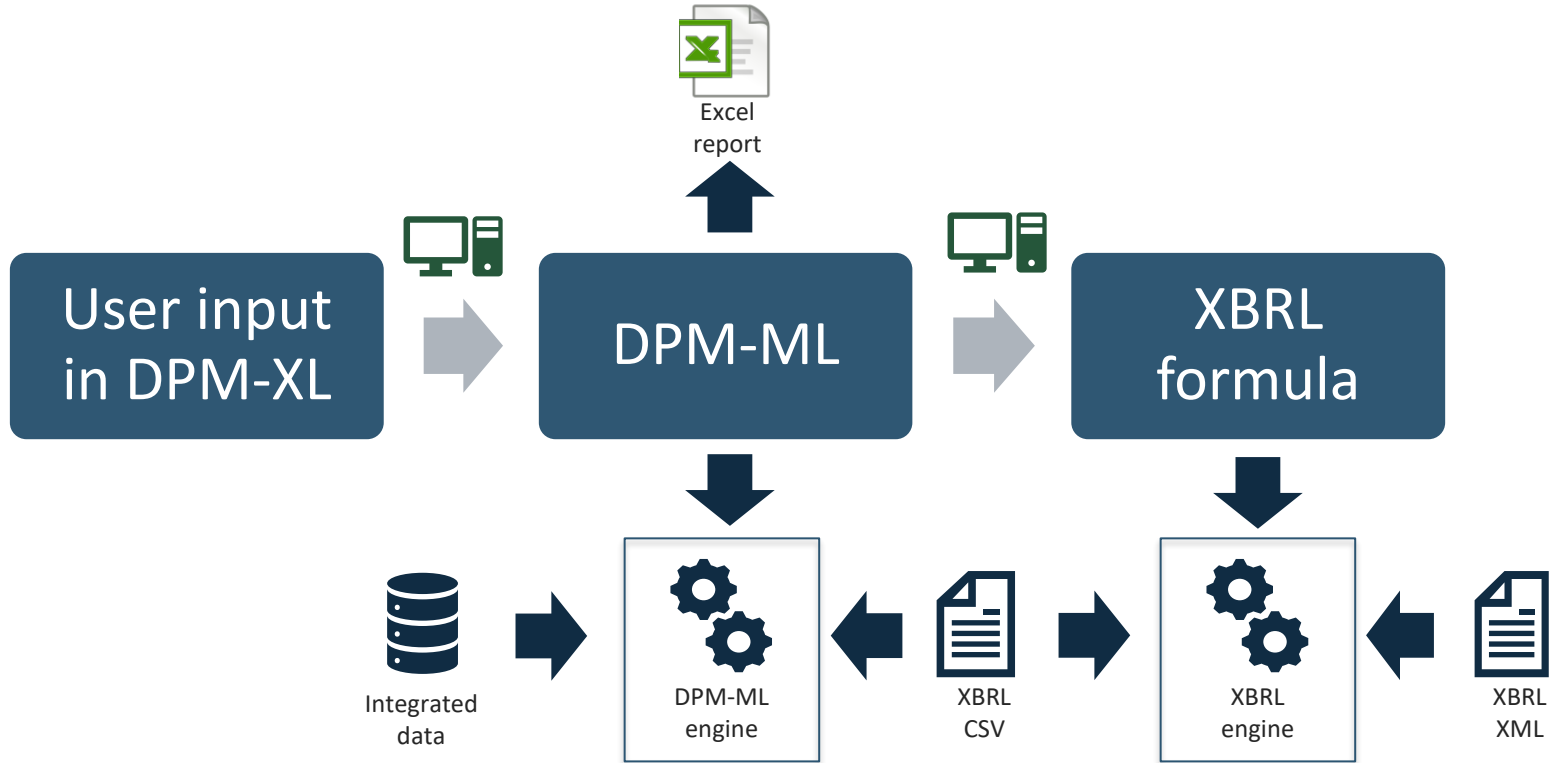
DPM Refit improvements

- The DPM Refit aims to formalize the operations (including validations and other calculations) by having:

  - A formal expression language: **DPM-XL** is a formal language for expressing calculations based on the DPM.

    ▸ Is based on the semi-formal language that the EBA and EIOPA have been using to write and share validation rules for several years.

