OÉ Gaillimh
NUI Galway

Supply Chains Modelling and Simulation Framework: Graph-Driven Approach Using Ontology-Based Semantic Networks and Graph Database

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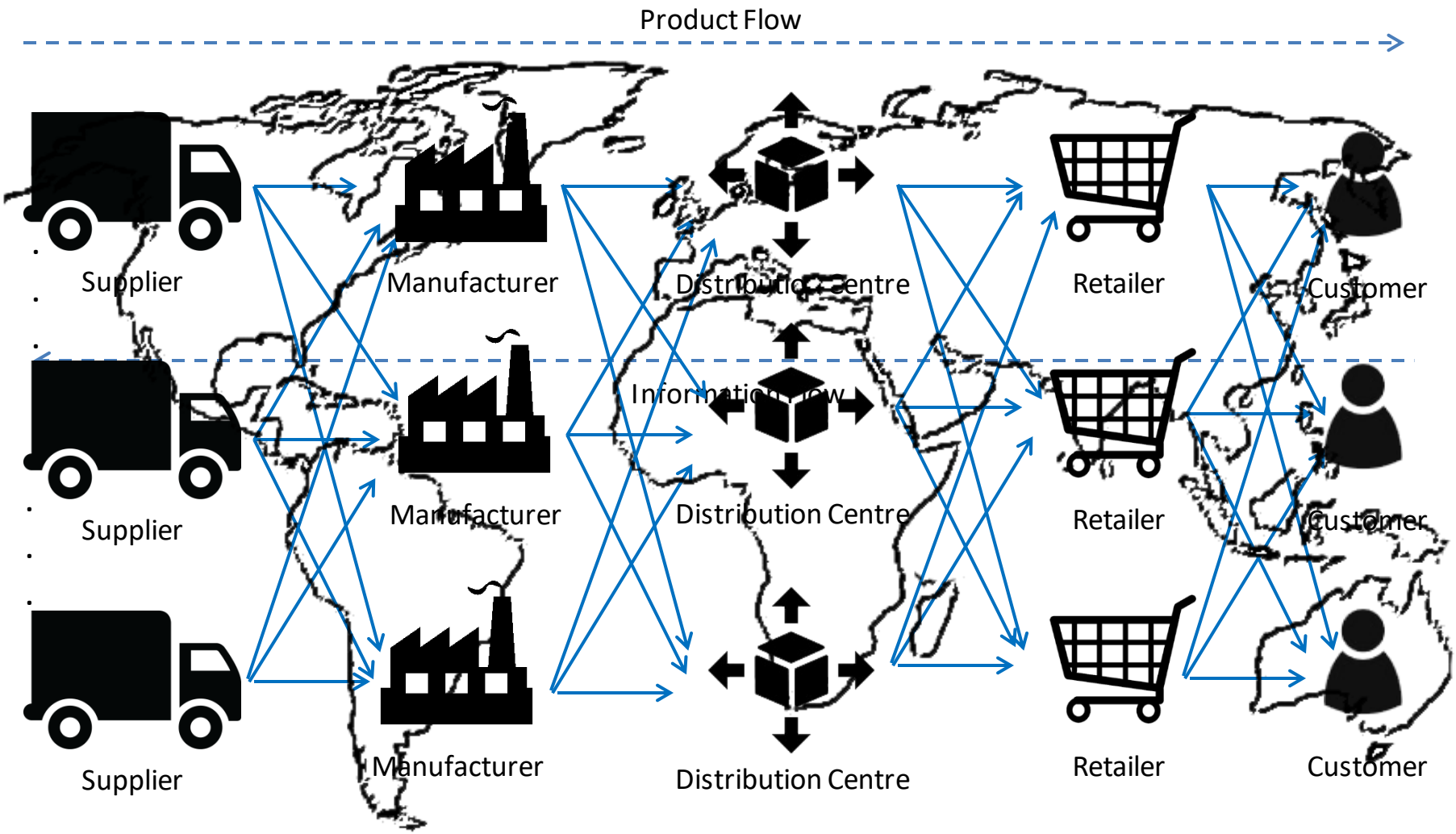
Outline

