

# On Formal Choreographic Modelling: a Case Study in EU Business Processes

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# Take-away message

## Choreographies & Correctness

### Formal Choreographic Methods

aim to correctness-by-construction

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## Our question

How do such restriction impact on “usability”?

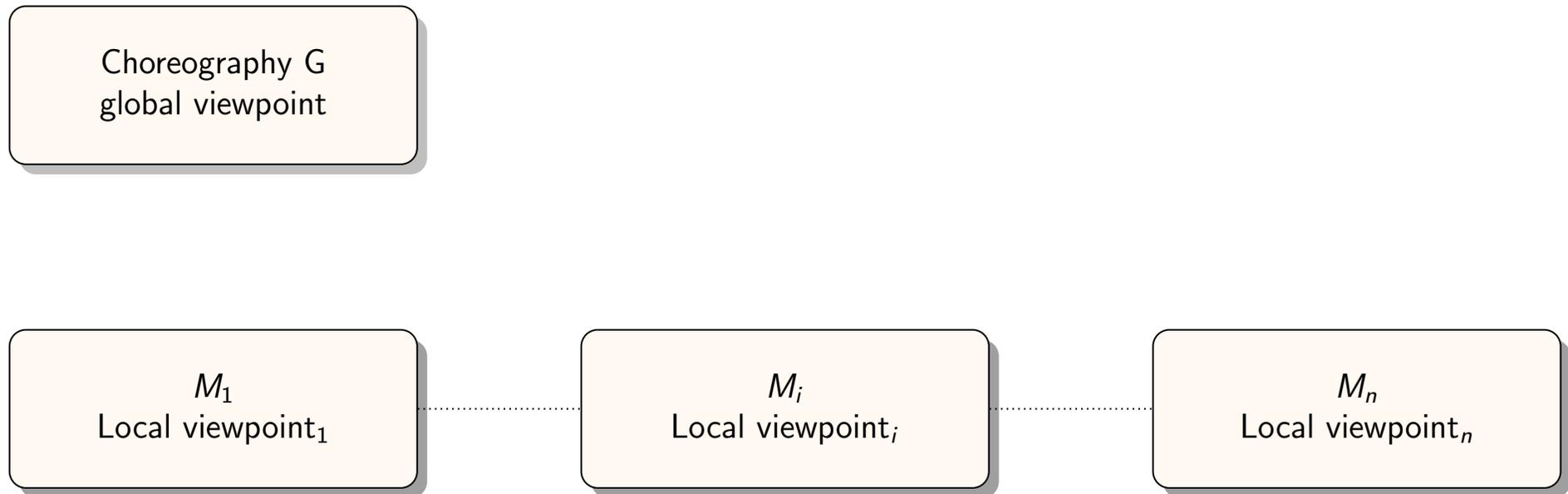
We address such question through

the application of a formal choreographic setting

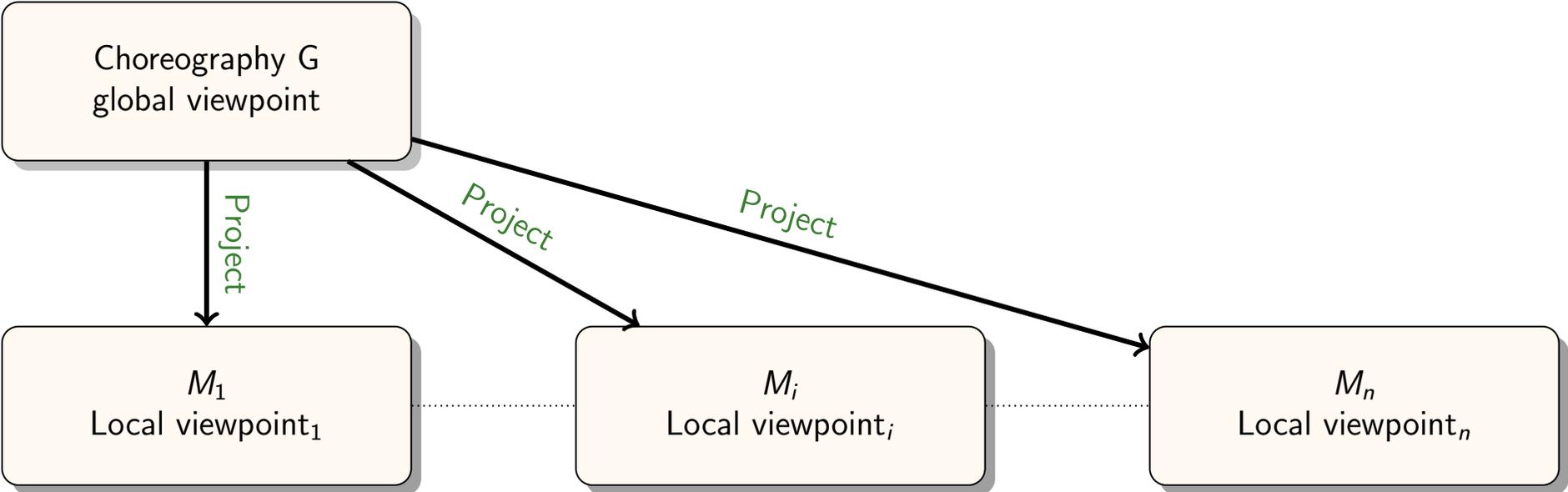
to the EU Custom business process models