    ▸ In practice, it is the result of a reverse-engineering process to formalize the language that was already existing, with the minimum changes necessary.

  - A metamodel to represent the operations tree of an operation, as well as the relations of the operands with the core DPM (**DPM-ML**).

- Why DPM-XL and DPM-ML? Because:

  - DPM-ML is based on variables (stable) instead of rendering (unstable).

  - In principle it is possible to translate languages different from DPM-XL into DPM-ML.

DPM Operations specification

The formalisation of the language has three **pieces**:

Information model

Specifies the artefacts that the language is using.

Grammar

Technical definition of the syntax of the language. Allows developers to build parsers for the language (only relevant for DPM-XL).

Semantic specification

Semantics for all operators of the language, specifying formally their constraints and behaviour. For instance, is it possible to use the + operator for two strings?

What are the options the DPM Refit Operations enable?

Outline

Introduction

An example

Calculations
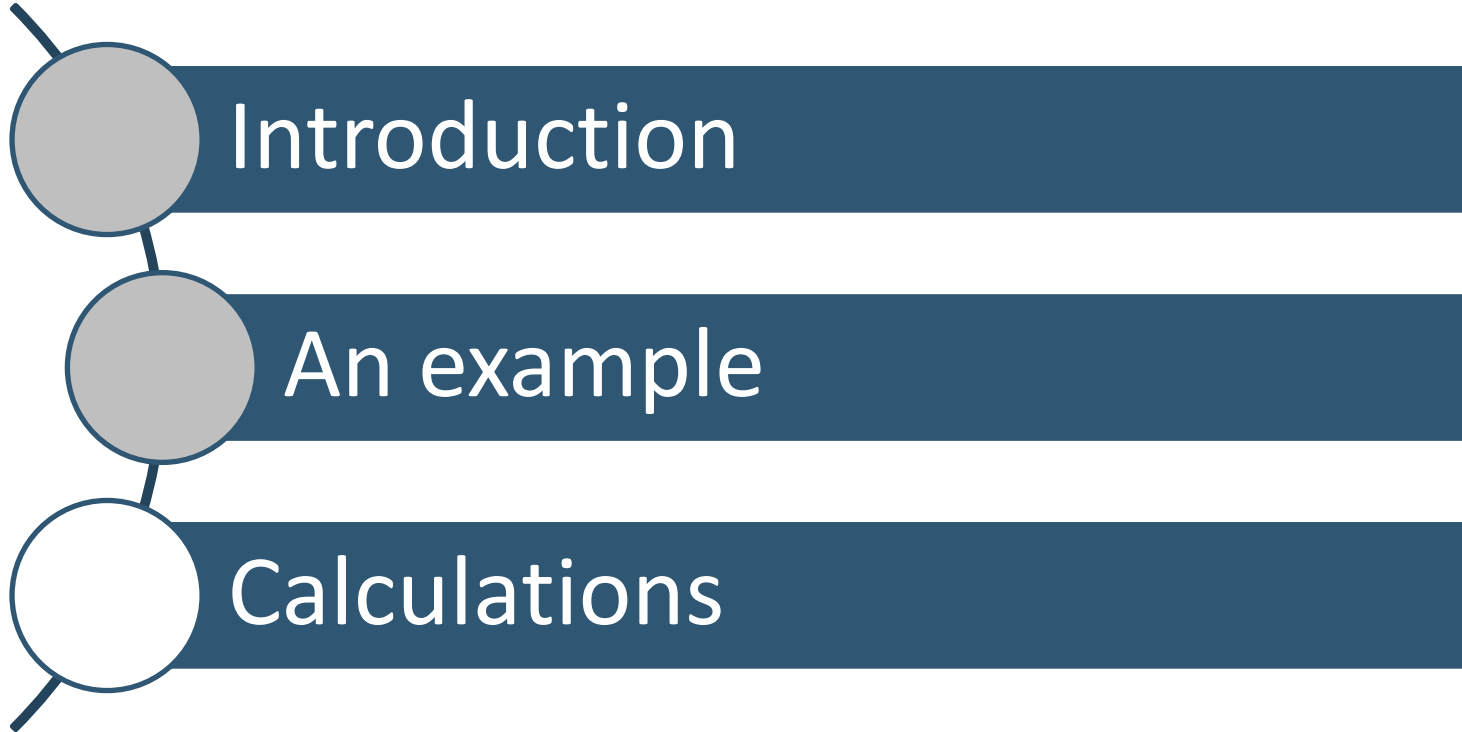
Validation rule

C 90.00 - Trading book and market risk thresholds (TBT)

