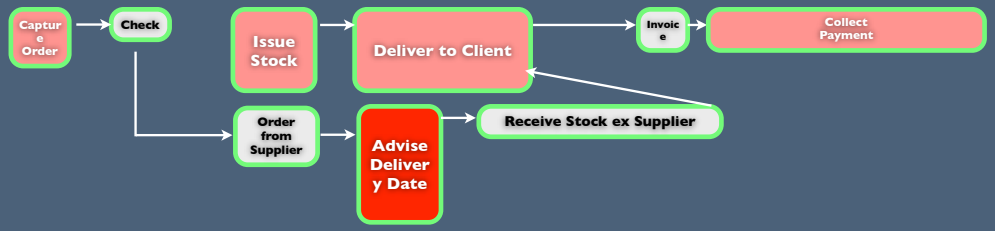

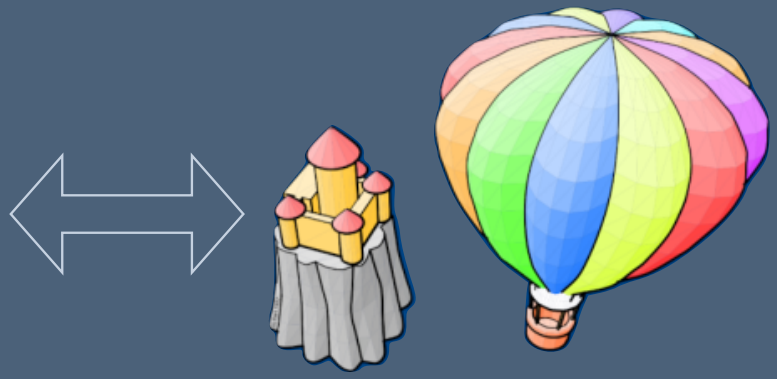

GLOSS - A GLSP[1] Model Server on the Smalltalk Platform

International Workshop on Smalltalk Technologies • Lille, France • 8th-11th July 2024

1 Graphical Language Server Protocol

Graham McLeod • University Duisburg-Essen & inspired.org
Gareth Cox • inspired.org

UNIVERSITÄT DUISBURG ESSEN

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Agenda

- Introduction
- Graphical Modelling
- IDEs
- Language Server Protocol
- Graphical Language Server Protocol
- Our project
- Results, Recommendations, Conclusions

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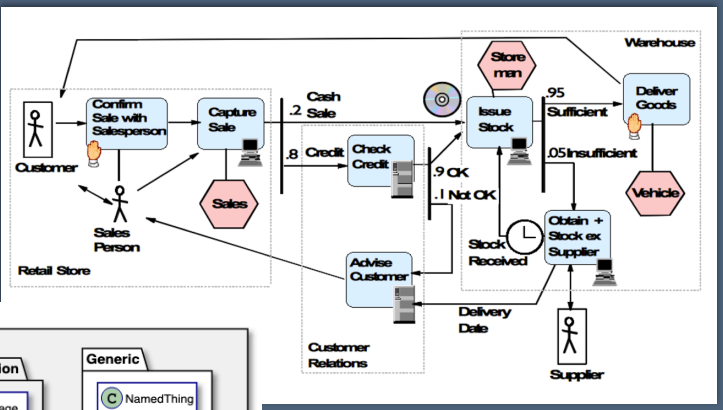
Introduction

