UNIVERSITY OF SURREY

Faculty of Engineering and Physical Sciences
Department of Computing

SERVICE CHOREOGRAPHY, SBVR, AND TIME

- **Overview of the Research Work**
- **Objectives of Paper**
- **Why Declarative Approach?**
- **Current Approaches to Specification of Service Interactions**
- **Service Choreography Specification using SBVR**
- **Conclusion**

Overview of the Research Work

SERVICE ORIENTED COMPUTING (SOC)
- A principle paradigm to develop distributed applications

→ **Attract the interest of practitioners and researchers –** particularly in Online Collaborative Business Applications

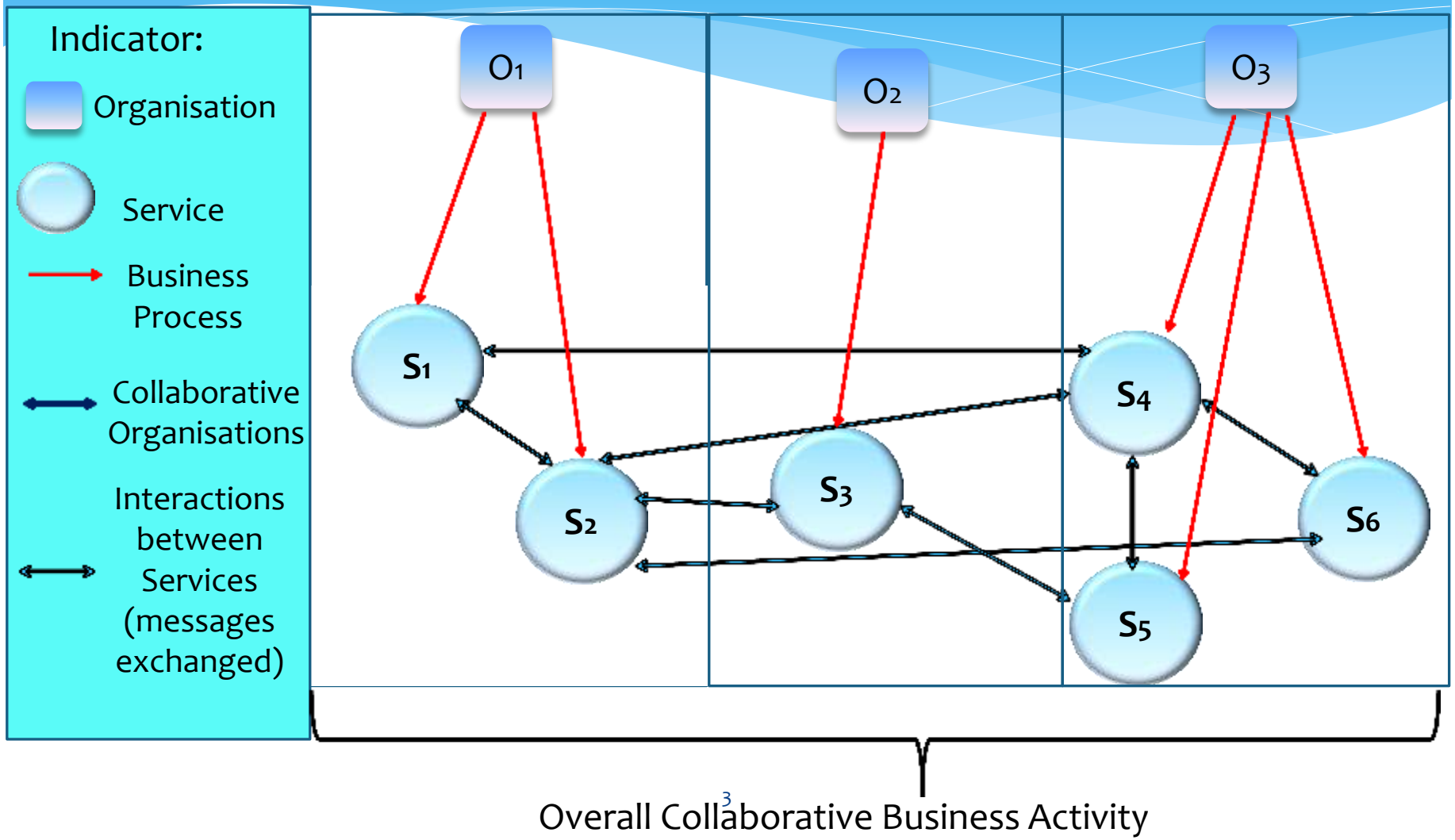
MAJOR CHALLENGES →

COORDINATION
(*the COORDINATION Int'l Conference series for 16 years running)

- To manage the interactions (messages exchanged) between loosely-coupled services from **different organisations** that contributed their part to the overall business collaborative process.
- There is no central coordinator to monitor and control the execution of service interactions across organisations.
- The ordering of the interactions between services.

*"COORDINATION: International Conference on Coordination Models and Languages," *A DisCoTec Member Conference*, 2014

