The iCity Ontology Visualization

Interactive Visual Exploration of Scalable Knowledge Graph

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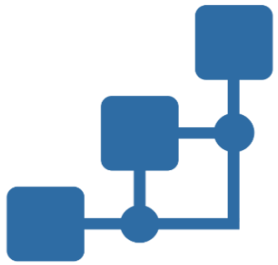
SEMANTIC GRAPHS (1/2)



The iCity Ontology

Complex role-relation

association between

multiple ***concepts*** with

multiple ***attributes***

Network Graph

An effective way to

represent the **complex**

dynamism of Semantic

Knowledge Base

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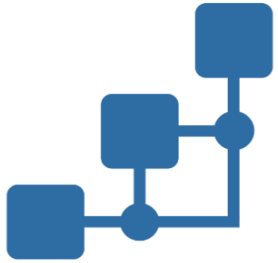
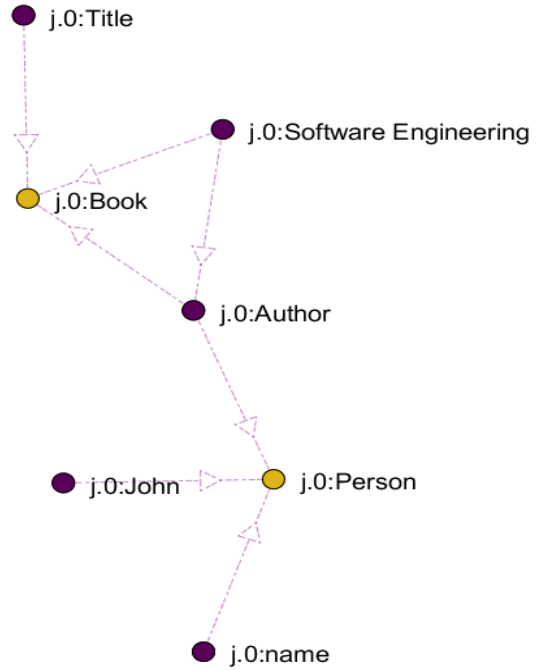
SEMANTIC GRAPHS (2/2)



Schema

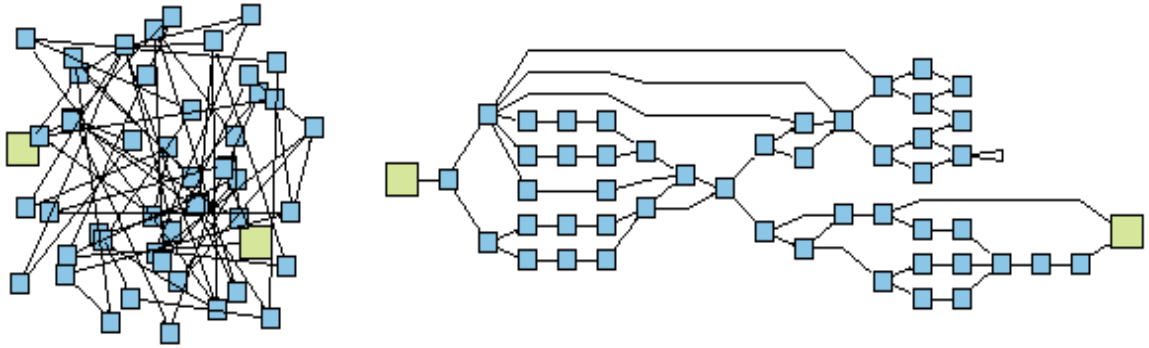
```
<rdf:RDF
    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
    xmlns:j.0="urn:seecs.edu.pk/">
  <rdfs:Class rdf:about="urn:seecs.edu.pk/Person"/>
  <rdfs:Class rdf:about="urn:seecs.edu.pk/Book"/>
  <rdf:Description rdf:about="urn:seecs.edu.pk/name">
    <rdfs:range rdf:resource="http://www.w3.org/2000/01/rdf-schema#Literal"/>
    <rdfs:domain rdf:resource="urn:seecs.edu.pk/Person"/>
  </rdf:Description>
  <j.0:Person rdf:about="urn:seecs.edu.pk/John">
   <j.0:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
    >John Abdullah</j.0:name>
  </j.0:Person>
---
----
</rdf:RDF>
```