- Supply Chains Background
- Research Problem
- The Proposed Framework & Methodology
- Expected Outcomes

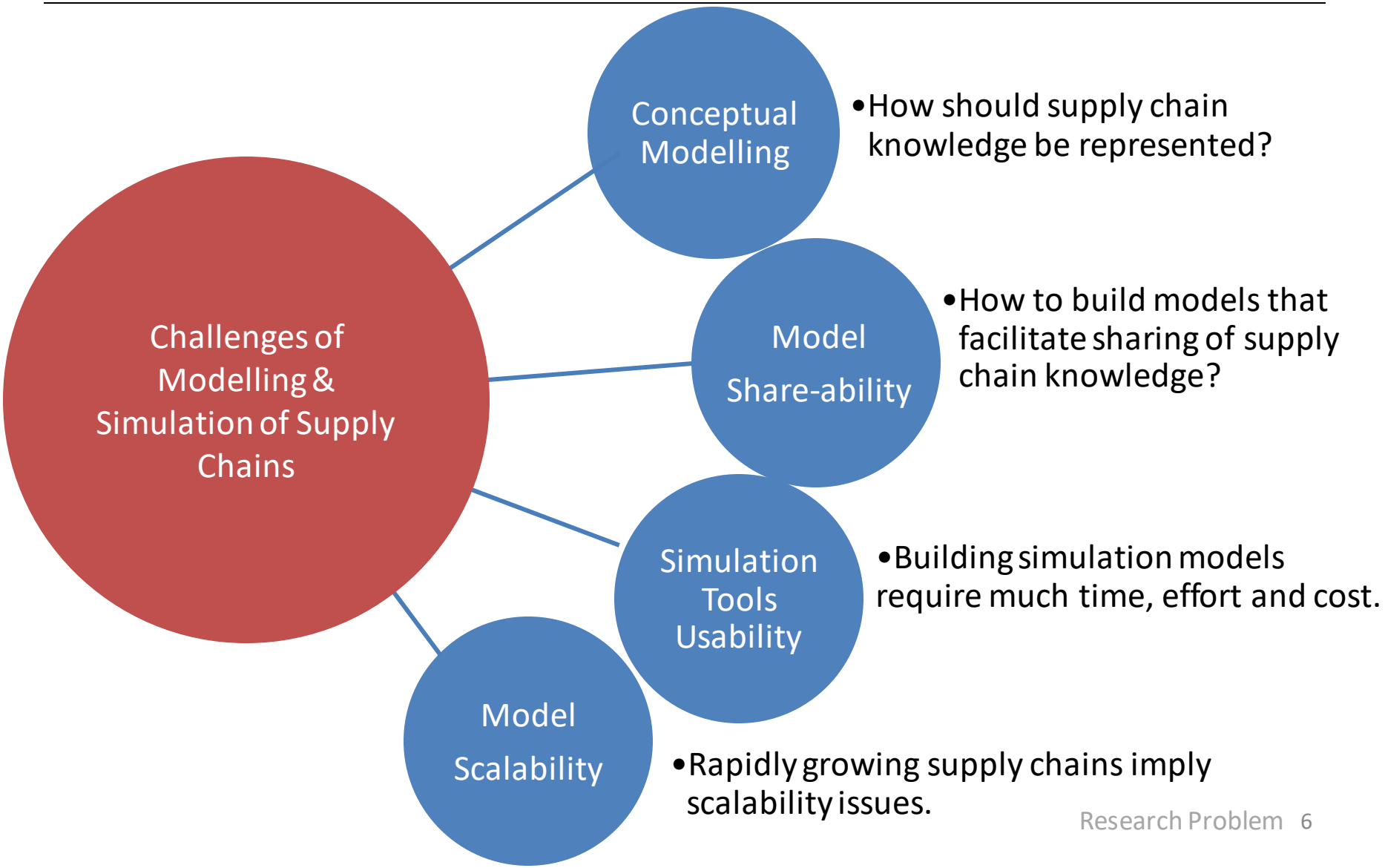
Supply Chains Background

What is a Supply Chain?