and we draw some conclusions from this exercise

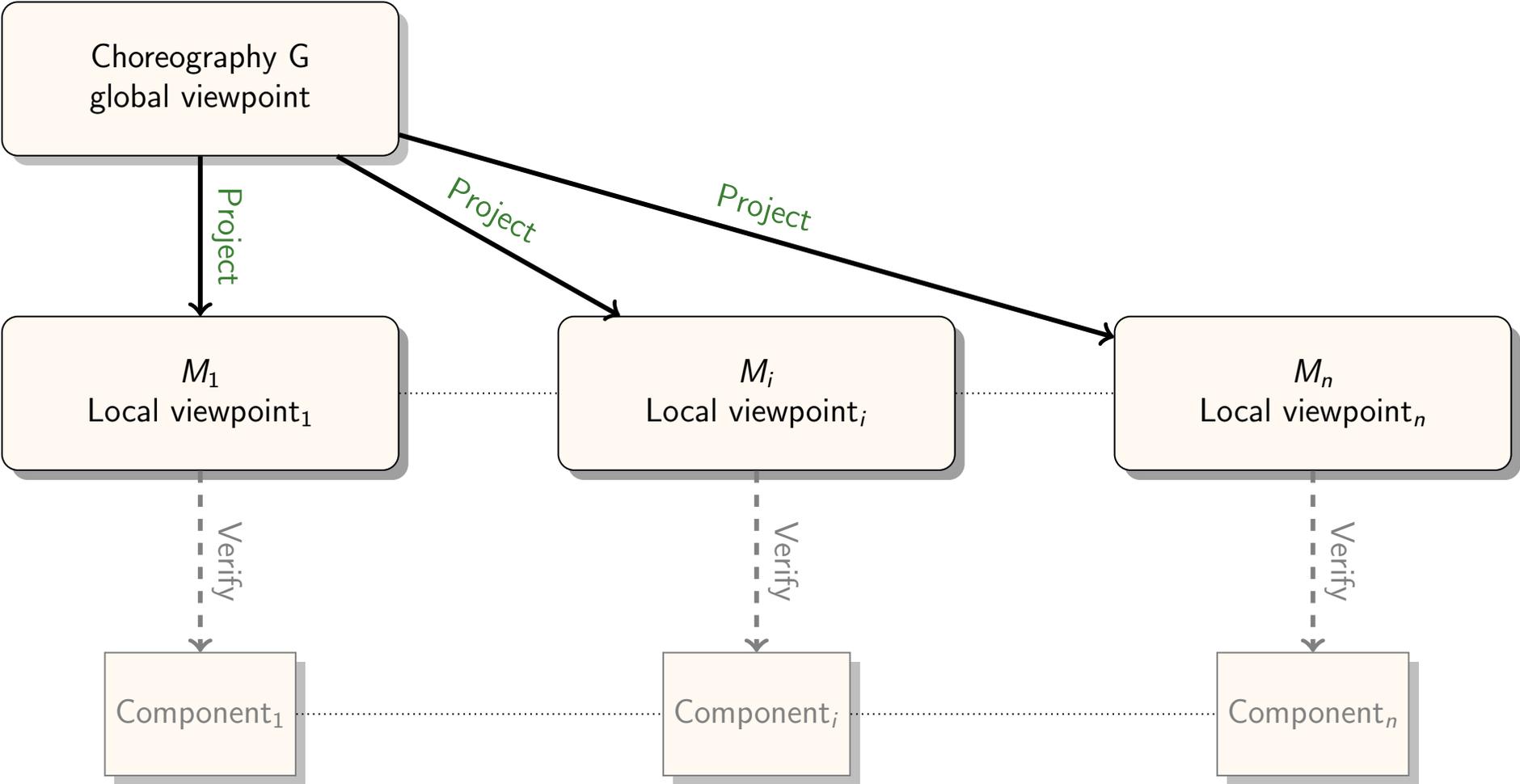
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– Prelude –