Graph



DESIGN CHALLENGE

Graph Drawing Layout



Structure of the graph can only be **understandable**, if it is in certain **readable layout**

Research Theme

- To understand the Highly **Complex**, **Dynamic** and **Scalable** *iCity Ontology*, there's an essential need to develop a **visual framework** supporting an aesthetically appealing **graph layout**
- **Visual Interaction** and **exploration of** *iCity Ontology* to understand the **semantics** behind complex role-relation associations in the form of **knowledge network graph**

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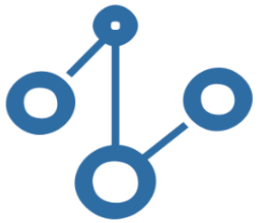
SOLUTION BREAKDOWN



Ontology Visualization Technique

- A visualization technique is needed, to **visualize** *iCity ontology* **complex** structure in **directed network graphs**

Graph Drawing Layout

- Visual **exploration** and **interaction** with *iCity Ontology* through proper **graph drawing layout**
- Should **preserve** the **aesthetic** measures for **clarity**

Scalability & Performance

- Highly **scalable**, computationally **efficient** and **expressive** in terms of visualizing *taxonomy*, *inheritance*, *micro-theory* (axioms/rules and inferences…)

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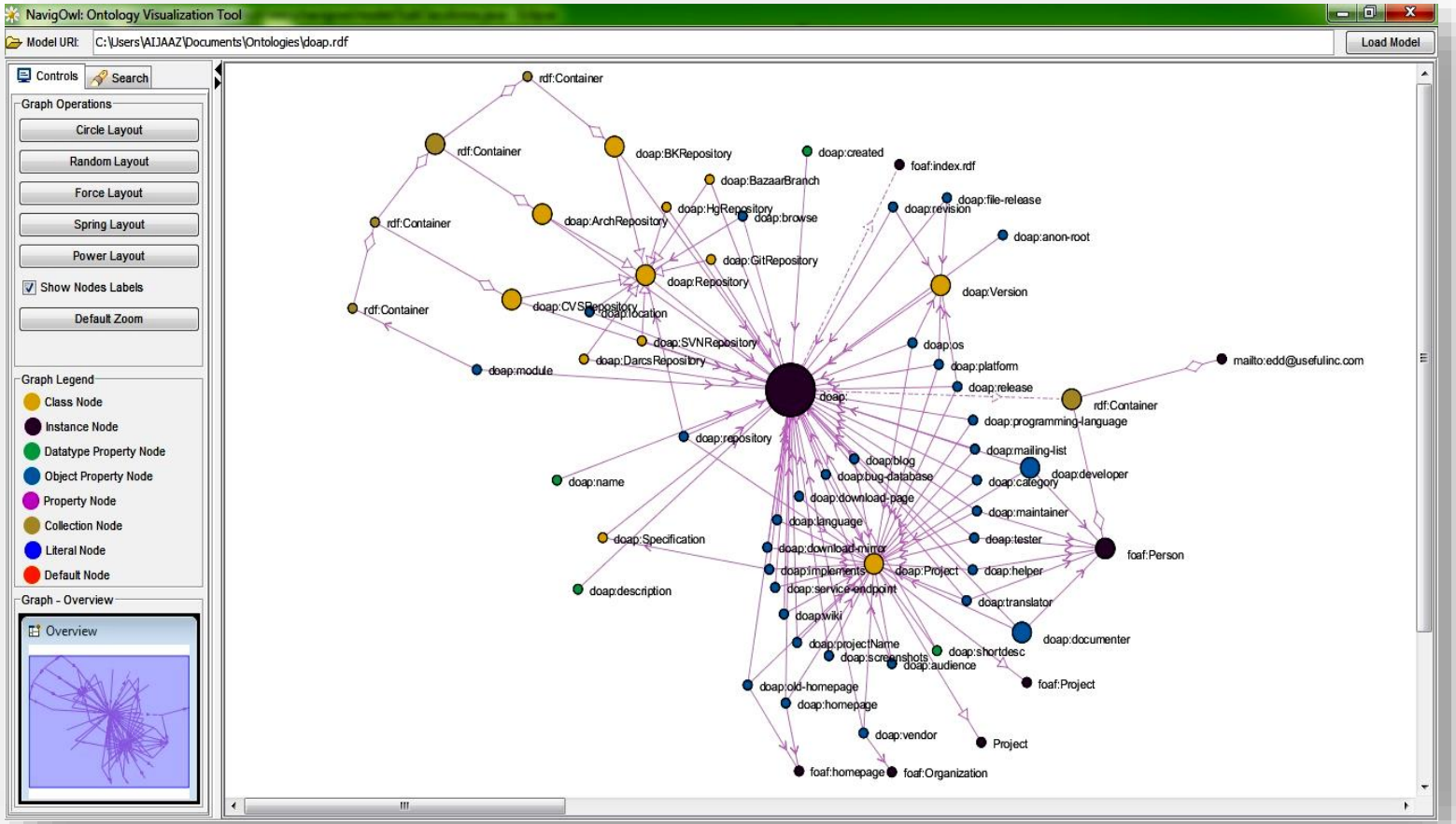
PROPOSED METHODOLOGY (1/2)

