A generic modelling to capture the temporal evolution in graphs

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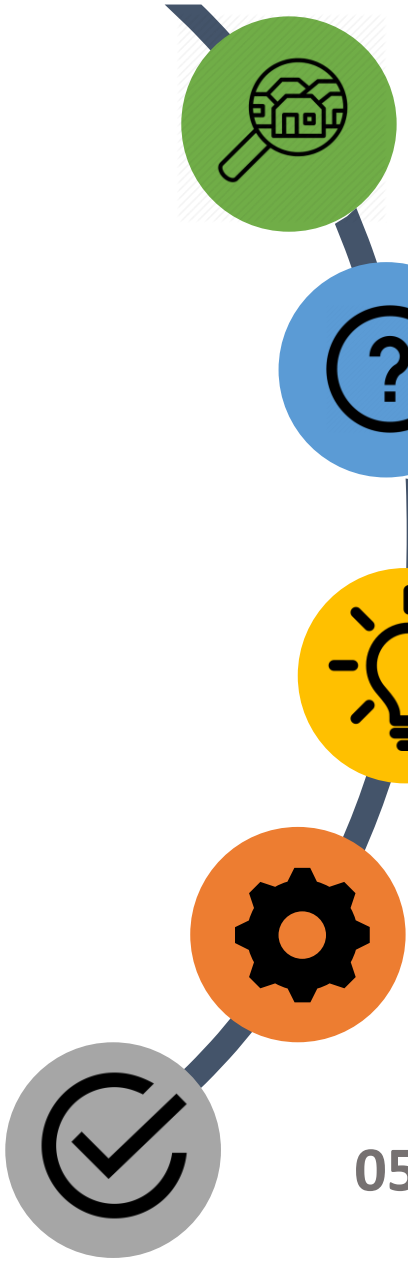
AGENDA