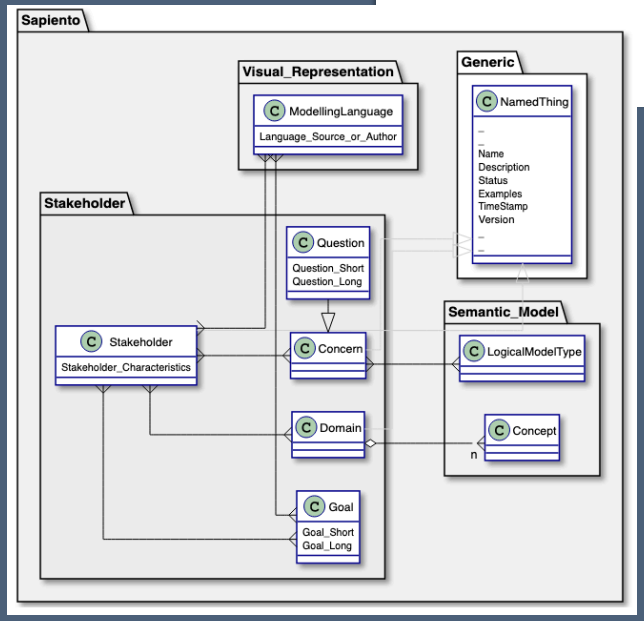
- Inspired is a boutique consultancy in Enterprise Architecture (Business, Application, Data, Technology and Solutions)
- We do methods engineering, training, consulting, and tools
- We offer a SaaS enterprise modelling platform written in Smalltalk (VAST for server, Pharo for graphical modelling client)
- Personal 30 year history with Smalltalk
- Also doing research into Visual Language design

Graphical Languages

e.g. UML, BPMN, Archimate

- Express semantics (meaning) relevant to a domain
  - Types/Classes and instances
  - Relationships
  - Properties/Property Values
- Represent these graphically through
  - Symbols
  - Lines
  - Adornments





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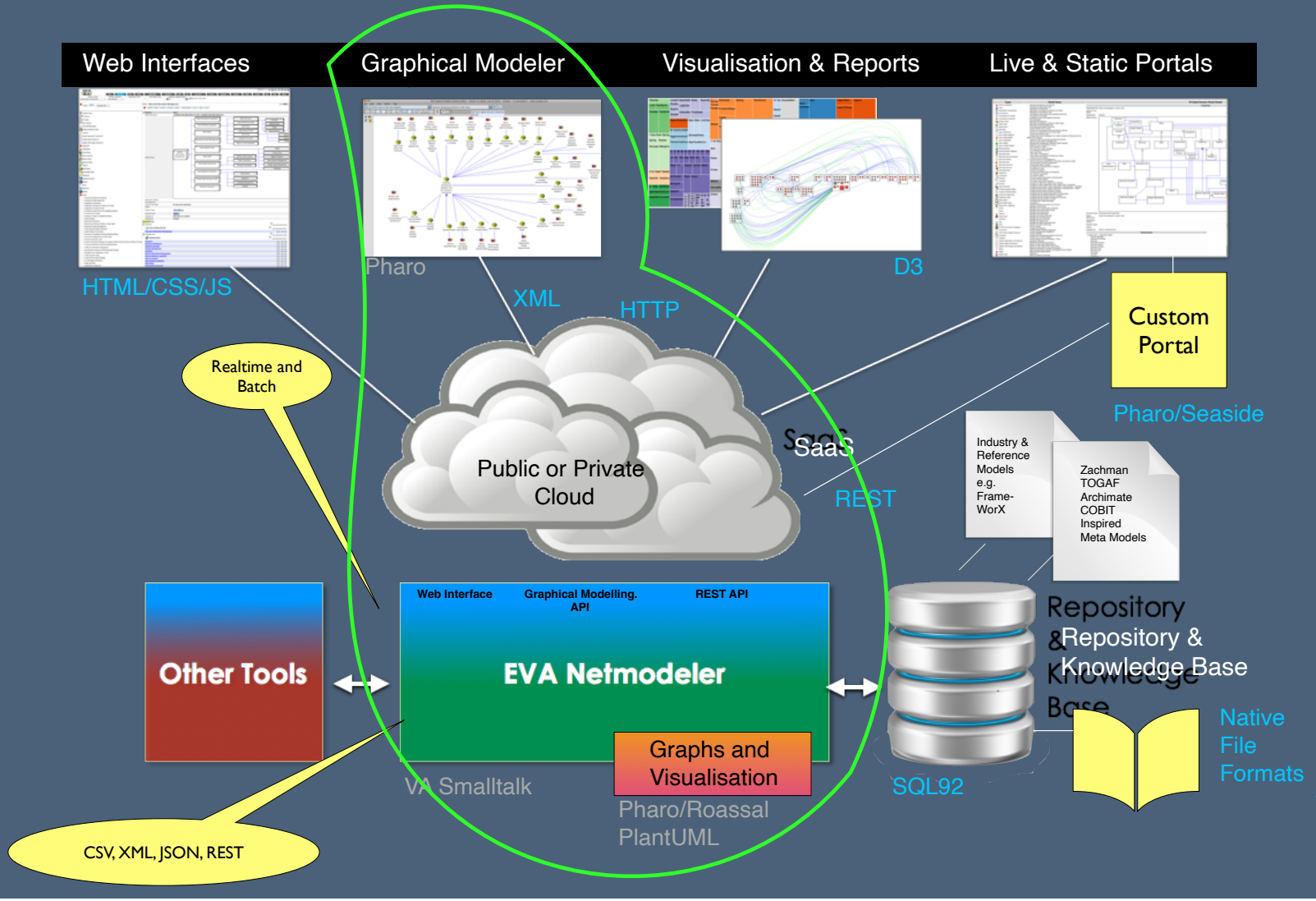
EVA Netmodeler