NavigOWL
A Tool for Exploring Semantic Nets!

Salient Features

- Highly **scalable** and **zoomable** Interface
- Multiple graph **drawing layouts**
- *Graph Search*, *Nodes Visibility*, *Role-relation hierarchy,* and *Tool-tip*
- Distinct **nodes' colors** based upon *roles*.
- Distinct **edges' shapes** based upon *relations* or *predicates*



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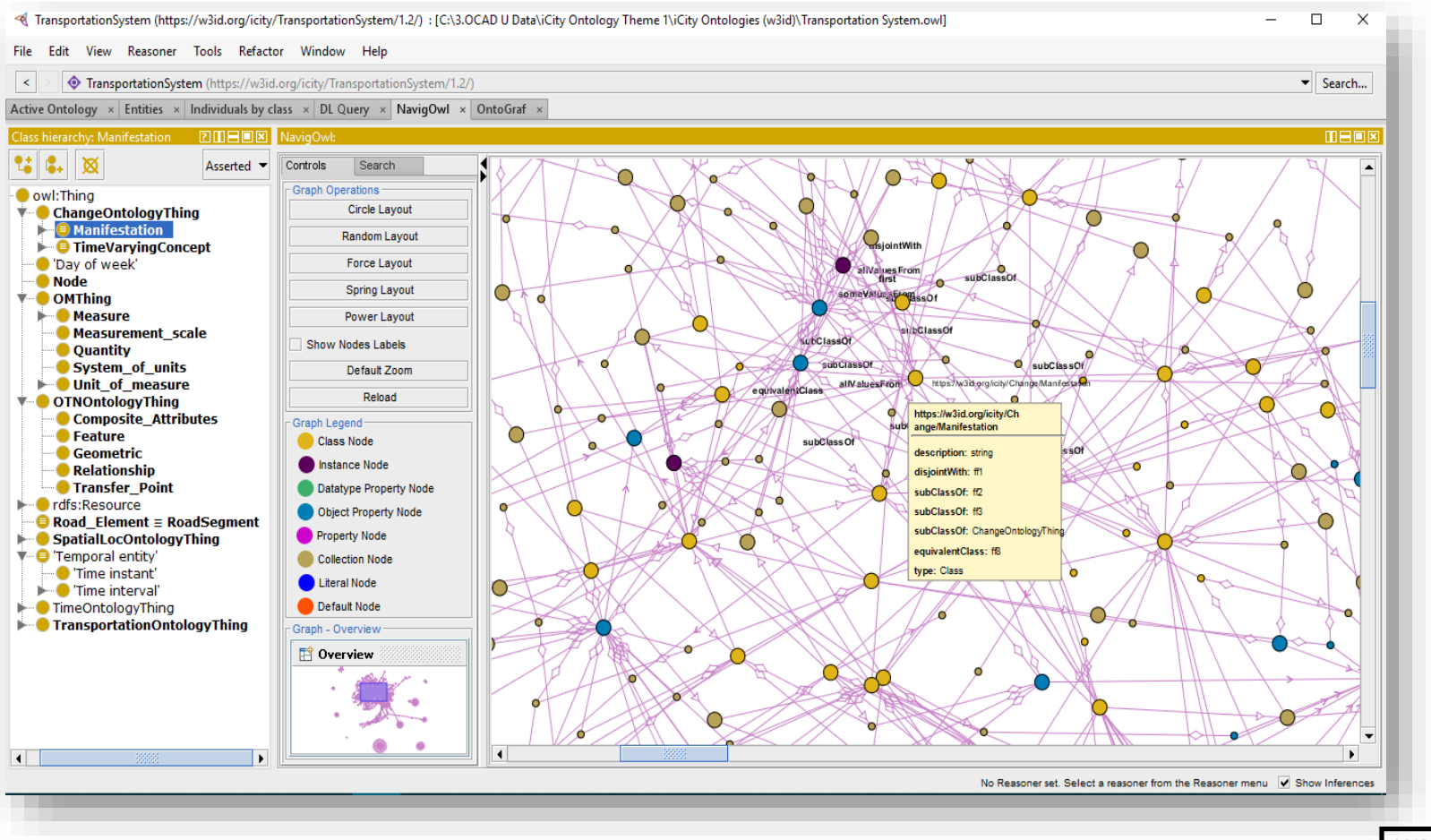
PROPOSED METHODOLOGY (2/2)