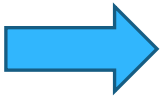
The Interactions between Services (across organisations) in Online Collaborative Business Applications



No Central Coordinator

"In real-world scenarios, corporate entities are often unwilling to delegate control of their business processes to their integration partners. Choreography offers a means by which the rules of participation within a collaboration can be clearly defined and agreed to, jointly. Each entity may then implement its portion of the Choreography as determined by the common or global view."

* N. Kavantzas, D. Burdett, G. Ritziger, *et. al. Web Services Choreography Description Language, Version 1.0*. World Wide Web Consortium (W3C) Working Draft 17-12-04, 2004



The Ordering of Service Interactions

It affects the dependencies between the participant services

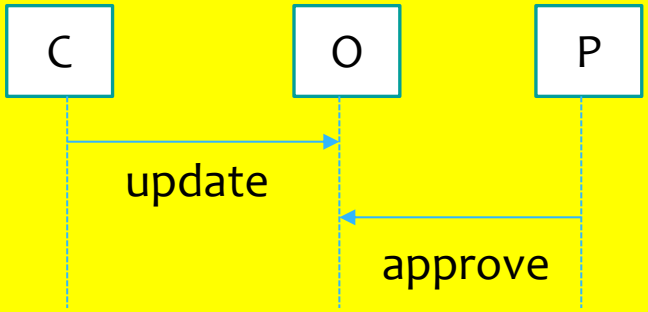
It affects the correctness in coordinating the service interactions

To avoid deadlock and race conditions

To ensure conformance and realisation

Race Condition in the Case Study : Photo-Shop Online

Race Conditions



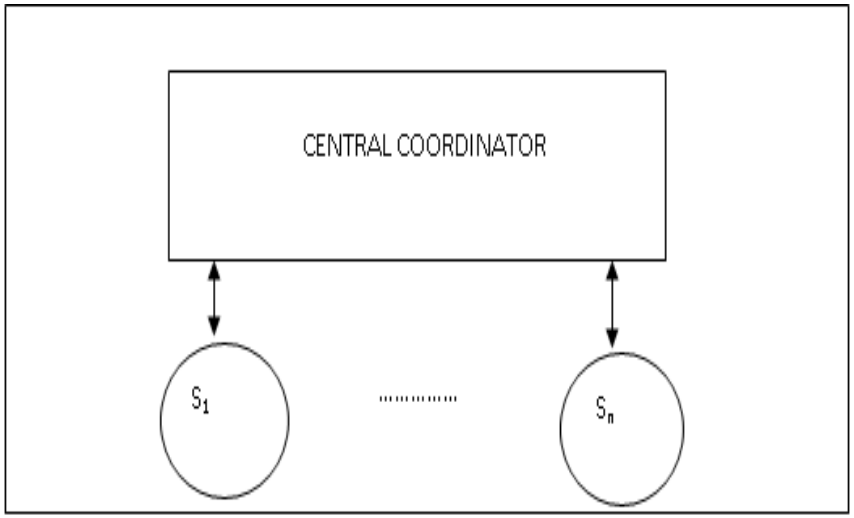
Indicator:

C Customer P Photo-shop O Order

Coordination

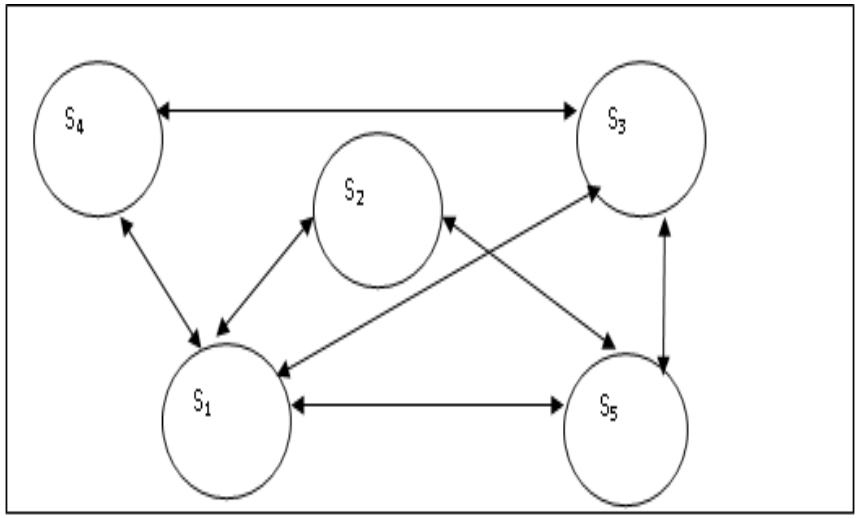
* The coordination of web services are considered to make a complex service to be a simpler ones. Two approaches:

I. Service Orchestration



The focus is on describing the interaction from a single service's viewpoint

II. Service Choreography



The focus is on describing the interaction from a global perspective (across participants)

Service Choreography, SBVR, and Time

We propose a declarative approach using SBVR for choreography specification.

We exploit SBVR to capture a notion of time:

- "B after A" – express **sequence/dependency**
- "B exactly 75 seconds after A" – not the explicit time period

Why declarative approach?

DECLARATIVE

* Focus on *what*
* Express business rules specification intuitively (for end-users/stakeholders)
* The effective methods for communication, interaction, and cooperation – choreographies & orchestrations [1]

[1] T. Bultan, R. Hull, B. Labs, M. Ave, and M. Hill, "Conversation Specification : A New Approach to Design and Analysis of E-Service Composition," in *WWW '03 Proceedings of the 12th international conference on World Wide Web*, 2003, pp. 403–410

IMPERATIVE/PROCEDURAL

* Focus on *how*
* Difficult to understand
* More restrictive
* Over-specifying/under-specifying [2]
* Modeller forces to premature decisions [2]

[2]F. Montali, M; Storari, S; Pesic, M; Mello, P; Aalst, van der, WMP; Chesani, "Declarative Specification and Verification of Service Choreographies," ACM Trans. Web,, vol. 4, no. 1, pp. 3:1–3:62, 2010.