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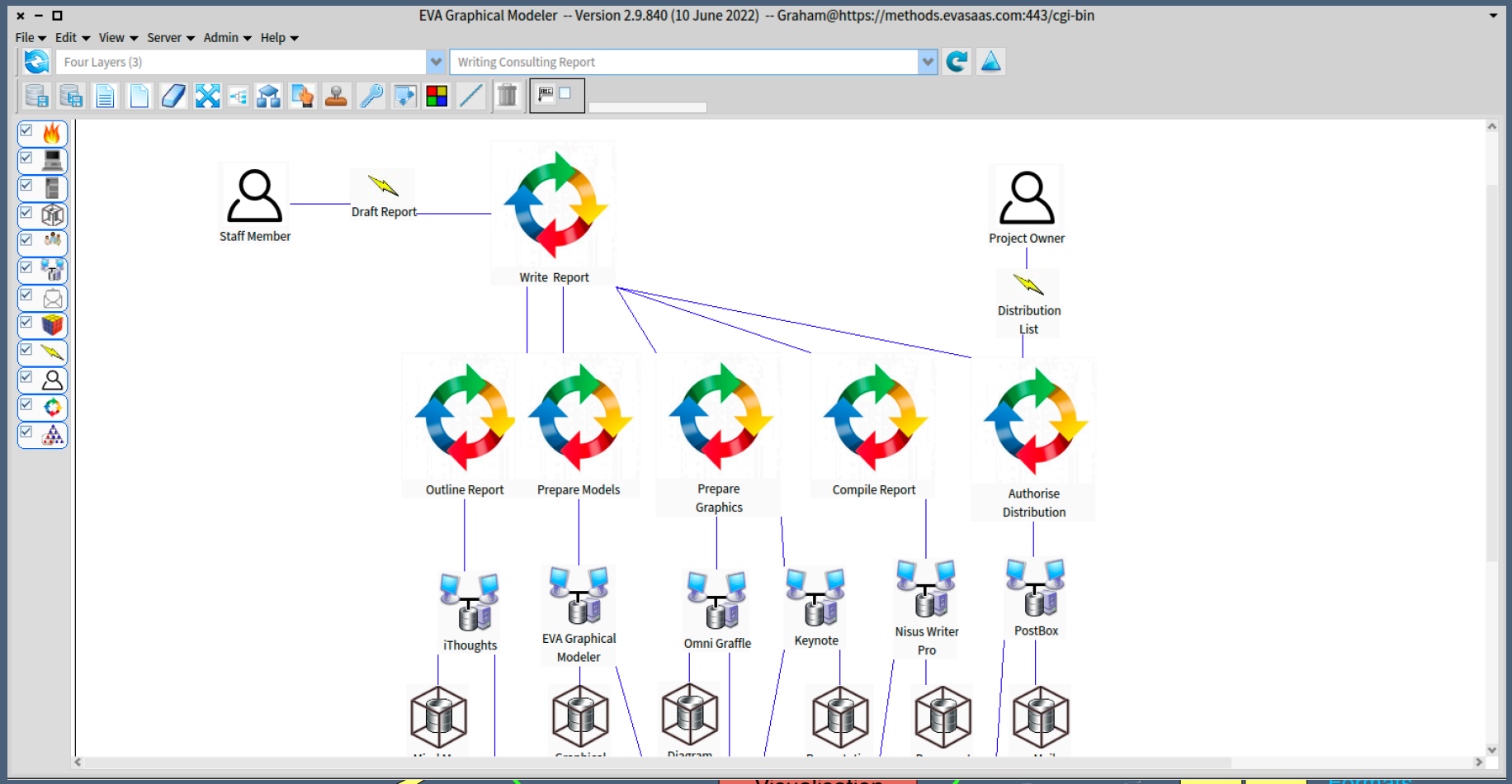