Protégé Plug-in

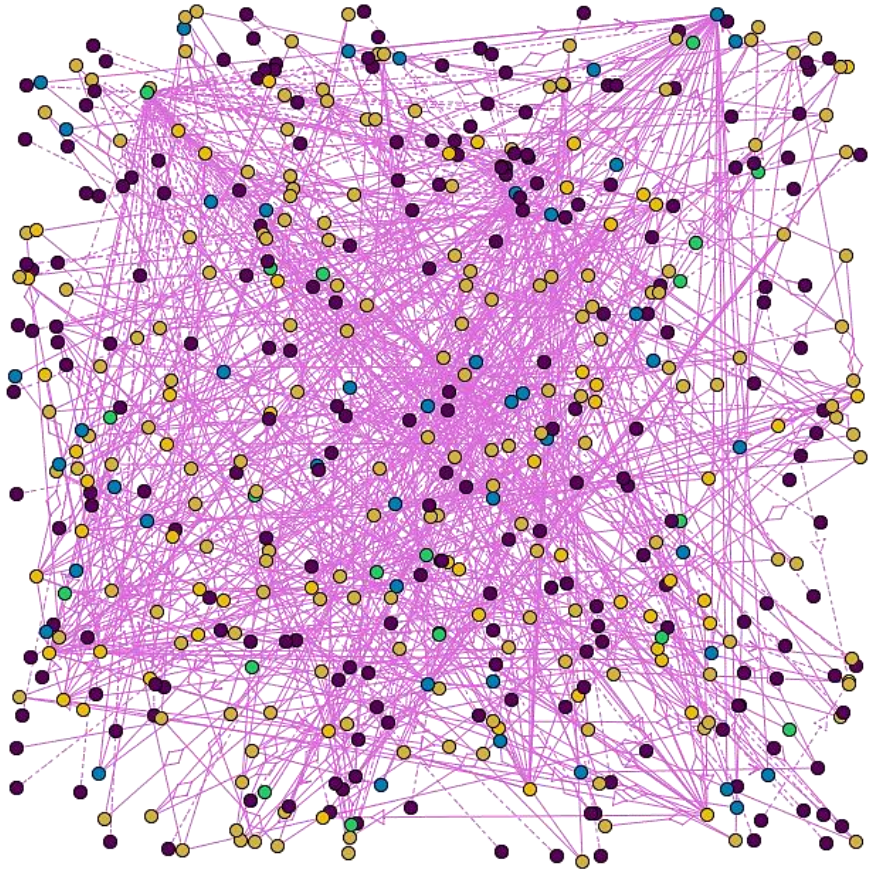
- Protégé is free, JAVA-based open-source **ontology editor** and a **framework** for building **Intelligent Systems** as per W3C standards

- *UoT* Researchers developing *iCity Ontology* in *Protégé* can **natively visualize** current ontology through *NavigOWL* plug-in