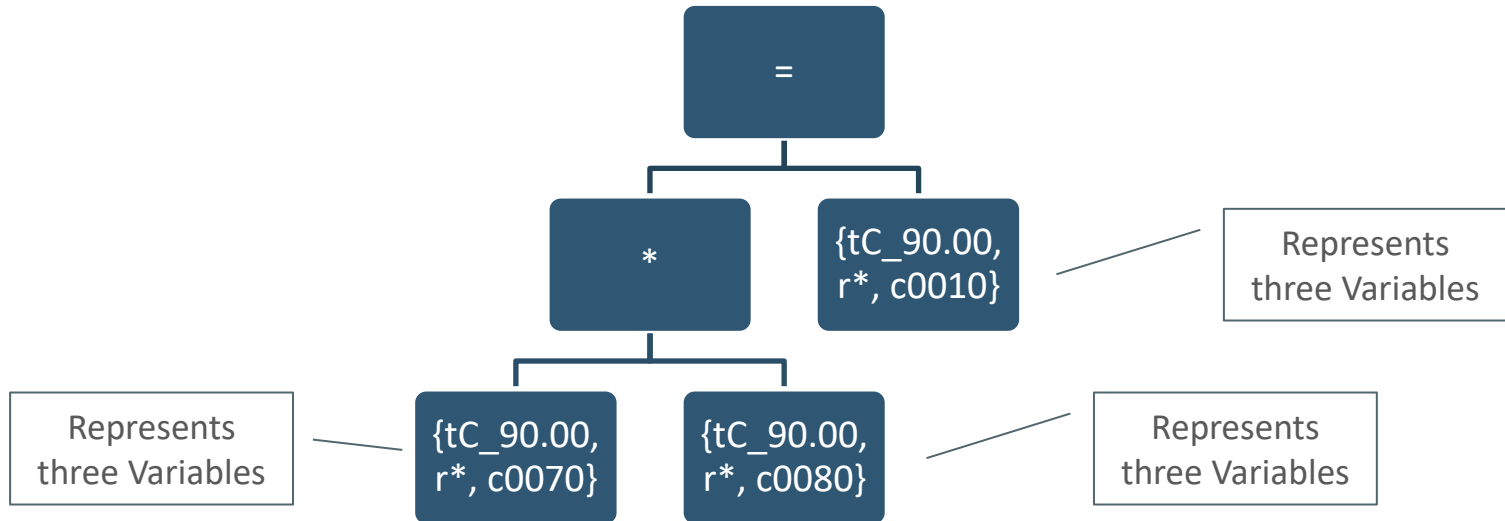|			Columns		
			On - and off - balance sheet business subject to market risk		Total assets
				In % of total assets	
			0010	0070	0080
Rows	Month 3	0010	51	5%	1020
	Month 2	0020	42	4%	1010
	Month 1	0030	60	6%	1000

DPM-XL

```
with {tC_90.00, r*}: {c0070} * {c0080} = {c0010}
```
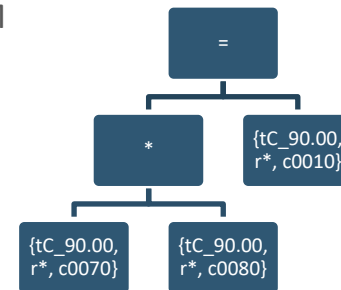
Tree representation of expressions

Any DPM-XL expression can be represented as a tree:

```
with {tC_90.00, r*}: {c0070} * {c0080} = {c0010}
```

DPM-ML

The tree of the expression can be then represented in the DB, with reference to actual DPM variables.