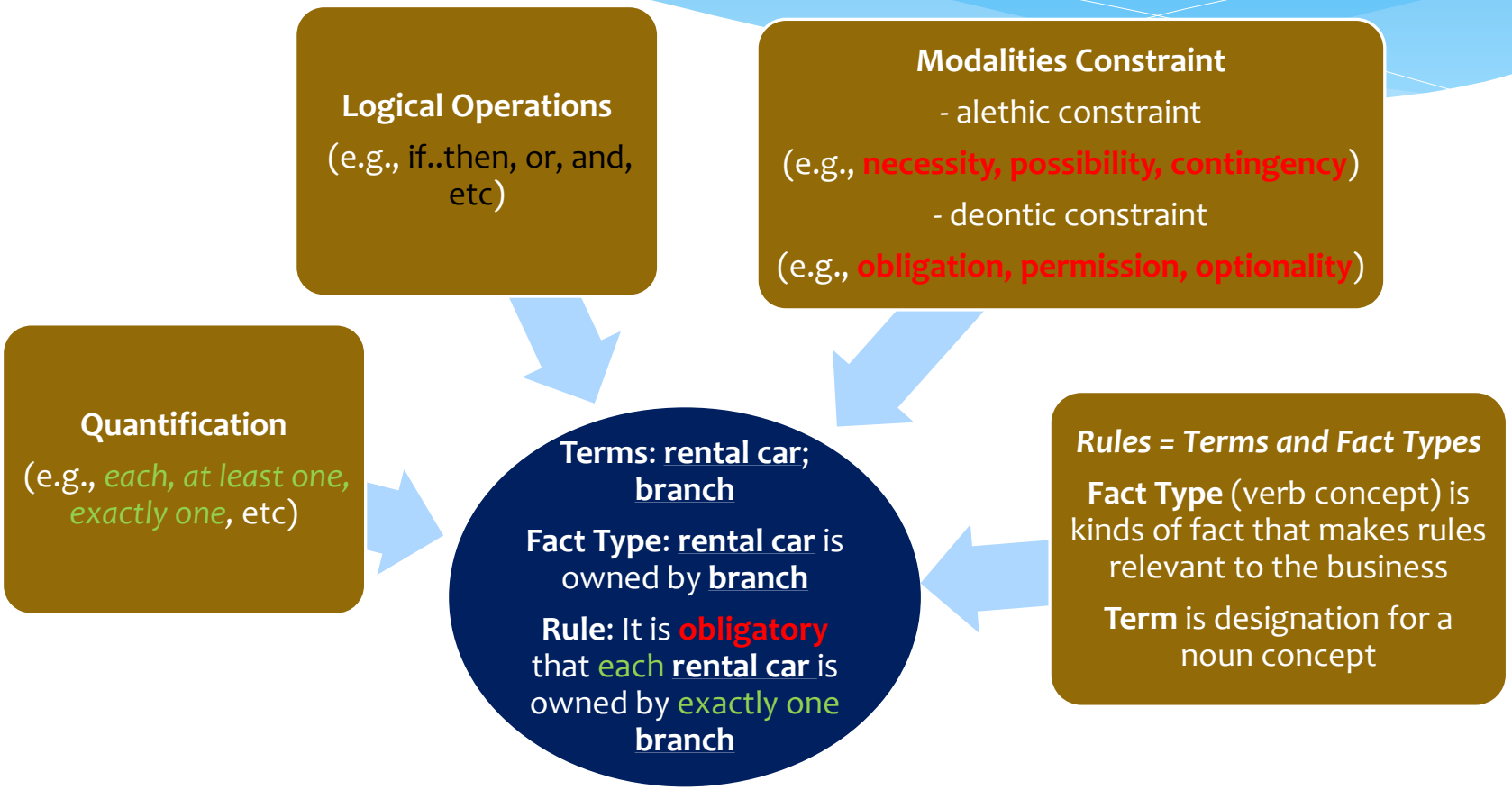
Current Approach to Specification Service Interactions

Informal Specification Languages	Formal Specification Languages	Declarative Choreography Specification

• Business Process Model Notation (BPMN)
• Web Services Choreography Description Language (WS-CDL)
• Unified Modeling Language (UML)
	• Vector Languages
	• Mealy Services
	• Communicating Sequential Processes (CSP) Traces
	• others
		• DecSerFlow [8]
		  • A proprietary language
		  • Graphical specification of service flows (mapped to Linear Tempoal Logic (LTL))

[8] F. Montali, M; Storari, S; Pesic, M; Mello, P; Aalst, van der, WMP; Chesani, "Declarative Specification and Verification of Service Choreographies," *ACM Trans. Web,*, vol. 4, no. 1, pp. 3:1–3:62, 2010.