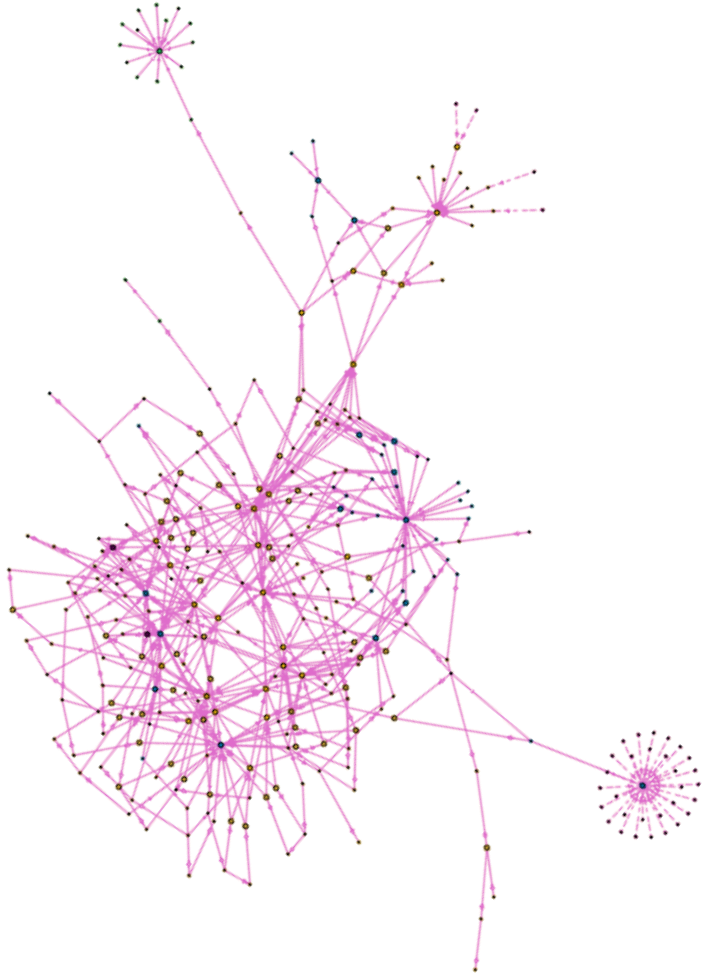


PRELIMINARY RESULTS (1/4)