# Global specs, formally (I)

## Global specs as regular expressions

*Global choreographies* (G-choreographies for short)

- kind of regular expressions

$$G ::= (o) \mid A \rightarrow B : m \mid G ; G' \mid G + G' \mid *G$$

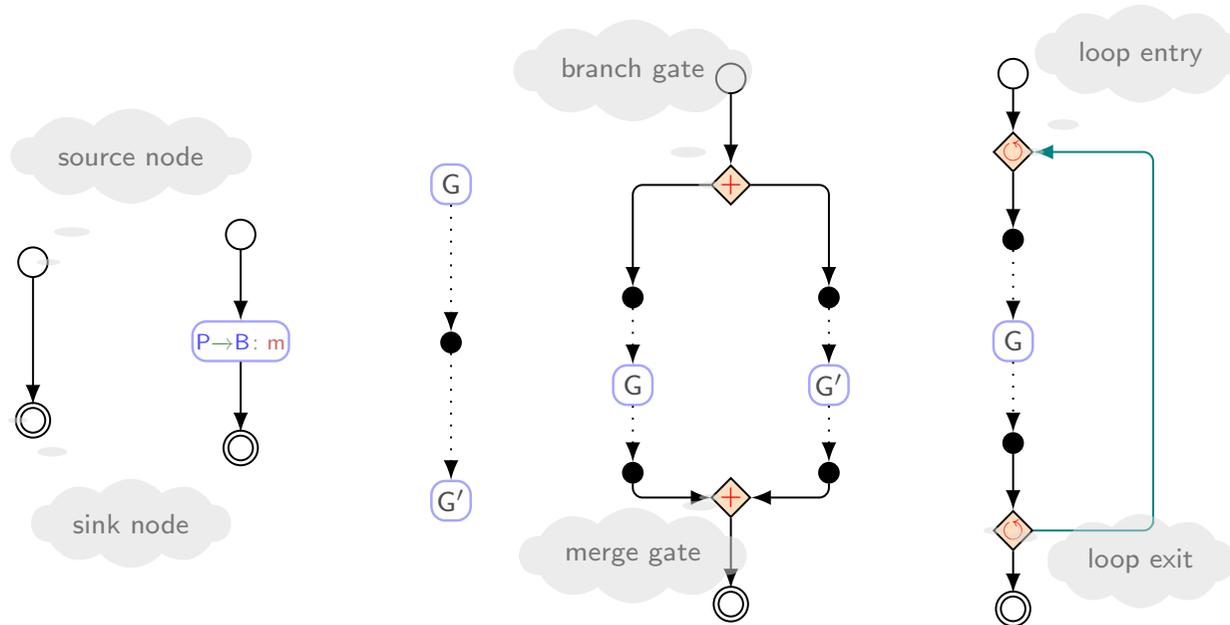
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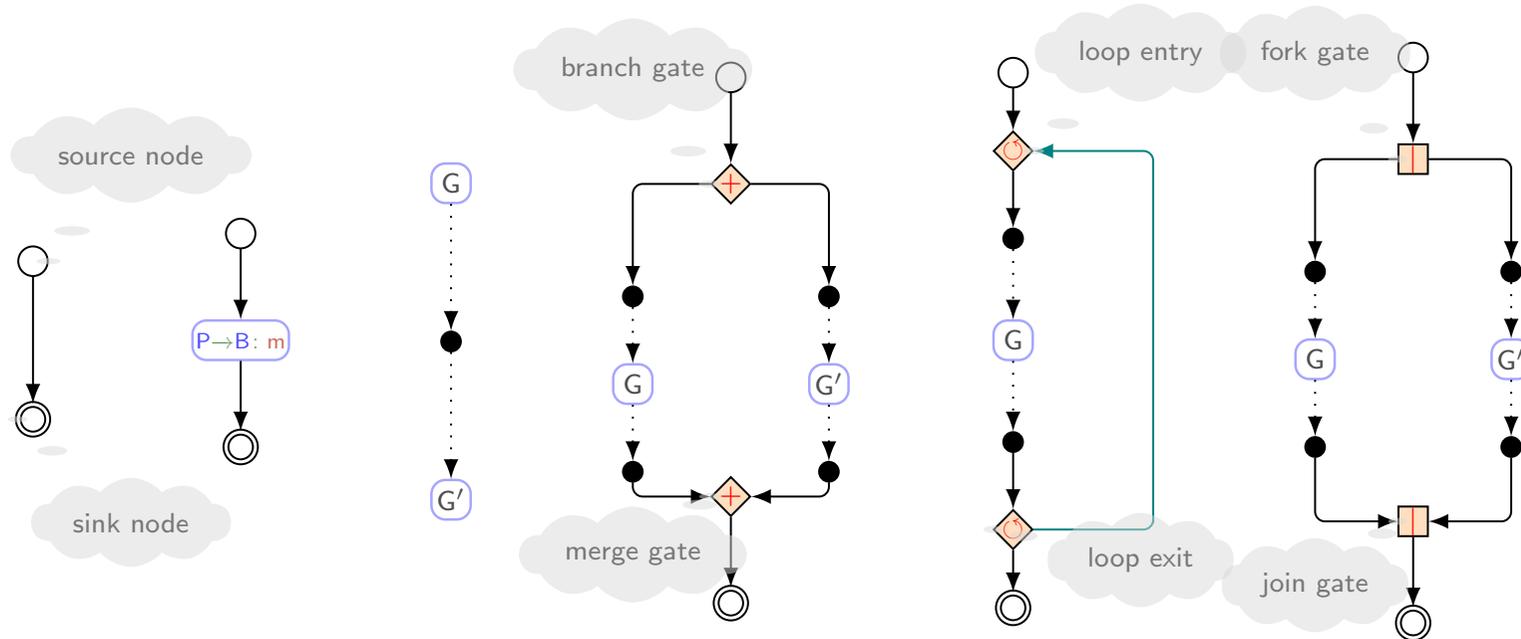
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Assume asynchronous communication. In a branch  $G_1 + G_2$