Semantics of Business Vocabulary and Business Rules (SBVR)



Case Study : Photo-Shop Online

* The scenario of case for Photo Shop Online (DecSerFlow (F. Montali et al., 2010))

Both the customer and the shop are responsible for executing an order and they have the following options:

Customer

The customer can enter order data, such as name, address, credit card number and preferred way of delivery, via activity "register". Activities "photo" and "poster" can be used to order photographs and posters (respectively) by uploading files and selecting wanted formats. Customer can also order photo albums by executing activity "album". Activities "receive" and "pay" are used when receiving and paying ordered products, respectively.

Photo Shop

The shop records order data via activity "open order". Activity "print" is used to print ordered photos and posters. The shop delivers products and charges the customer for the service via activities "deliver" and "charge".

The Applications Note

1. The shop will not "open order" before the customer executes activity "register". When the customer executes activity "register", the shop will update its data via activity "open order". This rule ensures that the shop has the right order data.

2. After the customer orders photos and posters (via activities "photo" and "poster"), the shop prints ordered products via activity "print".

3. Each ordered product ("photo", "poster" or "album") has to be delivered via activity "deliver". The shop will not "deliver" before at least one product is ordered.

4. Customer can receive products only after the shop executes "deliver".

5. Customer can "pay" before (e.g., credit card) or after (e.g., when picking up) the shop executes its activity "charge".

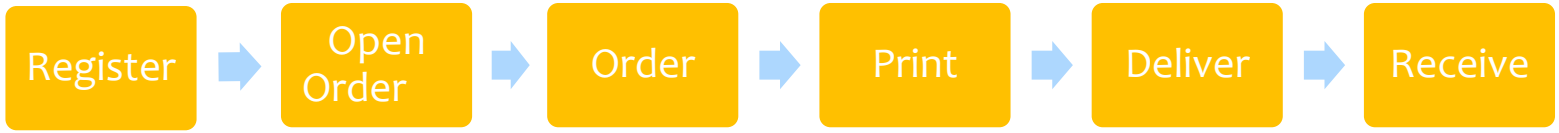
Informal Specifications

SBVR Rules:

It is obligatory that each product *is ordered by* **customer occurs before each product** *is printed by* **photo-shop.**

Rules in SBVR model

The Dependency/Sequence of Process



The sequence of processes

A notion of time

The ordering of service interactions (Dependency/Sequencing, not period/interval (Allen's temporal))

Propose: SBVR

-Type 2 ("Date-Time Vocabulary, V1.0," OMG) – Temporal relationship (situation kinds and occurrences)

- The objectification ("Semantics Of Business Vocabulary And Business Rules (SBVR), V1.2," *OMG*)

"B after A"

The Objectification

An example rule in this case study that used the objectification :

"It is obligatory that each product *is ordered by* **each customer** *occurs before* **each product** *is printed by* **photo-shop**".

Fact Types: **product** *is ordered by* **customer** and **product** *is printed by* **photo-shop** .

Terms: an **ordered product** and a **printed product** (an *actuality* denoted by the *objectification* of the given both fact types)

The vocabulary structure:
State of affairs1 *occurs before* ***state of affairs2*** *occurs*
ordered product is a state of affairs$_1$; **printed product** is a state of affairs$_2$

"**It is obligatory that an ordered product** that *is of* **customer occurs before** a **printed product** that *is of* **photo-shop**."

SBVR First Order Logic

Declaration:

x is a product; y is a customer; z is a photo-shop;