Before



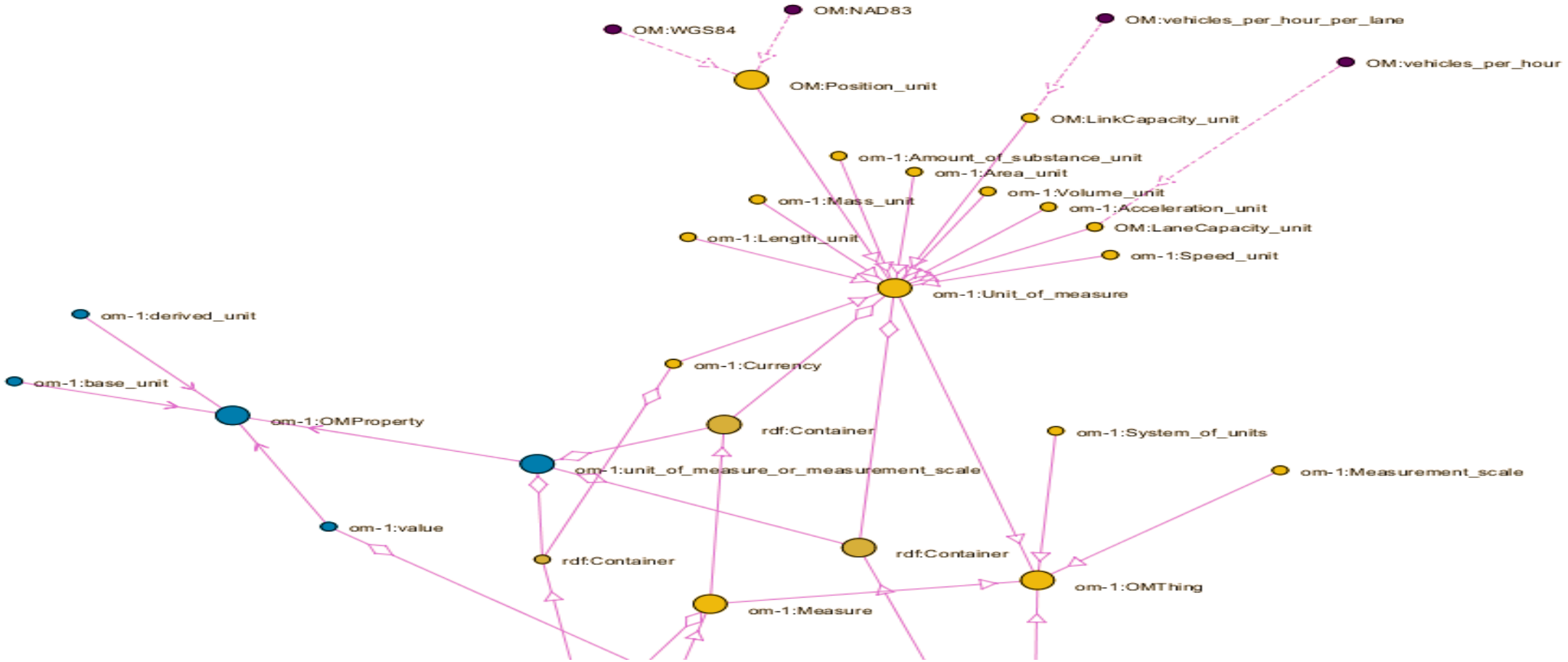
After



Visualizing the *iCity Transportation System* Ontology

PRELIMINARY RESULTS (2/4)

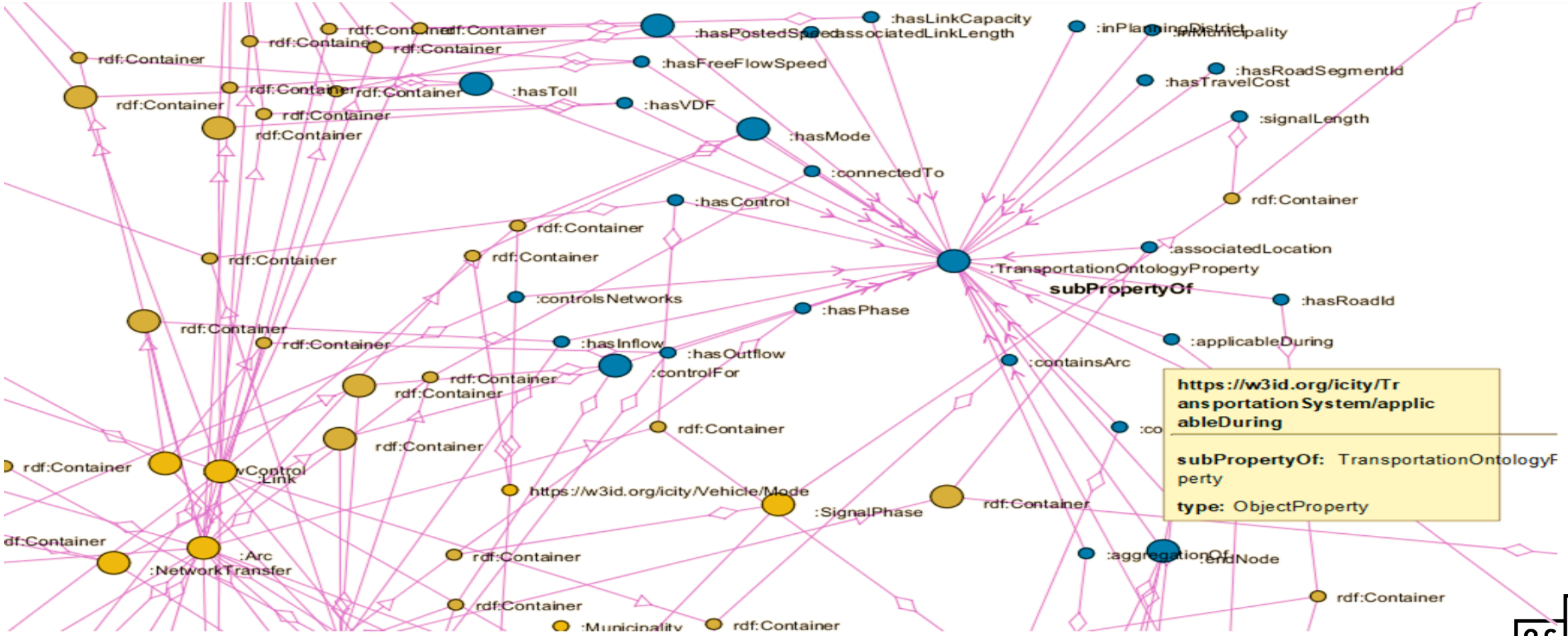
Sub-Graph Snapshots



In-Depth Visual Analysis of *iCity Transportation System* Ontology

PRELIMINARY RESULTS (3/4)

