**Application of directed property graphs / tuples to MBSE**

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**Problem Statement**

Notations & tools used by systems engineers typically software-engineering or software development tools – aimed at describing objects (object-focused).

System design, description & system-thinking primarily concerned with describing context, boundaries, dependencies, sequence – (relationship-centric)

Using an object-focused notation / tool makes it hard to exploit relationships & therefore use the model in which so much time has been invested.

Tuples / graphs are relationship-centric – what practical use can they offer for Model-Based System Engineering?

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**Current – Tools / Notation**

Modelling tools use notations such as UML, SysML. These are specified by organisations such as the Object Management Group. This includes presentation and behaviour of the tool e.g. diagram type, diagram scope & content.

Some relationships are implicit (visibility, affordance) and not easily traced or queried e.g. UML Object vs Port Objects, connectors & their attributes held in many database tables. Queries require detailed knowledge of the underlying database schema. They involve many table joins which affects time taken to return result and ability to exploit (feasibility, usability).

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**Graphs / Graph Databases**

A graph consists one or two nodes joined by a relationship. ‘This Poster produced using MS PowerPoint’. They naturally support language, can be easily read without technical knowledge and the statements form assertions (usability, verifiable).

The Neo4j graph database stores graphs natively – no tables, no table joins. A (CYPHER) graph query is an instruction to follow a path or match a pattern. e.g. MATCH (e:Evidence)[a:supports]->(a:Argument) RETURN a, s, e

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**Outputs: Ongoing & Future**

Currently working with native Neo4j & browser interface & command line.

Development of bespoke modelling tool: - in-browser creation of views, nodes, relationships & queries, format / appearance.

Sparx EA (via MDG for TRAK)

Improve import / export capability (CSV and ideally, JSON)

Pilot

Pilot application involving claims, evidence, event sequence. > 600,000 nodes. Has to support non-technical team and be intuitive.

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- Software Architecture / Tool Development – Bradley Plum
- Neo4j – http://neo4j.com