VA Smalltalk

Visualisation

Pharo/Roassal

PlantUML

SQL92

Formats

CSV, XML, JSON, REST

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EVA GM Model Handling

Manages how a Model Type is defined in terms of Types to include and what symbol should be used to represent them (in Model Type diagram) and instances (in Models)

Manages model instances and their relationships to the repository instances they represent

Manages model relationships and the relationships between instances they represent

Note that model type definition is held as XML property

Note that model visual only information such as position, size, colour override, relationship path is stored in XML property

Vector symbols and line characteristics are defined in a Logo derived script held on symbol instances

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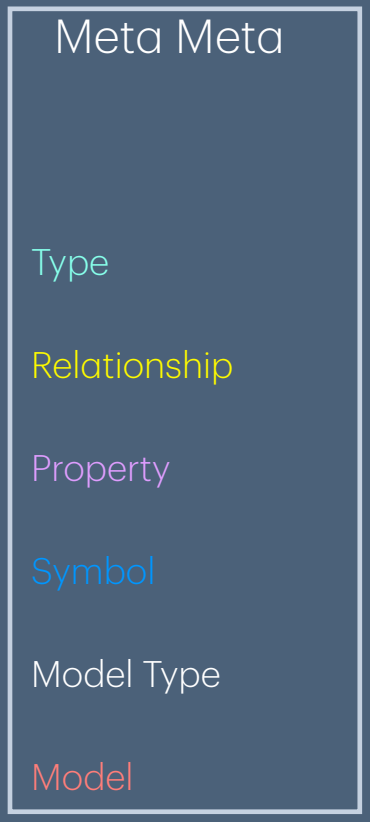