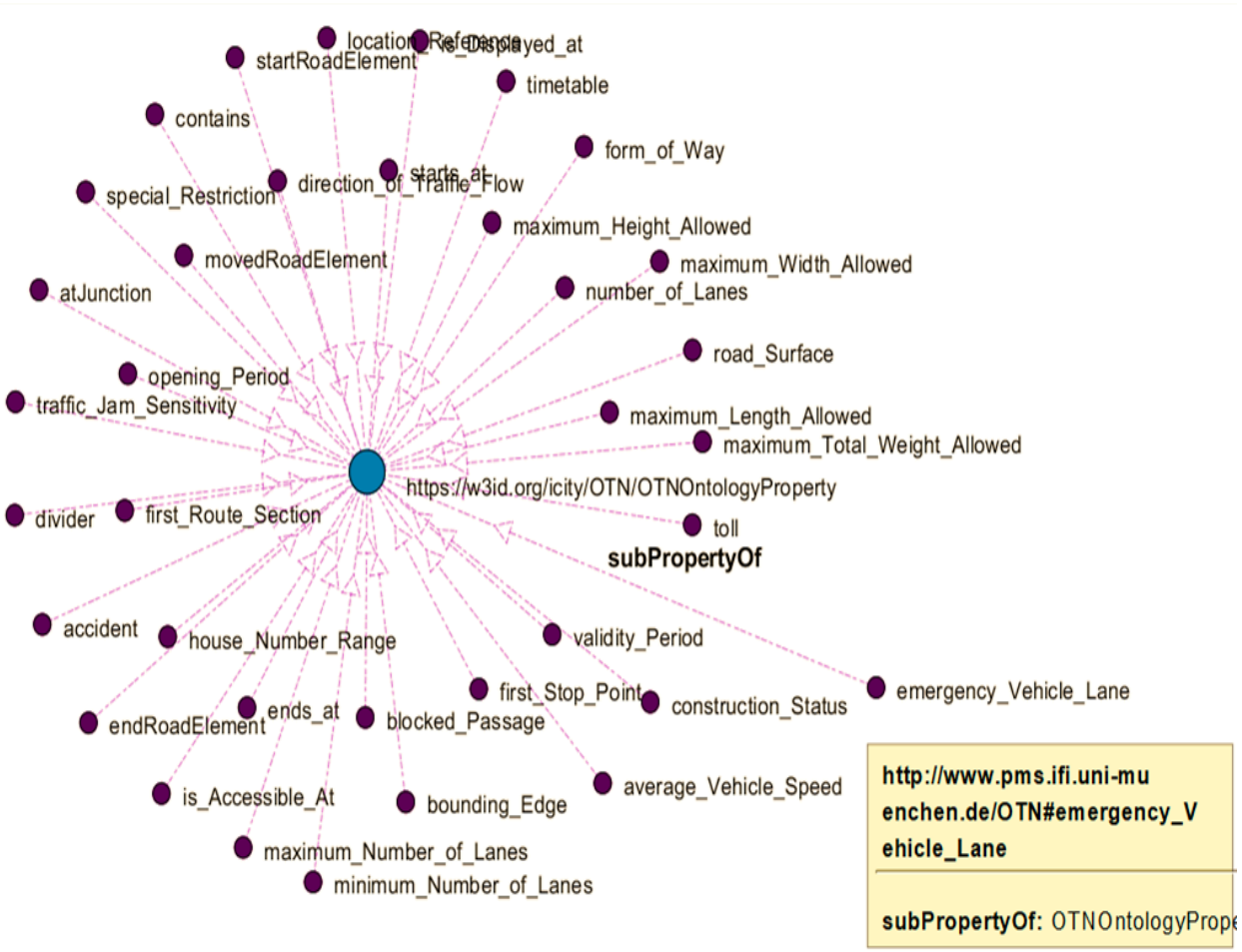
Sub-Graph Snapshots

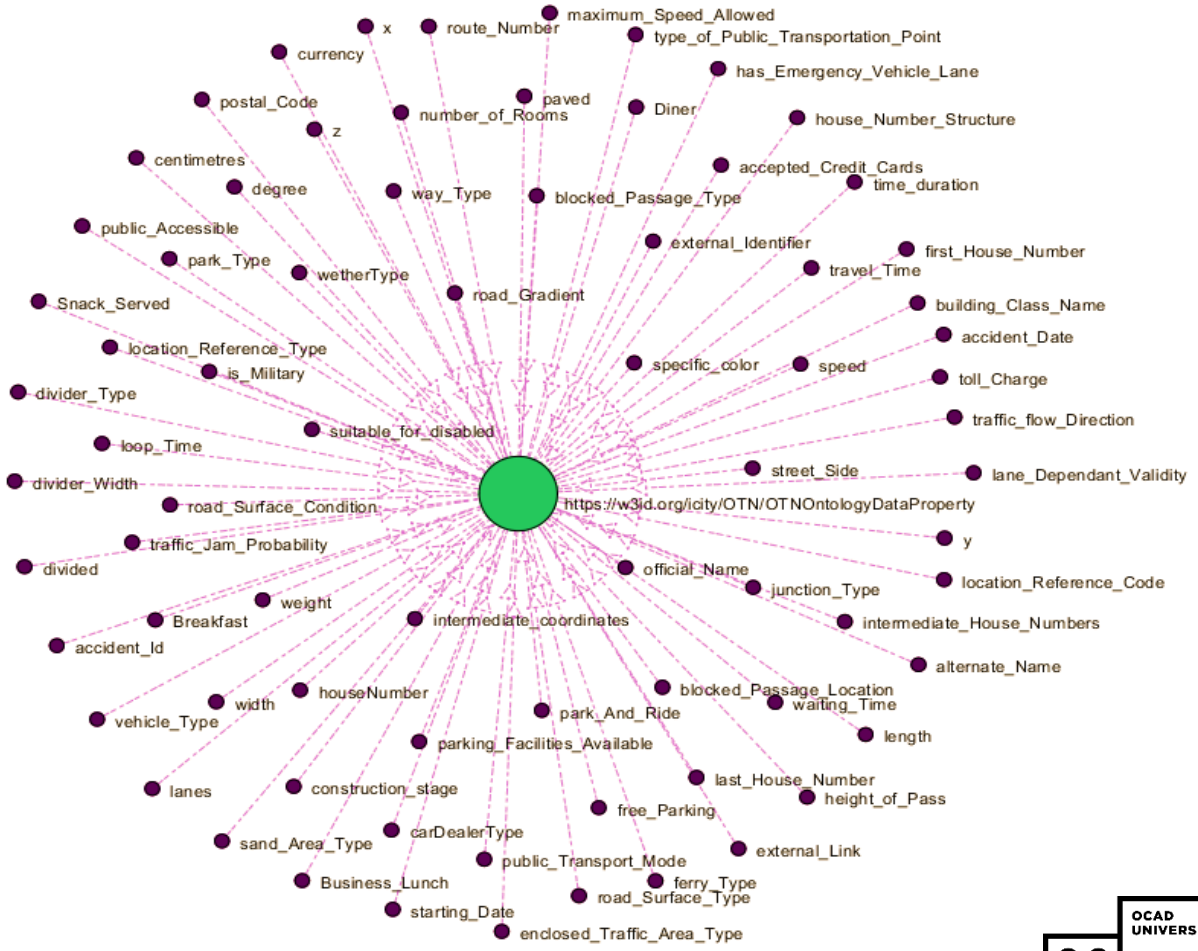


In-Depth Visual Analysis of *iCity Transportation System* Ontology

PRELIMINARY RESULTS (4/4)

Sub-Graph Snapshots





In-Depth Visual Analysis of *iCity Transportation System* Ontology

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FINAL THOUGHTS

VISUAL INTERFACE

Initial **Visual Interface** for **exploration** and **interaction** of *iCity ontology* for better understanding the **dynamism** and **complexity**

WEB INTERFACE

Proceeding with web-based interface for online **accessibility** and **usability** for other *iCity* groups and stake-holders

ENRICHMENTS

Expressive representation of *micro-theory*, *axioms/roles* with support of **Visual Filters** and **Adaptive View** to display "*Significant*" sub-graph(s)

QUERY INTERFACE

Visualization of **Query Results** on *iCity Ontology* with **embedded view** in other *iCity Dashboards* for **reusability** and **extendibility**

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