DPM-ML

Nodes

Node	ParentNodeID	Operator	Operand
1		=	
2	1	*	
3	2		A
4	2		B
5	1		C

Operands

Operand	Index	Variable
A	1	Dpid1({tC_90.00, r0010, c0070})
A	2	Dpid2({tC_90.00, r0020, c0070})
A	3	Dpid3({tC_90.00, r0030, c0070})
B	1	Dpid4({tC_90.00, r0010, c0080})
B	2	Dpid5({tC_90.00, r0020, c0080})
B	3	Dpid6({tC_90.00, r0030, c0080})
C	1	Dpid7({tC_90.00, r0010, c0010})
C	2	Dpid8({tC_90.00, r0020, c0010})
C	3	Dpid9({tC_90.00, r0030, c0010})

Input data

{tC_90.00, r*, c0010}

Index	f
1	51
2	42
3	60

{tC_90.00, r*, c0070}

Index	f
1	5%
2	4%
3	6%

{tC_90.00, r*, c0080}

Index	f
1	1020
2	1010
3	1000

=
├─ *
│ ├─ {tC_90.00, r*, c0070}
│ └─ {tC_90.00, r*, c0080}
└─ {tC_90.00, r*, c0010}
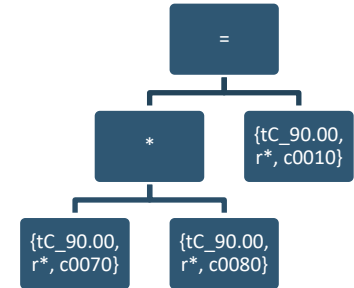
Results