01 – GENERAL CONTEXT

02 – RESEARCH QUESTION

03 – PROPOSITION

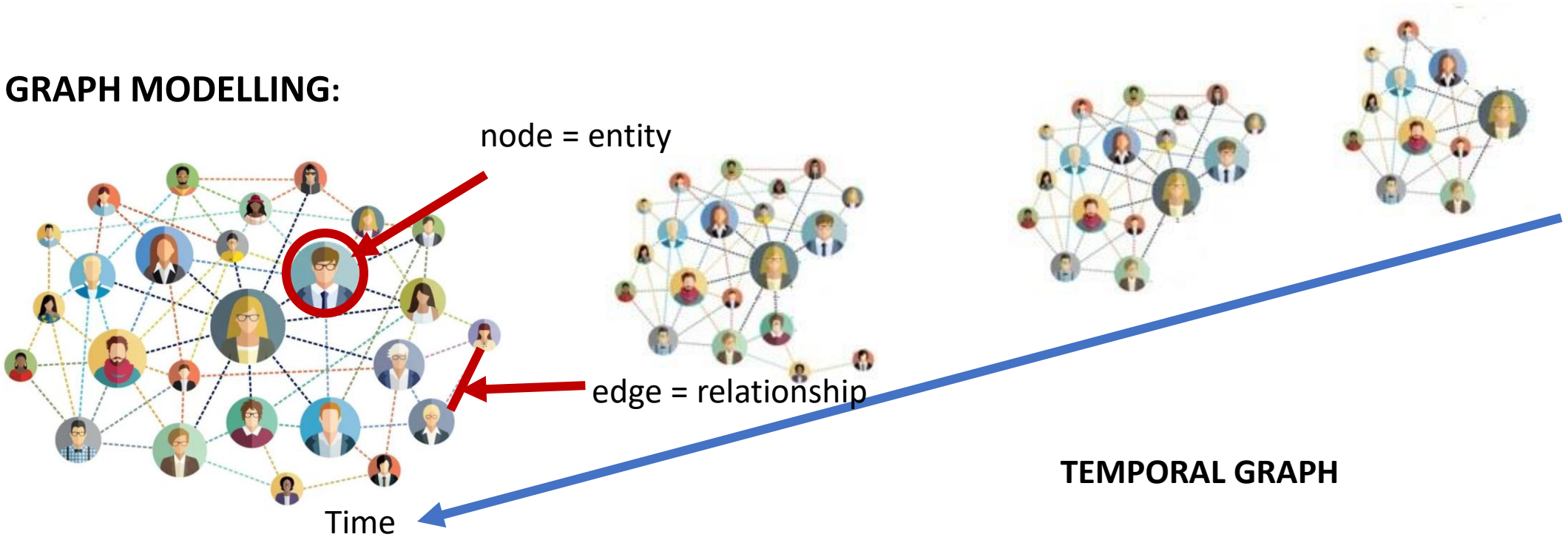
04 – IMPLEMENTATION

05 – CONCLUSION

BUSINESS ISSUES:

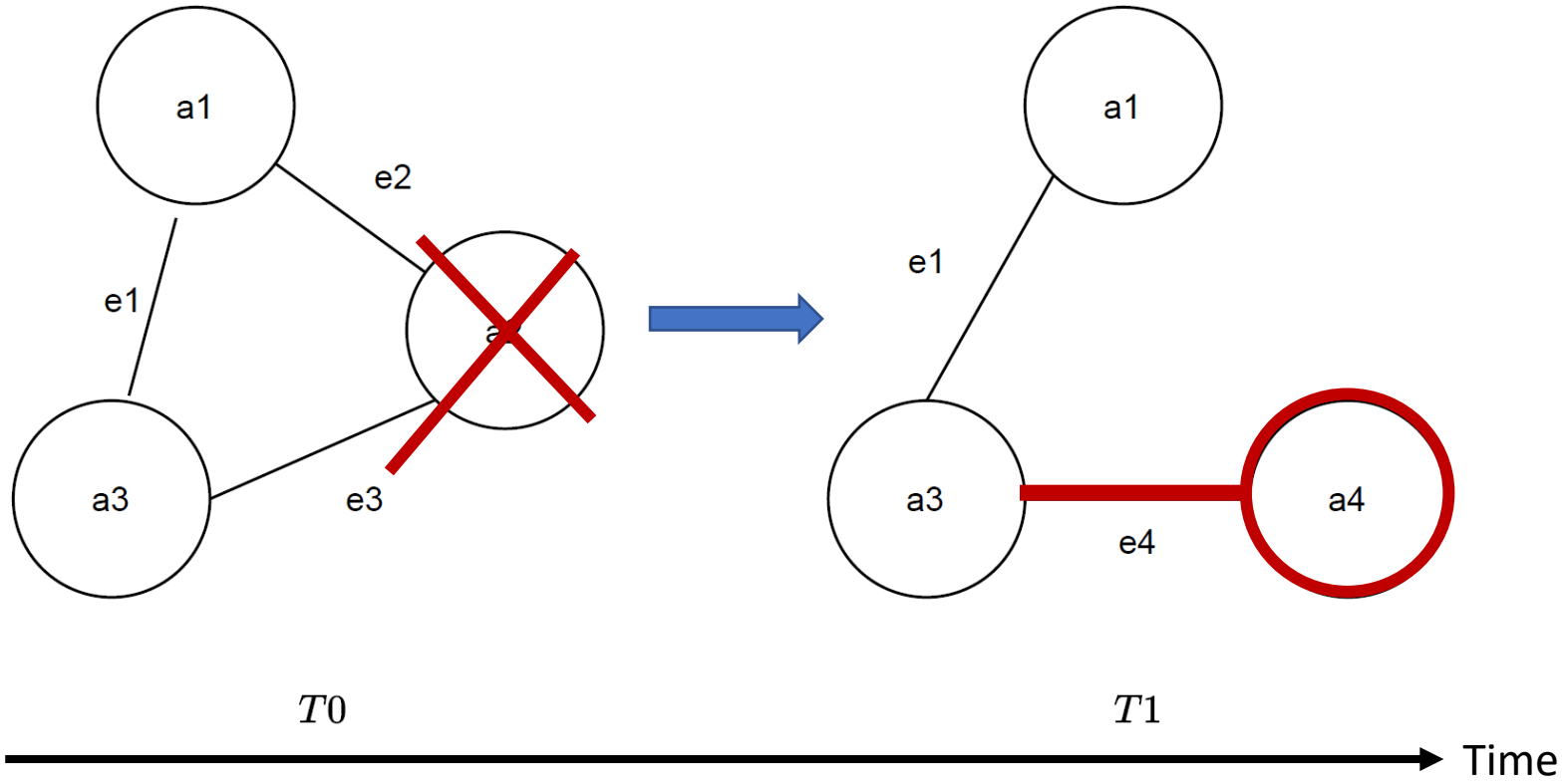
- Goal of companies: ***continually evolve*** and ***change*** business processes.
- How? use ***interconnected*** and ***time-evolving*** data.