Research Problem

Outline of Challenges



Potential Gaps in Literature

Conceptual Modelling

- The lack of a standard basis for modelling supply chains.
- The developed models might not help with scalability for large-scale supply chains.
- The Lack of recognition that supply chains are neither completely discrete nor continuous, but a mixture of both.

Supply Chains Ontology

- Apart from (*Fayez, Rabelo, 2005*), the ontology mainly addressed the strategic level of supply chains.
- The shortage of industry-specific ontologies.

Simulation Tools

- Simulation tools were mostly convenient for simulation experts.
- Automatic generation (model-driven architecture) of simulation models has been little addressed.

The Proposed Framework

Outline of Objectives

Conceptual Modelling

- Providing a semantic-based modelling method for supply chains.
- Investigating the flexibility and scalability provided by graph database for building complex large-scale supply chain models.

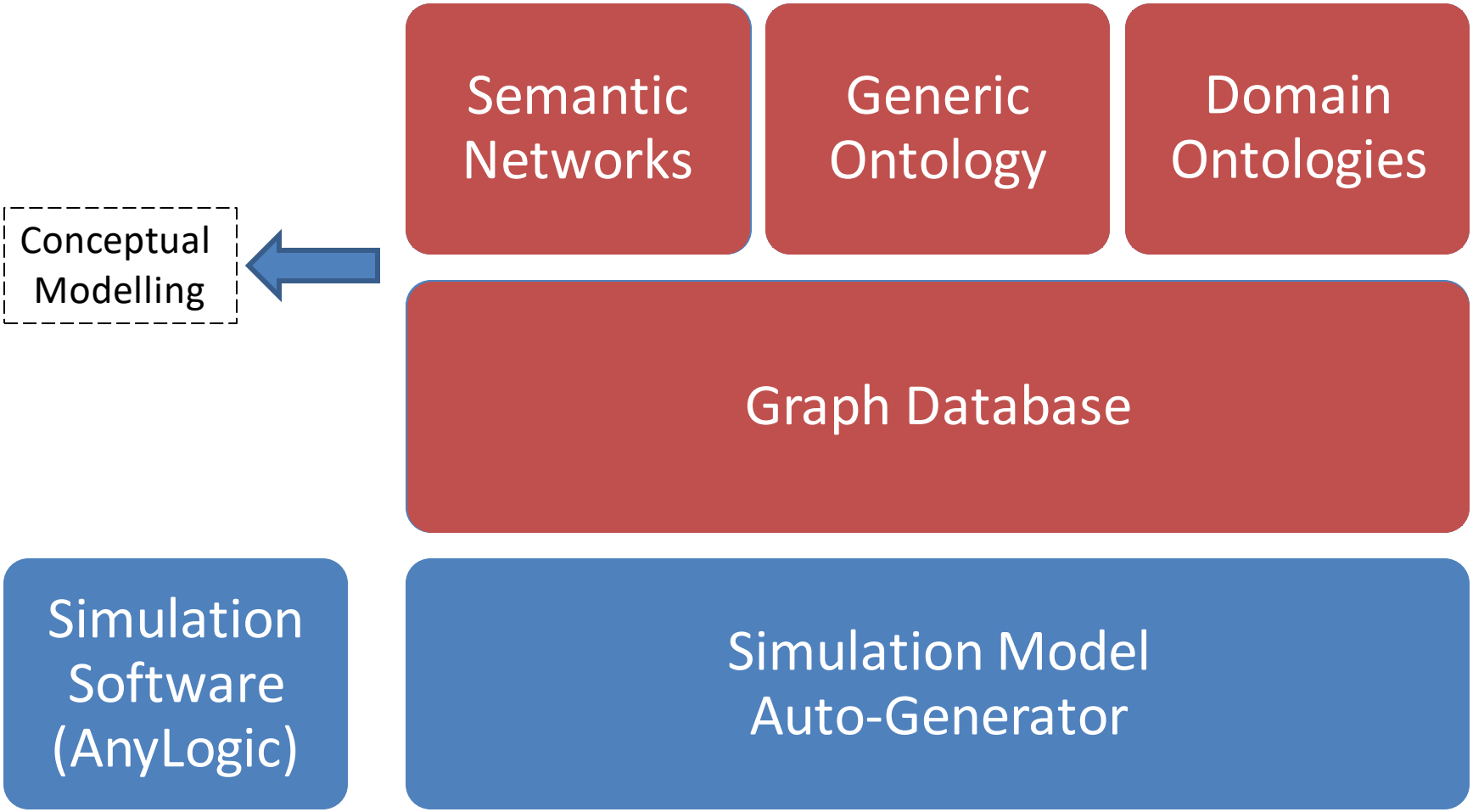
Supply Chains Ontology

- Developing generic ontology that can describe the strategic, tactical and operational levels of supply chains.
- Developing specific ontology for healthcare supply chains.

Simulation Models

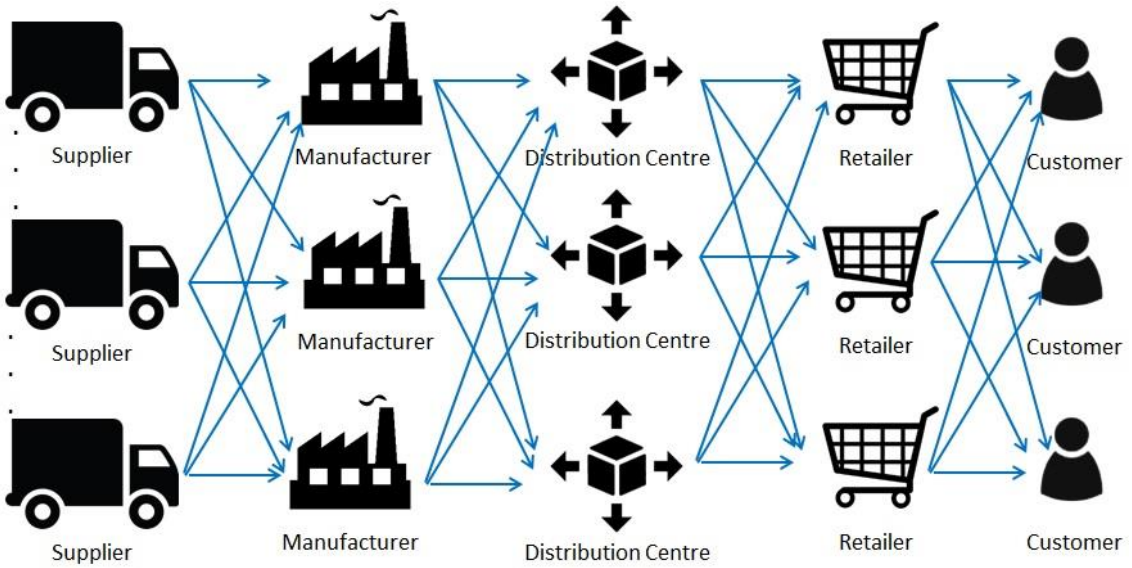
- Automatic generation of simulation models based on high-level conceptual models to help non-simulation experts.