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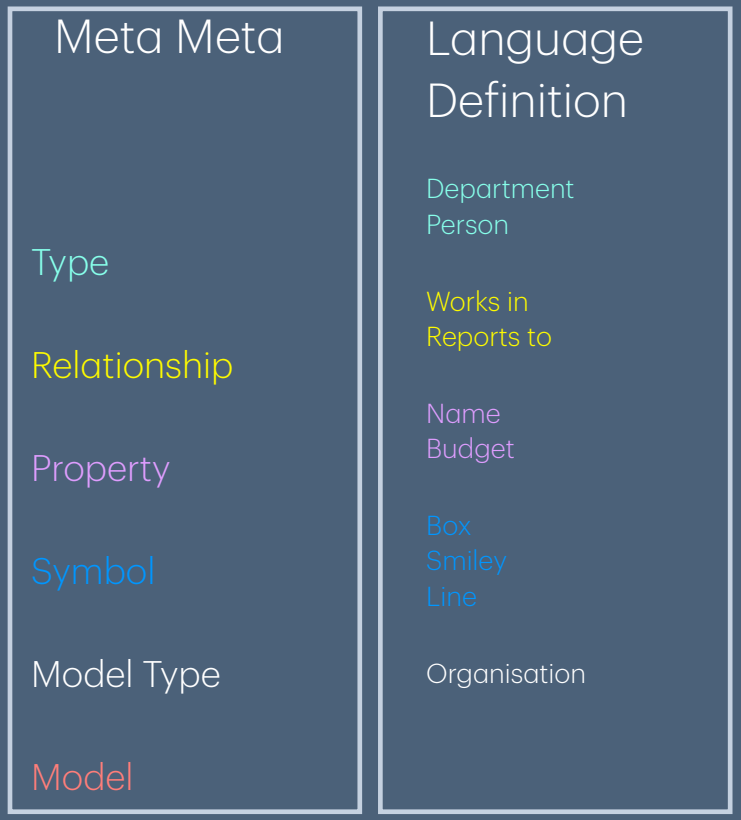

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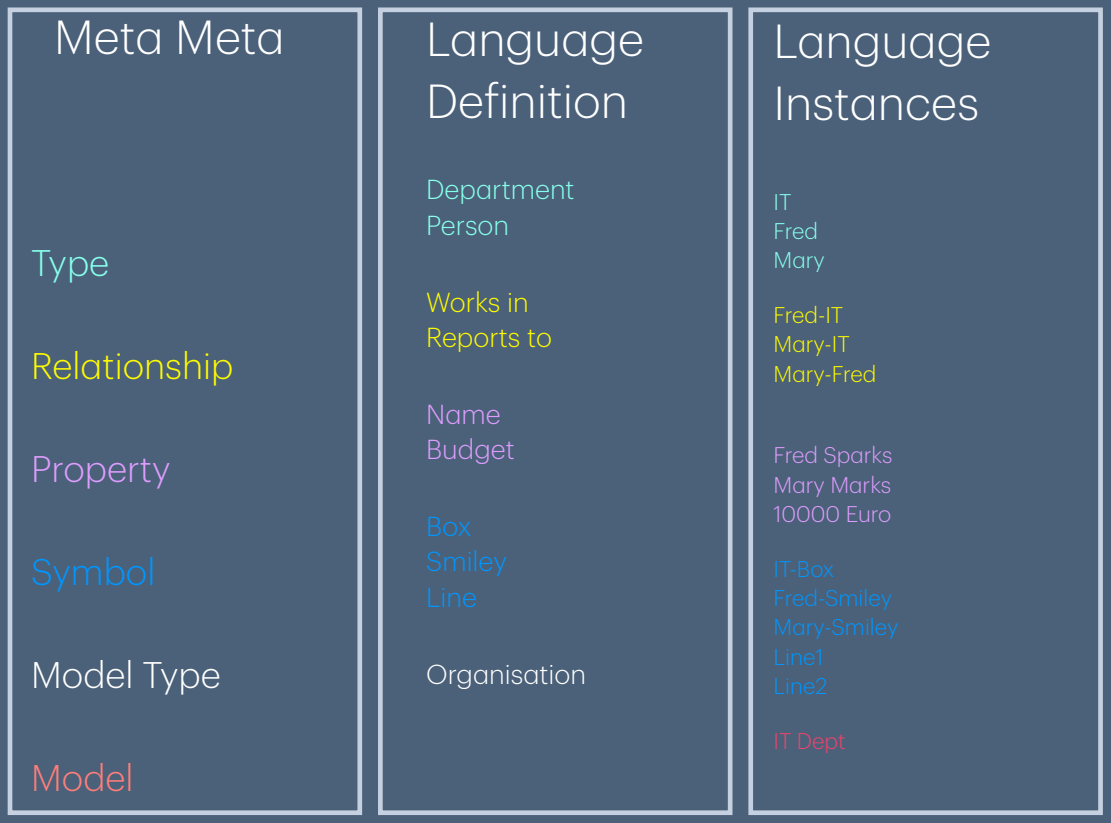