GRAPH MODELLING:



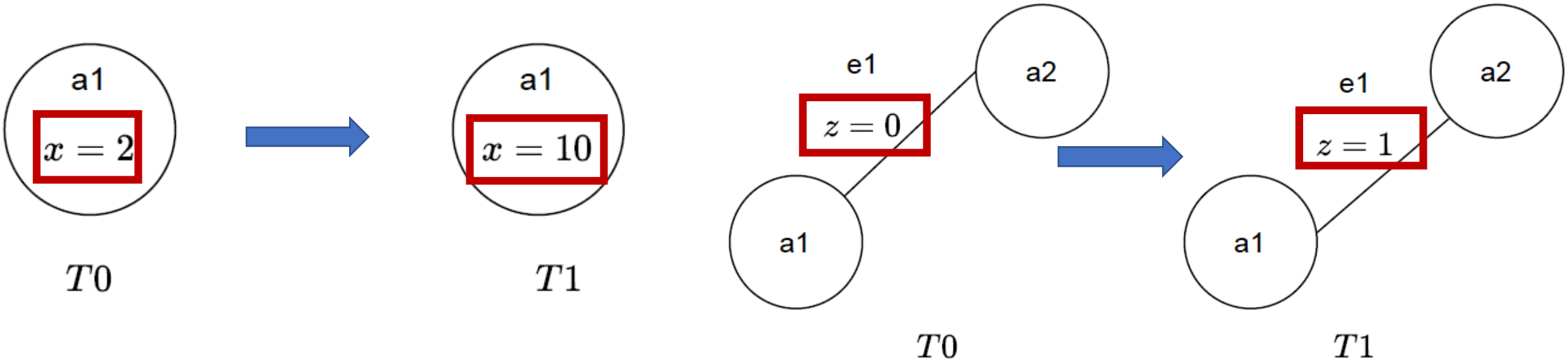
- **Temporal graphs deal with two evolution types (Zaki et al., 2016):**