with {tC_90.00, r*}: {c0070} * {c0080} ▶

Index	f
1	51
2	40.4
3	60

with {tC_90.00, r*}: {c0070} * {c0080} = {c0010} ▶

Index	f
1	True
2	False
3	True

Outline

Introduction

An example
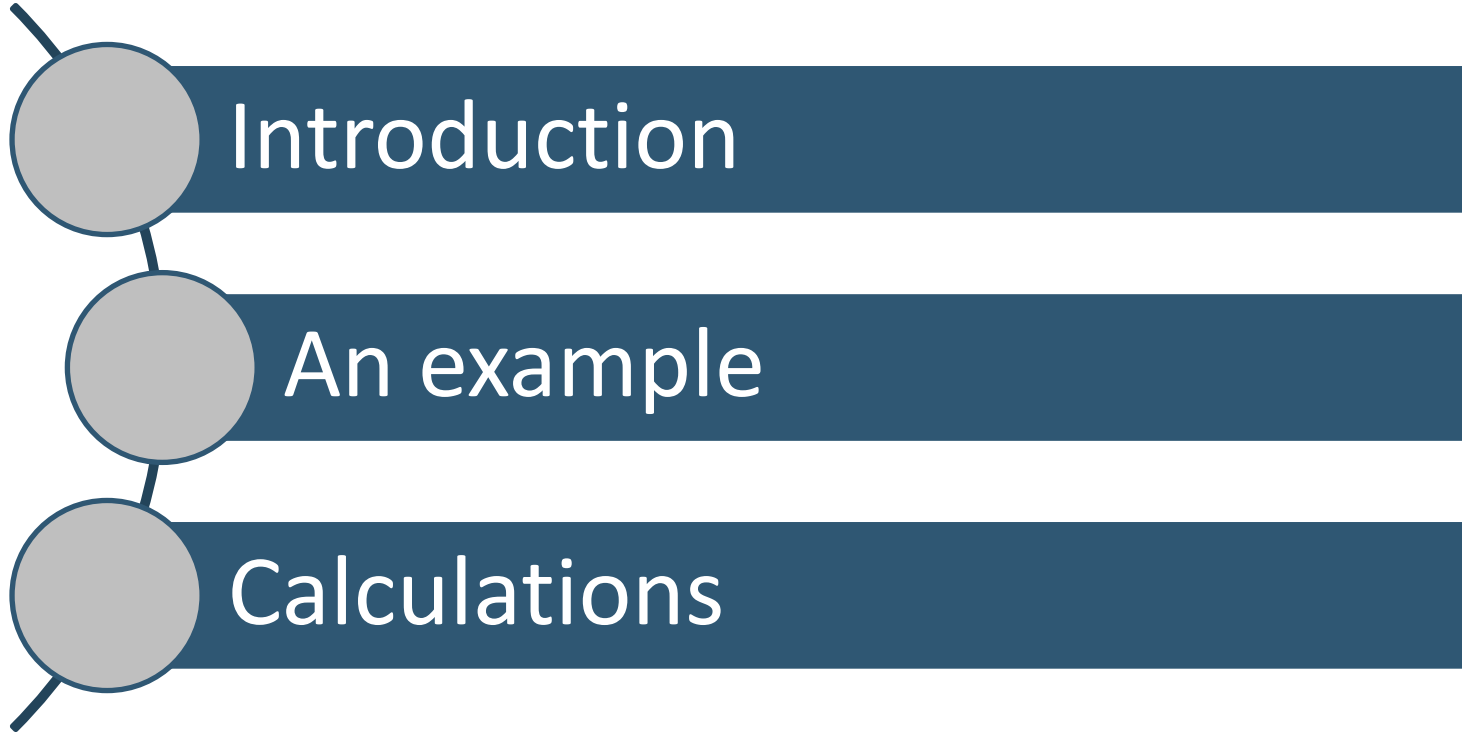
Calculations

About calculations

- Calculations are very similar to validations: Algorithms to manipulate input data into output data.

- The DPM-XL and DPM-ML for validations can also be used for calculations.

- Only difference is in the treatment of related issues, like triggers to run validations vs calculations, or what to do with the results of execution.

The Transparency exercise case - I

Consider the current transparency exercise table with mapping:

		(mln EUR, %)	As of 30/09/2020	As of 31/12/2020	As of 31/03/2021	As of 30/06/2021	COREP CODE
			1	2	3	4	
A	1	OWN FUNDS	#VALUE!	#VALUE!	#VALUE!	#VALUE!	C 01.00 (r010,c010)
A.1	2	COMMON EQUITY TIER 1 CAPITAL (net of deductions and after applying transitional adjustments)	#VALUE!	#VALUE!	#VALUE!	#VALUE!	C 01.00 (r020,c010)
A.1.1	3	Capital instruments eligible as CET1 Capital (including share premium and net own capital instruments)	C 01.00_030_010	C 01.00_030_010	C 01.00_030_010	C 01.00_0030_0010	C 01.00 (r030,c010)
A.1.2	4	Retained earnings	C 01.00_130_010	C 01.00_130_010	C 01.00_130_010	C 01.00_0130_0010	C 01.00 (r130,c010)
A.1.3	5	Accumulated other comprehensive income	C 01.00_180_010	C 01.00_180_010	C 01.00_180_010	C 01.00_0180_0010	C 01.00 (r180,c010)
A.1.4	6	Other Reserves	C 01.00_200_010	C 01.00_200_010	C 01.00_200_010	C 01.00_0200_0010	C 01.00 (r200,c010)
A.1.5	7	Funds for general banking risk	C 01.00_210_010	C 01.00_210_010	C 01.00_210_010	C 01.00_0210_0010	C 01.00 (r210,c010)
A.1.6	8	Minority interest given recognition in CET1 capital	C 01.00_230_010	C 01.00_230_010	C 01.00_230_010	C 01.00_0230_0010	C 01.00 (r230,c010)
A.1.7	9	Adjustments to CET1 due to prudential filters	C 01.00_250_010	C 01.00_250_010	C 01.00_250_010	C 01.00_0250_0010	C 01.00 (r250,c010)
A.1.8	10	(-) Intangible assets (including Goodwill)	C 01.00_300_010+C 01.00_340_010	C 01.00_300_010+C 01.00_340_010	C 01.00_300_010+C 01.00_340_010	C 01.00_0300_0010+C 01.00_0340_0010	C 01.00 (r300,c010) + C 01.00 (r340,c010)

The Transparency exercise case - II

The table could be represented as a DPM table, and each cell would be a variable.

The DPM-XL (and the related metadata) can assign the results of operations to DPM variables.

For calculations, being able to concatenate operations is critical.

Example: calculation of variables in row 10 (DPM-XL):

```
tTE_capital_r10 := {tC_01.00, r0300, c0010} + {tC_01.00, r0410, c0010};


tTE_capital_r10_c1 <-

    filter(tTE_capital_r10, date='2020-09-30');


tTE_capital_r10_c2 <-

    filter(tTE_capital_r10, date='2020-12-31');

…
```

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