- there should be **one active** participant
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Well-branchedness

When the above holds true for each choice, the g-choreography is **well-branched**.  
This enables **correctness-by-design**.

(See [Tuosto & Guanciale JLAMP 2018] for the “greek symbols”)

# Class test

Which of the following global graphs is well-branched?

- $G_1 = A \rightarrow B: \text{int} + A \rightarrow B: \text{str}$
- $G_2 = A \rightarrow B: \text{int} + (o)$
- $G_3 = A \rightarrow B: \text{int} + A \rightarrow C: \text{str}$
- $G_4 = \left( \begin{array}{l} A \rightarrow C: \text{int}; A \rightarrow B: \text{bool} \\ + \\ A \rightarrow B: \text{bool}; A \rightarrow C: \text{bool} \end{array} \right)$

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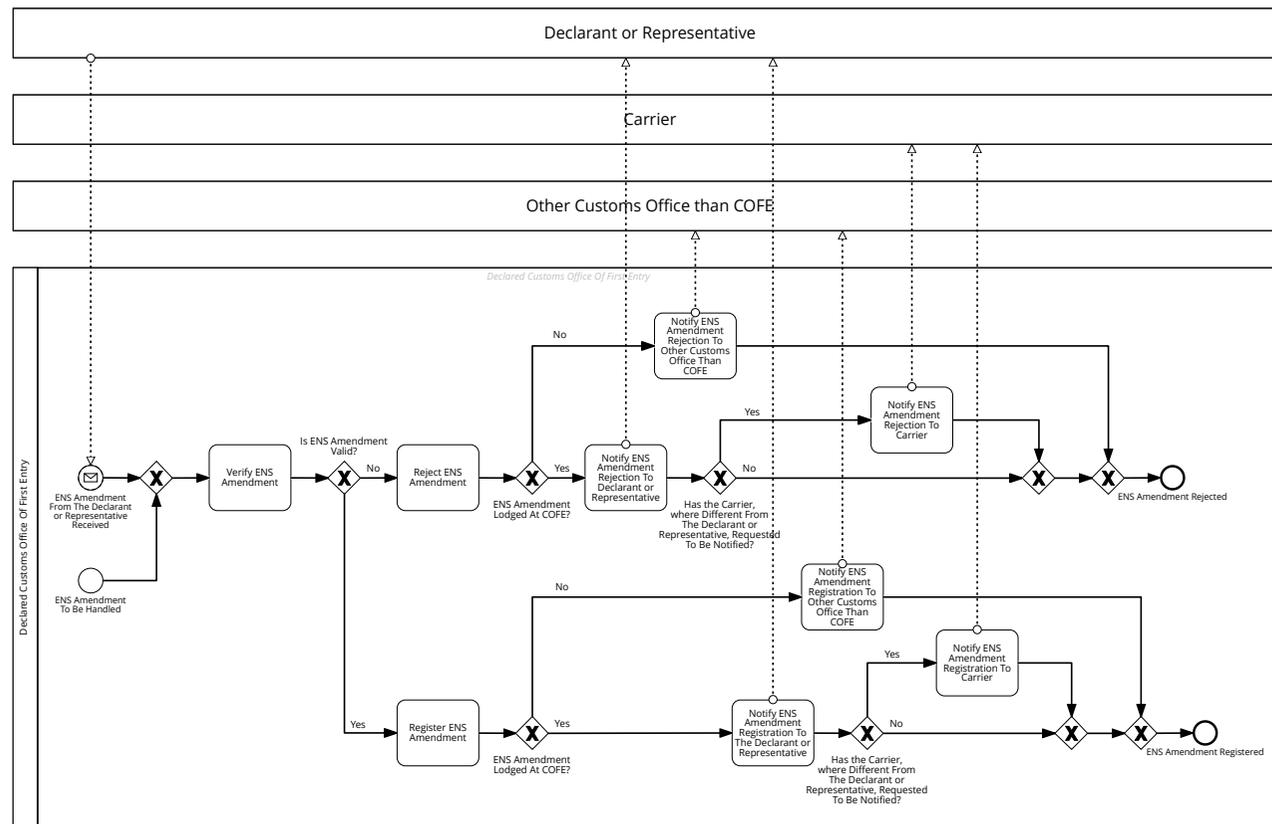


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# Global specs as BPMN diagrams