Evolution of graph topology



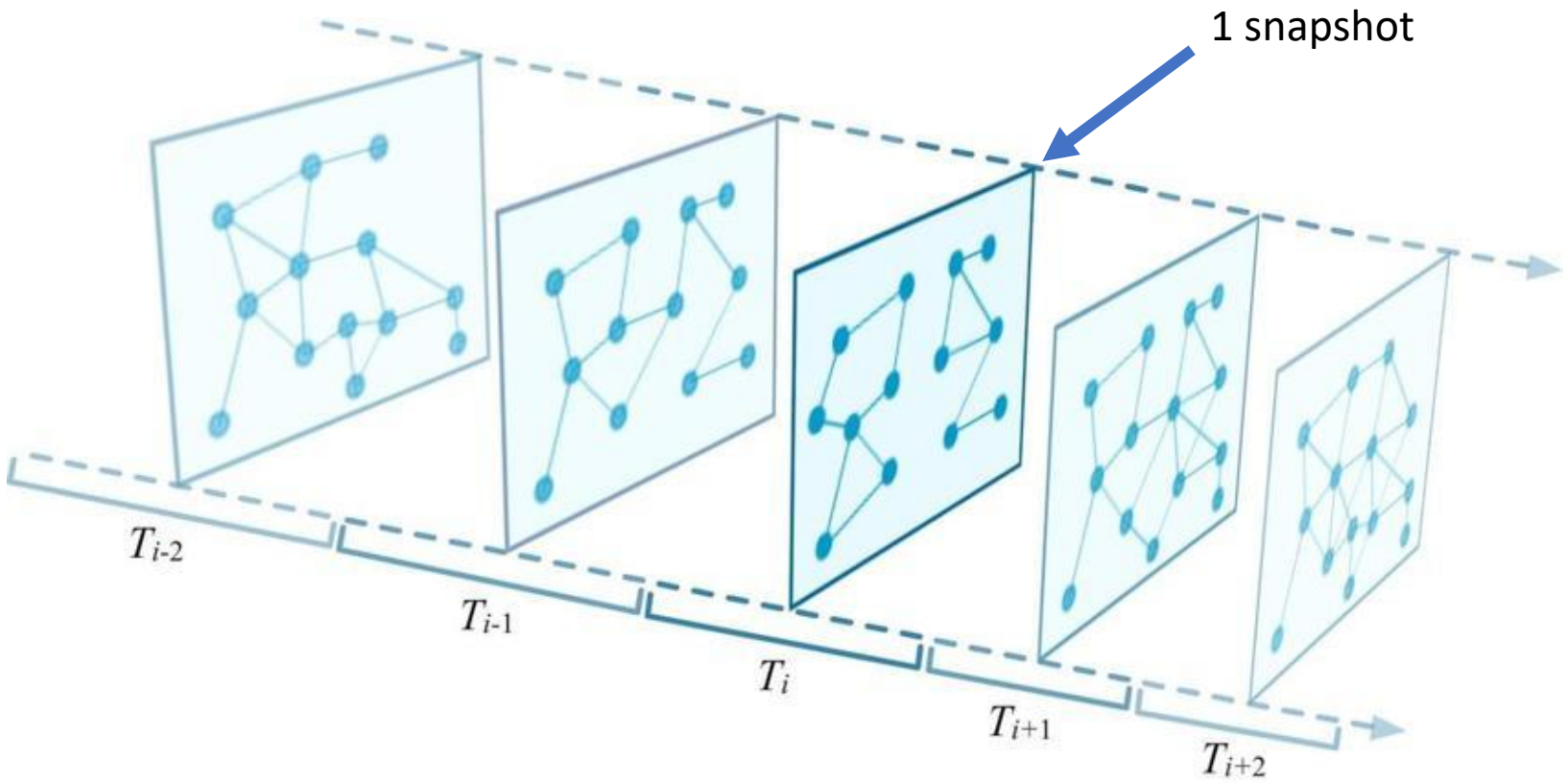
- **Temporal graphs deal with two evolution types (Zaki et al., 2016):**

Evolution of graph data



- **Limits of existing works :**

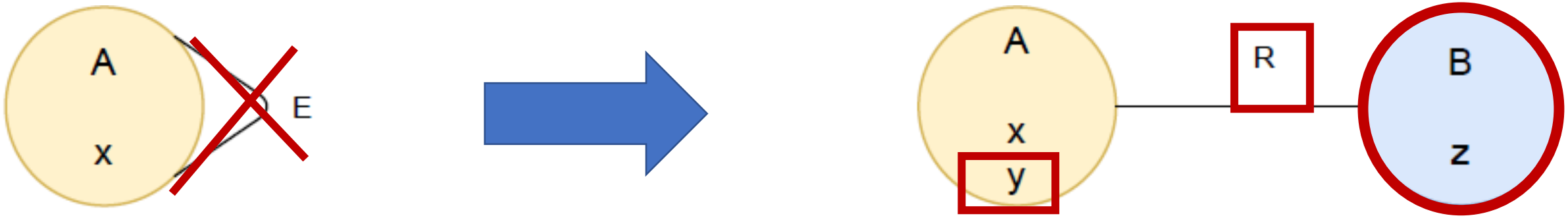
1) Snapshots: retrieval complexity and data redundancy



(Borgwardt et al., 2006) (Chan et al., 2008) (Fard et al., 2012) (Khurana and Deshpande, 2013).