The Proposed Framework Overview



Conceptual Modelling Approach

Supply Chains as Big Graphs

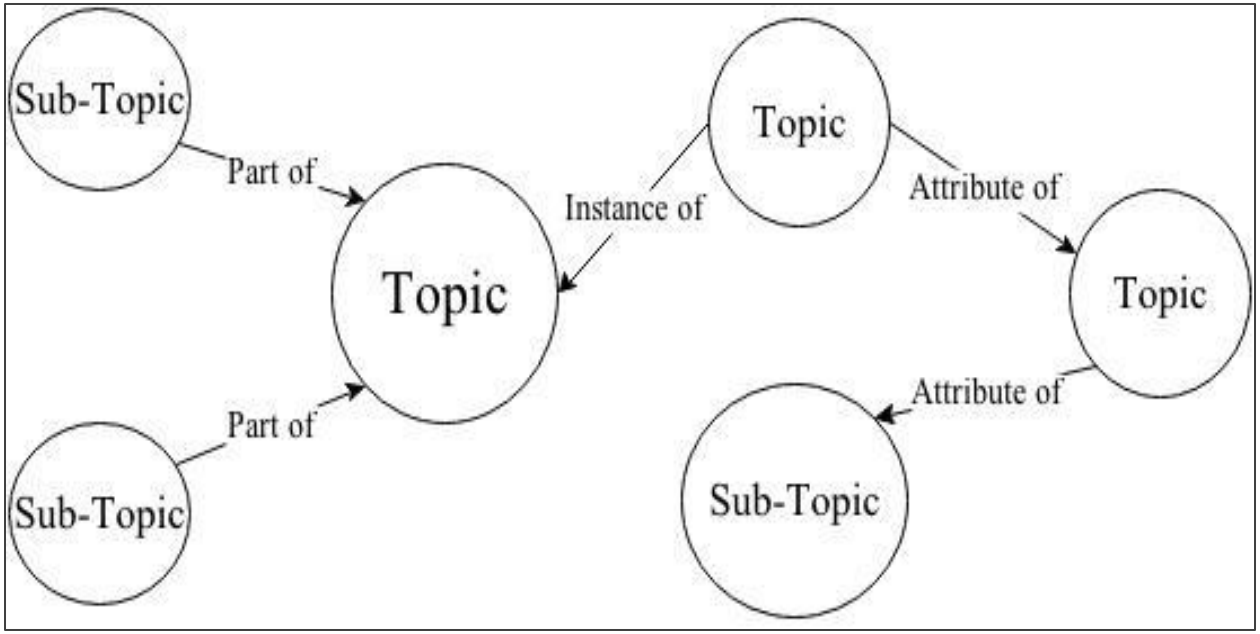


A typical supply chain example.

- A virtual complex network of suppliers, manufacturers, wholesaler, retailers and customers connected through upstream and downstream linkages.

- Apparently, it can be conceivable to consider modelling supply chains as constructing **"Big Graphs".**