## Collaboration diagrams of EU custom process (Ignore the small print)

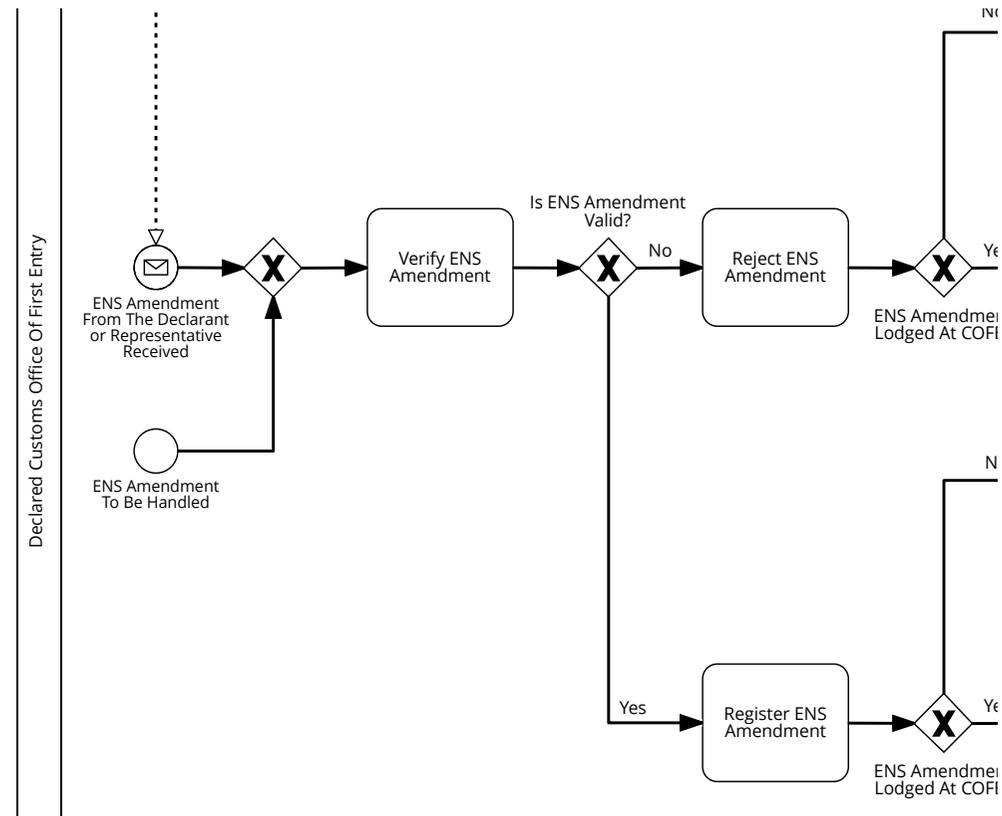


cf. <https://aris9.itsmtaxud.eu/businesspublisher>

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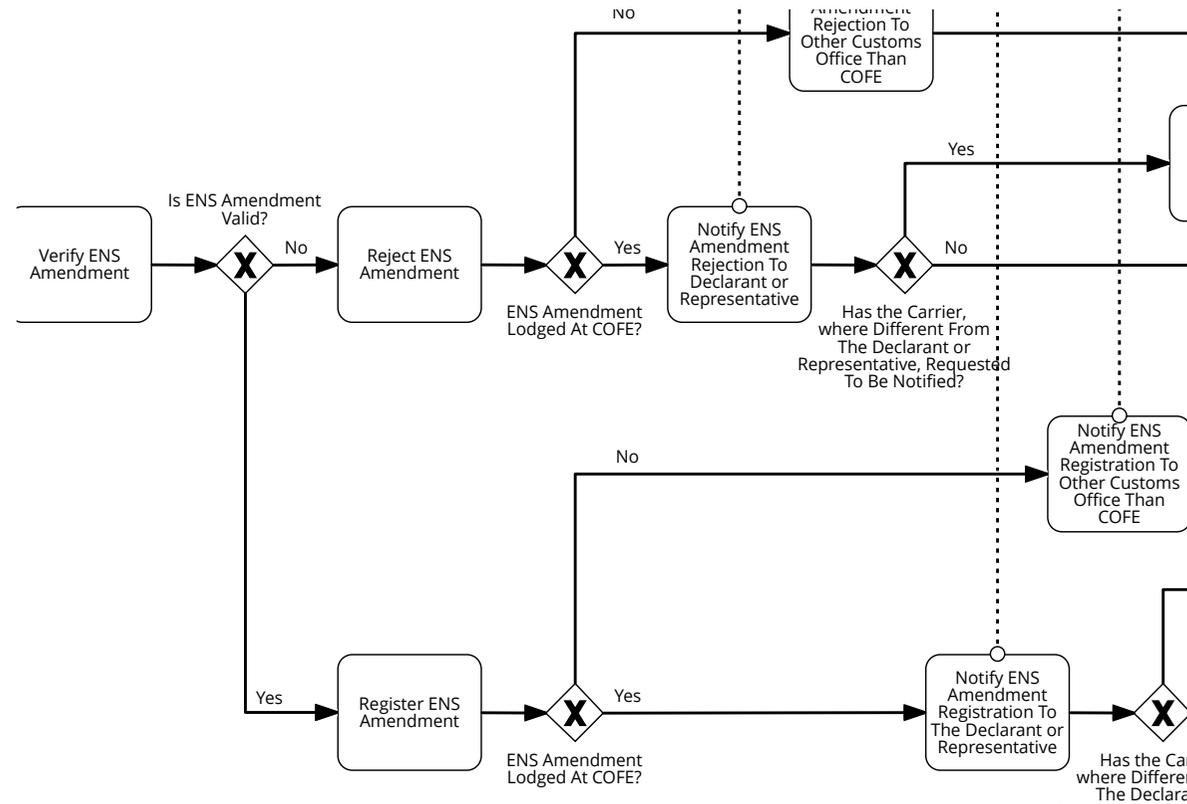
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– Results –

[ A modelling exercise ]