- **Limits of existing works :**

2) no evolution of graph structure

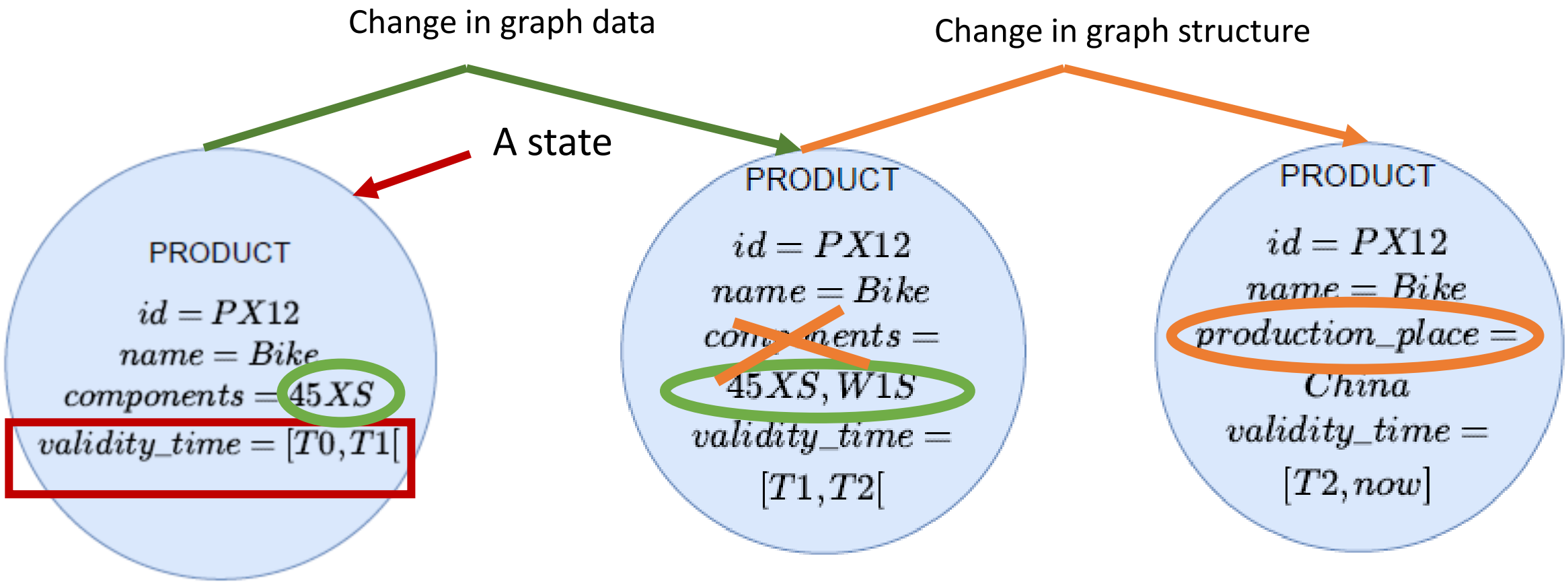


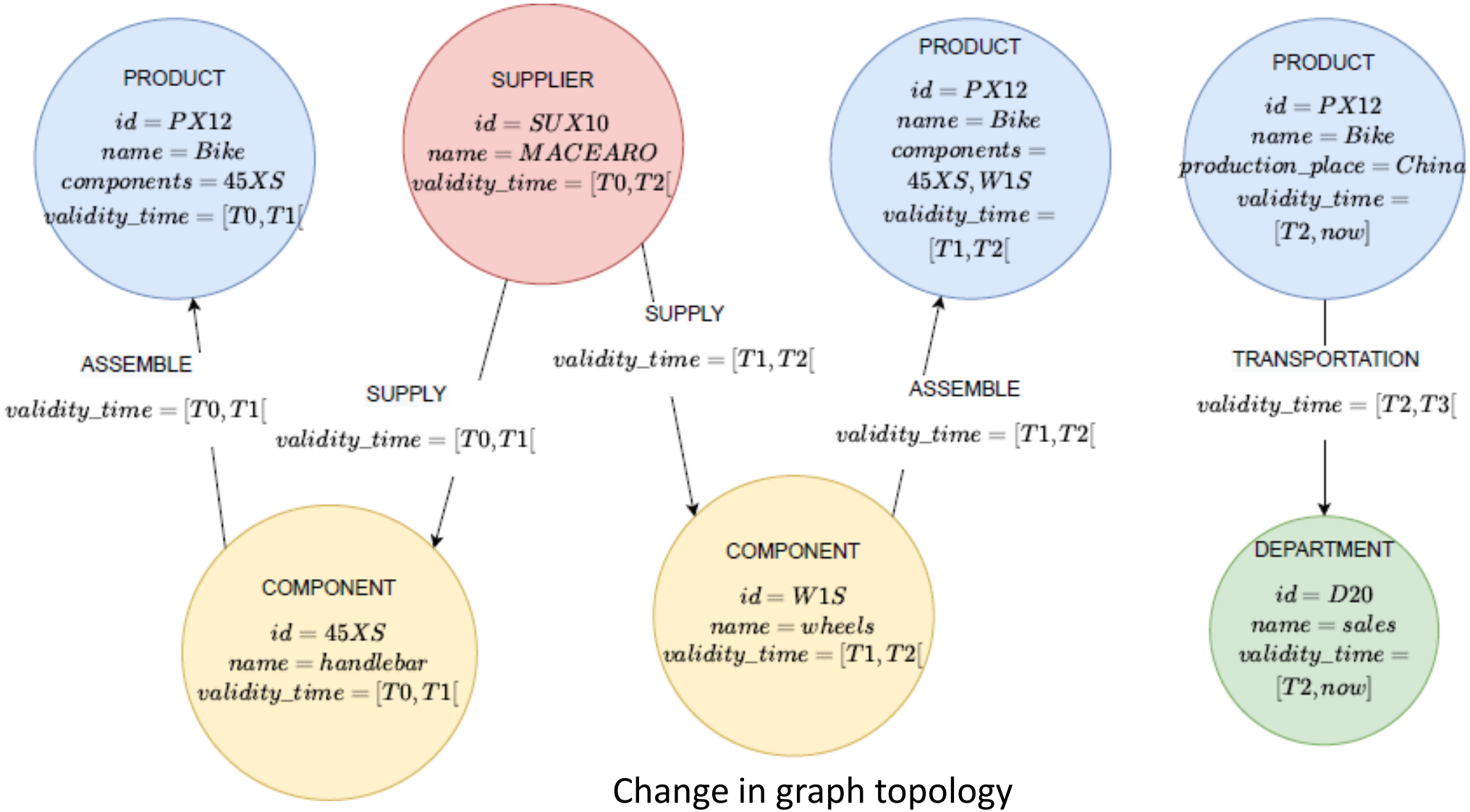
$T0$ $T1$

- **Limits of existing works:**

3) 1 temporal graph model = 1 specific domain

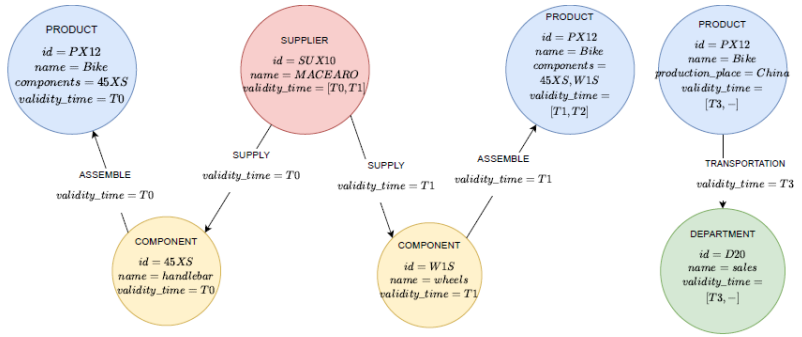
- **Research question: How to model temporal graph to integrate any temporal evolution types ?**


Change in graph data
Change in graph structure
A state
PRODUCT
$id = PX12$
$name = Bike$
$components = 45XS$
$validity\_time = [T0, T1[$
PRODUCT
$id = PX12$
$name = Bike$
$components = 45XS, W1S$
$validity\_time = [T1, T2[$
PRODUCT
$id = PX12$
$name = Bike$
$production\_place = China$
$validity\_time = [T2, now]$