Supply Chains as Semantic Networks

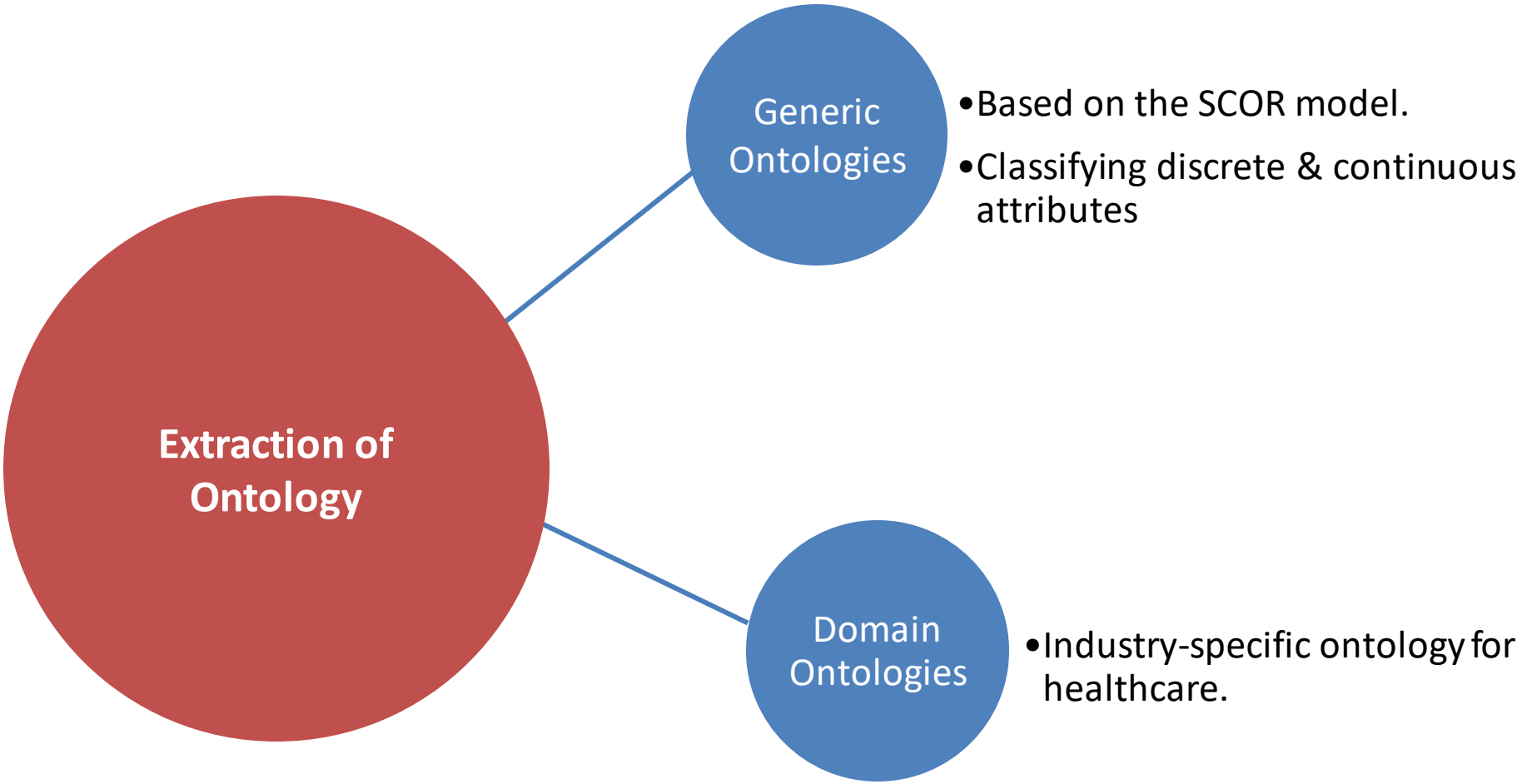


An example of a semantic network.

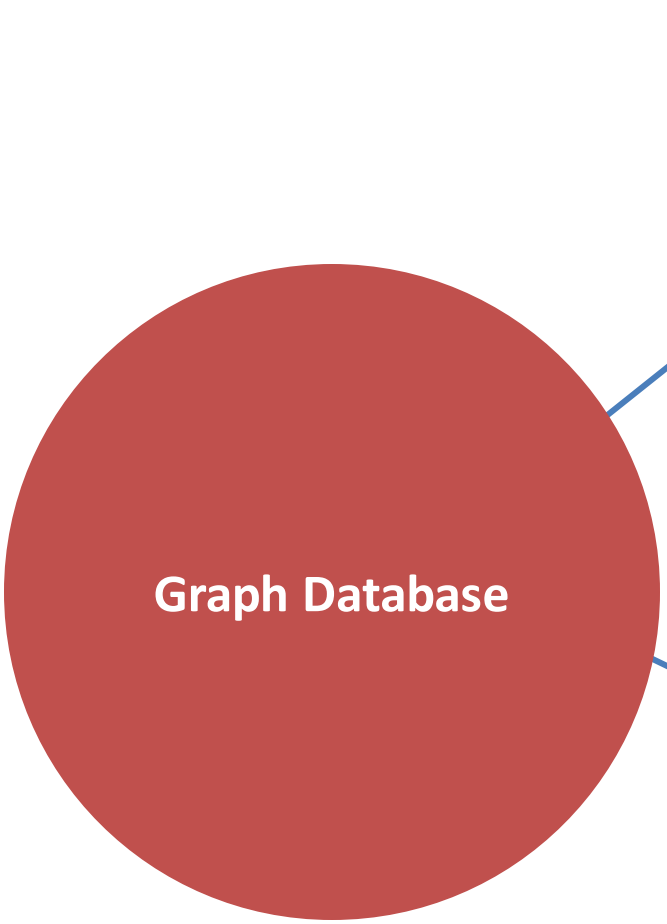
Nodes → The supply chain participants (entities) interconnected.

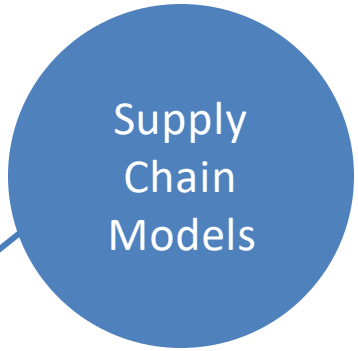
Arcs → Predicates that can represent properties or relationships.