# Legal provisions

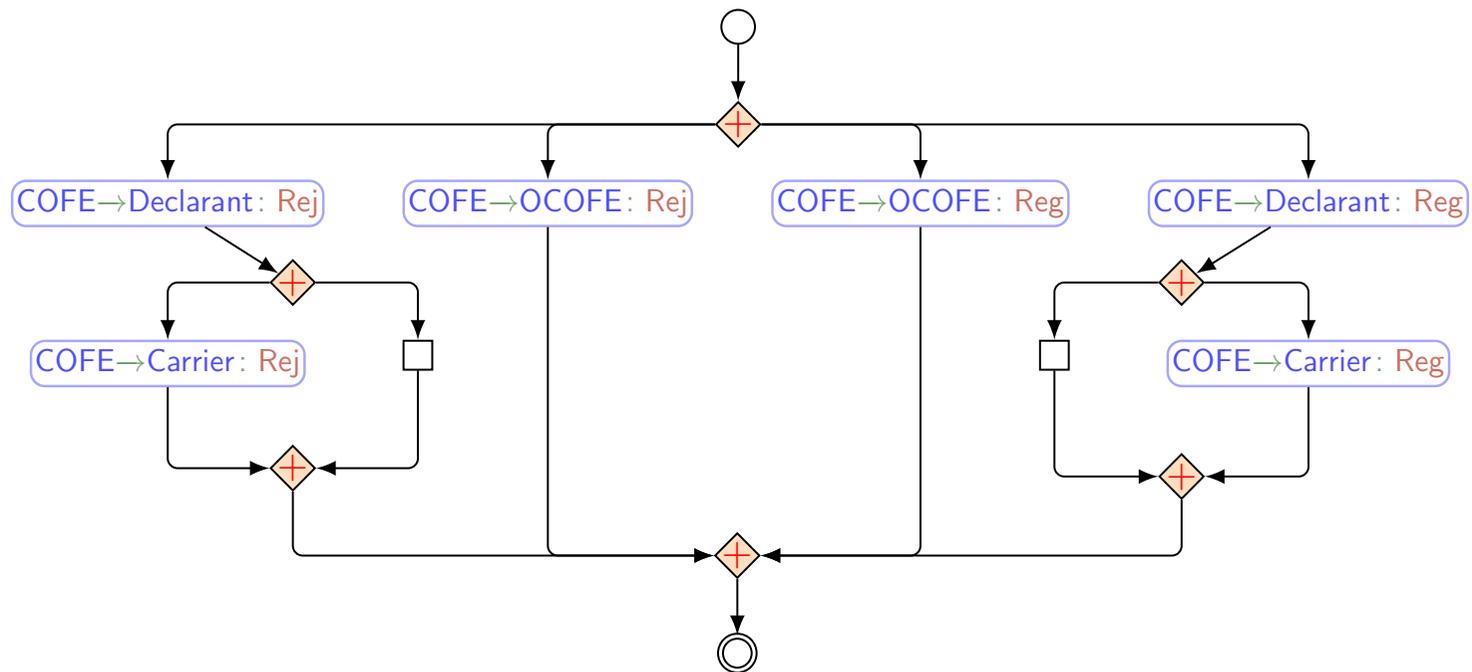
## A workflow for importing goods into EU

- Declarants submit an *entry summary declaration* (ENS) (i.e., information for the import such as nature of the goods, carrier, etc.)
- The submission triggers several tasks which depend on multiple factors:
  - where was the ENS lodged?
  - is the good imported by road&rail, sea, air,...?
  - is the ENS valid?
    - register, if it is
    - request amendments & notify involved parties, otherwise



# G-choreographies

## A succinct representation



Obtained by the BPMN diagram and looking at textual descriptions only when something wasn't clear

## Lessons learned (I)

Adopting formal models akin BPMN helps

### Some advantages of g-choreographies

- G-choreographies are more compact and their visual representation can be understood by lay stakeholders
- G-choreographies seem clearer than the BPMN spec...  
(I'm biased, of course)
- Other formalisms may be less clear (e.g., those relying on process algebras)

## Lessons learned (II)

Its great to start from BPMN diagrams, but...

### Coping with underspec

- maintaining the correspondence could be problematic  
E.g., the discussion on loops in the paper
- often sharing of relevant information implicit in value passing  
E.g., notification to carrier is **presumably** required in the ENS after carrier & declarant struck a deal
- sticking to the informal specification increases *non-determinism* (like in our model of the amendment process)

– Epilogue –

# Conclusions

## Expressiveness vs. Correctness-by-construction

- specs usually violate the conditions for correctness required by formal models  
E.g., well-branchedness is broken by *optional communications* such as the notifications from COFE to Carrier
- Mitigations:
  - *extra interactions* instead of relying on value passing
    - formalisation drifts away from BPMN specs
    - but help identifying ambiguities / lack of precision
  - use more general conditions
    - models different from BPMN
    - verification of conditions is more expensive

Thank you!

# Thank you!

If you are looking for job, get in touch