Change in graph topology

Conceptual level



Temporal graph

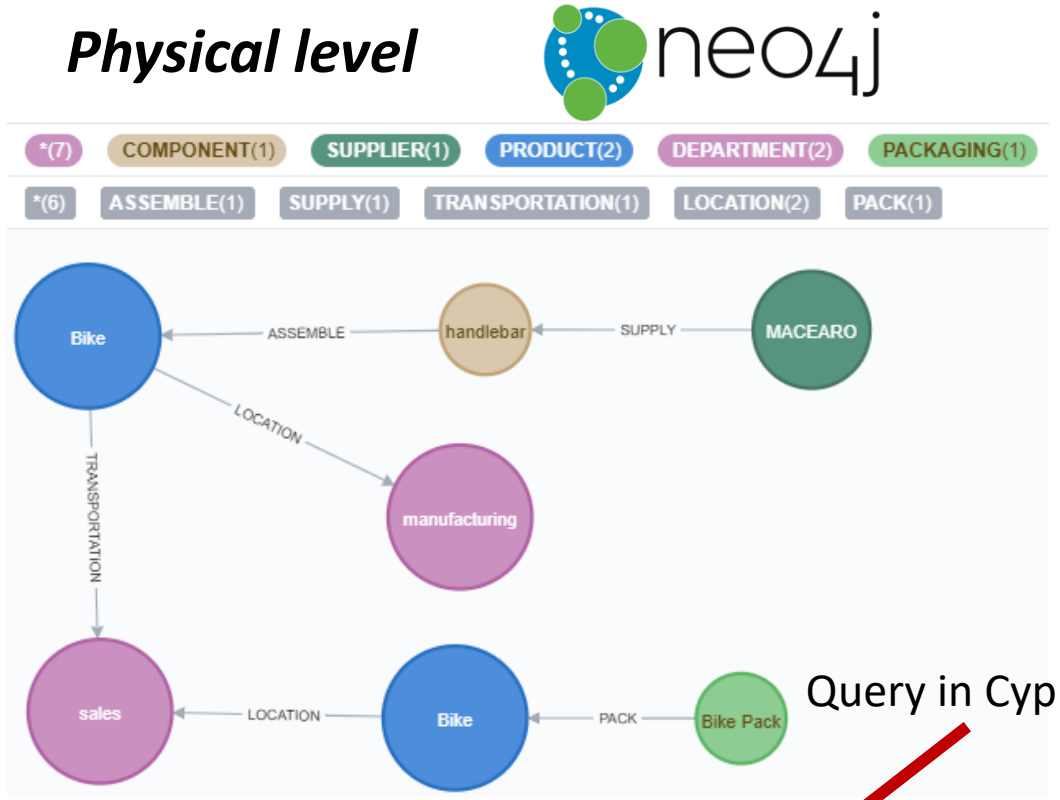
Translation rules

Logical level

Our model concepts	Property graph concepts
an entity state $S_j^{E_i}$	a node
a relationship state $S_j^{R_i}$	an edge
an entity type Y_i	a label tagged on a node
a relationship type Z_i	a label tagged on an edge
an entity identifier id_{E_i}	a property
a set of entity type attributes A_{Y_i}	a set of properties
a set of relationship type attributes A_{Z_i}	a set of properties
a validity time of an entity state $T_{S_j^{E_i}}$	two properties (*start* and *end validity time*)
a validity time of a relationship state $T_{S_j^{R_i}}$	two properties (*start* and *end validity time*)

TAB. 2 – *Translation rules of our model into the property graph model.*

Physical level



Query in Cypher

```
MATCH (n)
WHERE n.start_validity_time > date("2020-01-08")
      and n.start_validity_time < date("2020-01-23")
RETURN n
```

- **Advantages of our model:**

- All temporal evolution types

- Only keeps changing entities and relationships

- Complete approach from conceptual modelling to implementation

- **Future research directions :**

- Evaluation of the performance of our implementation

- Temporal graph manipulation

Thank you for your attention