Supply Chains Ontology



Models and Ontologies Storage with Graph Database



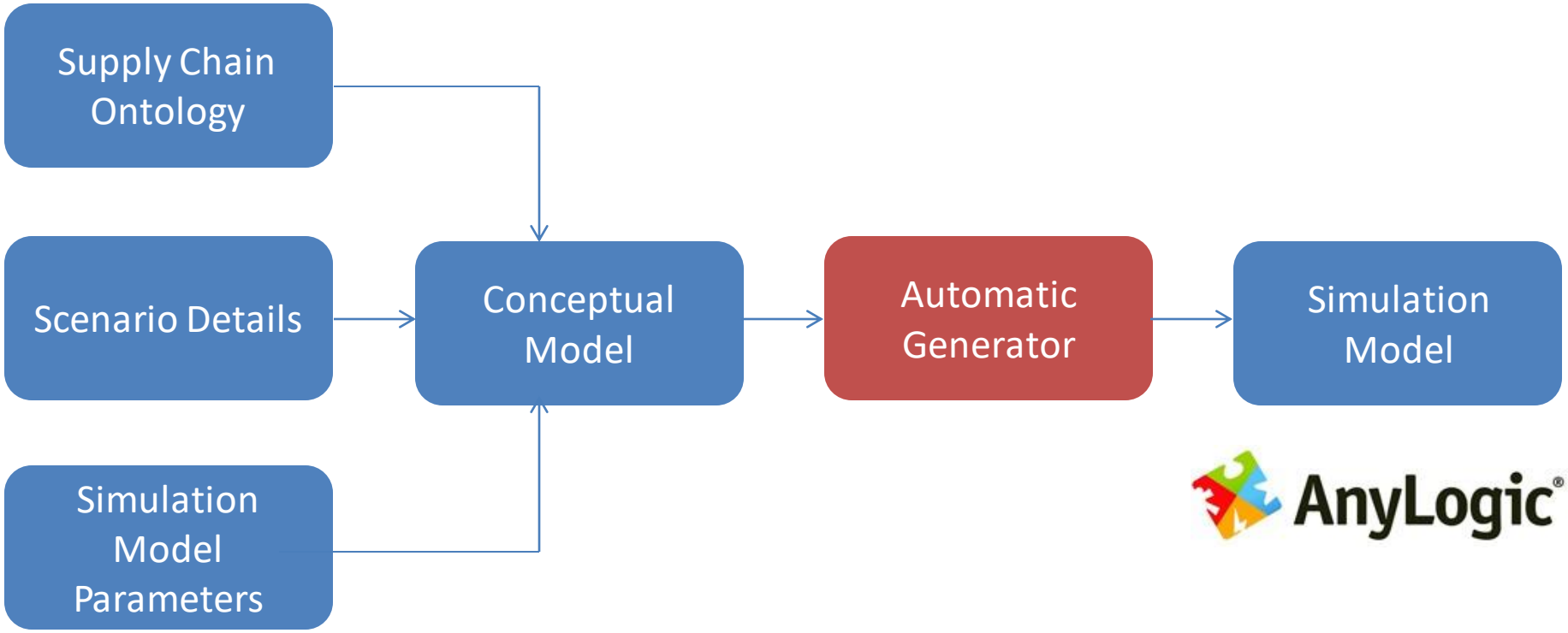


- Flexible graph-based models.
- Scalable schema-less models.

- Typically faster for associative datasets.
- Potential flexibility to align the ontology with RDF-based format.

Building Simulation Models

Automatic Generation of Simulation Models



Expected Outcomes

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- Higher flexibility and share-ability of supply chain models through semantic graph-driven models.
- Extended potentials for storing large-scale supply chain models using graph database.
- Extracting generic ontology for supply chains.
- Developing specific ontology for healthcare supply chains.

Expected Outcomes (cont'd)

- Capability to build combined discrete-continuous models based on discrete-continuous classification of ontology attributes.

- Helping non-simulation experts by automatic generation of simulation models.

Thank You!