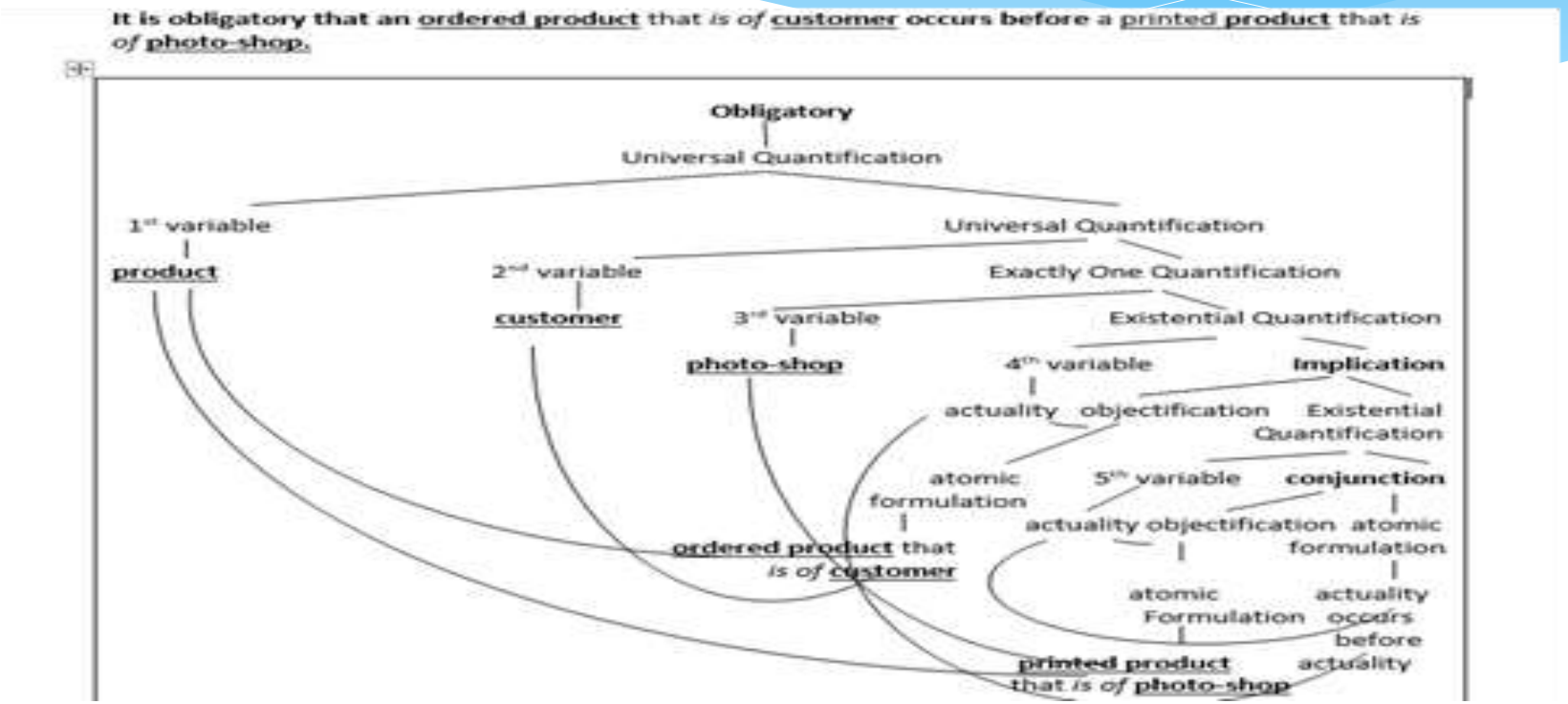
$P(x, y)$: x is ordered by y $T(x, z)$: x is printed by z

$B(P(x, y), T(x, z))$: $P(x, y)$ occurs before $T(x, z)$

RULES	**First Order Logic**
It is obligatory that each <u>product</u> *is ordered by* **each <u>customer</u>** *occur before* **each <u>product</u>** *is printed by* **<u>photo-shop</u>**	$O\forall x \forall y \exists^1 z(B(P(x, y), T(x, z)))$

SBVR First Order Logic

SBVR Logical Formulation



SBVR Logical Formulation

Conclusion

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* **Analysis of complex interactions**
  * Online collaborations, Coordination, Service choreography
  * Specification, Reasoning
  * SBVR: make the business rules accessible both to the experts and non-experts (business people), thus improving their inter-communication
* **Open questions (SBVR as a modelling language):**
  * Have all rules been captured? *completeness* of rule set
  * When does a Term come to existence? *instantiation* of the model
* **Future work:**
  * Determining the complete set of behaviours (the possible outcomes)
  * Reasoning (*deadlock* & *race-conditions*)
  * Choreography Verification (*conformance* & *realisation*)

Thank You!!

Questions?