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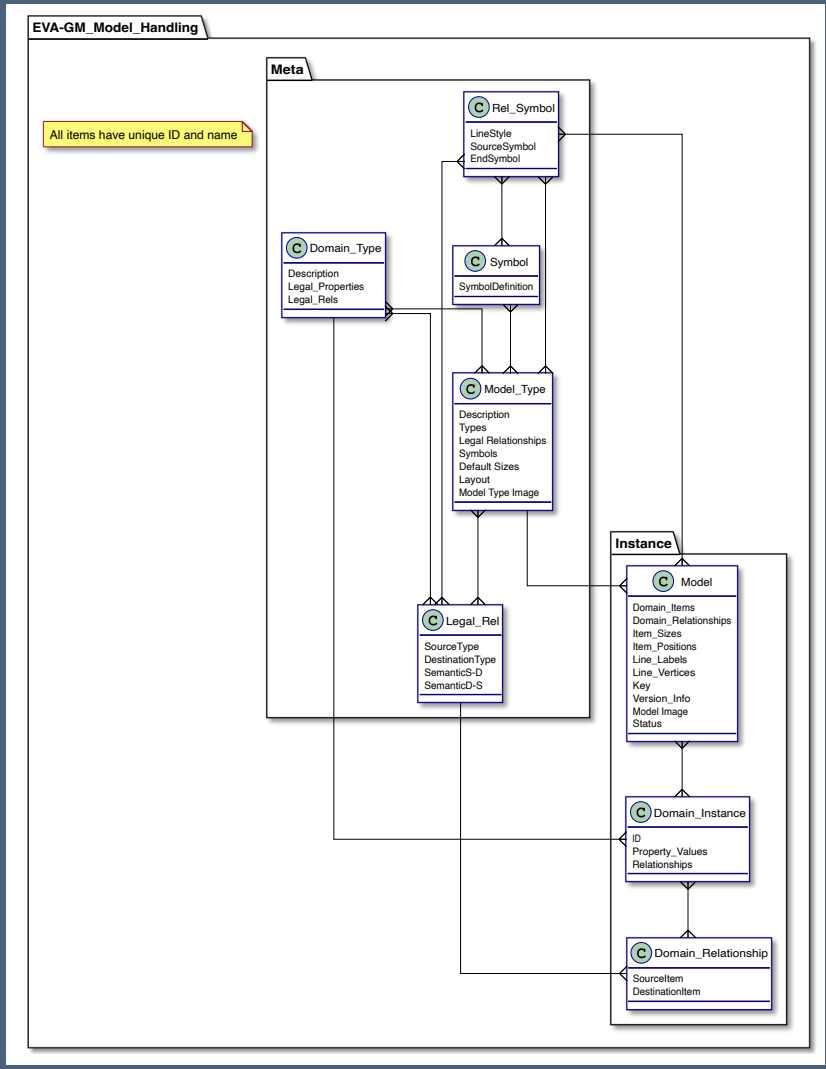

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Language Server Protocol (LSP)

- Languages have proliferated in recent years
- Development of IDEs was often lacking, or at least very labour intensive
- Platforms such as the Java Virtual Machine and .Net Common Language Runtime used to support execution of multiple languages
- IDEs started to support many languages
  - Needed code completion, syntax highlighting etc.
  - Should not embed all the language knowledge with UI and Tools
- Microsoft and others implemented the Language Server Protocol to separate the concerns

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Language Server

- Understands the language semantics and syntax rules
- Provides source to an IDE
- Processes changes made by user to update source
- Provides modified code for re-rendering

Editor Client

- Manages User Interfaces
- Provides code completion, syntax highlighting
- Deals with editing actions
- Renders the provided source code
- Can be desktop or web based

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GLSP Architecture

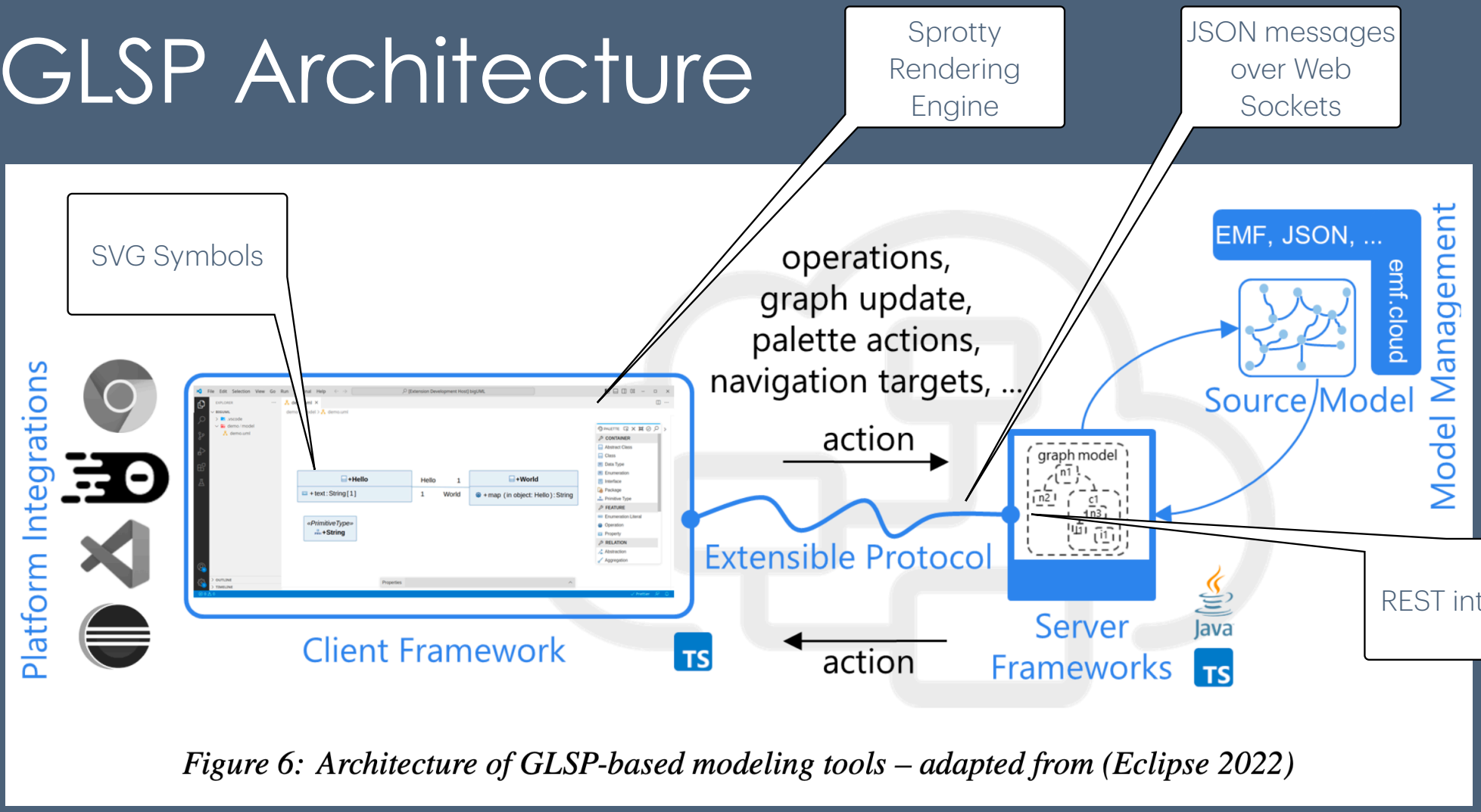

Figure 6: Architecture of GLSP-based modeling tools – adapted from (Eclipse 2022)

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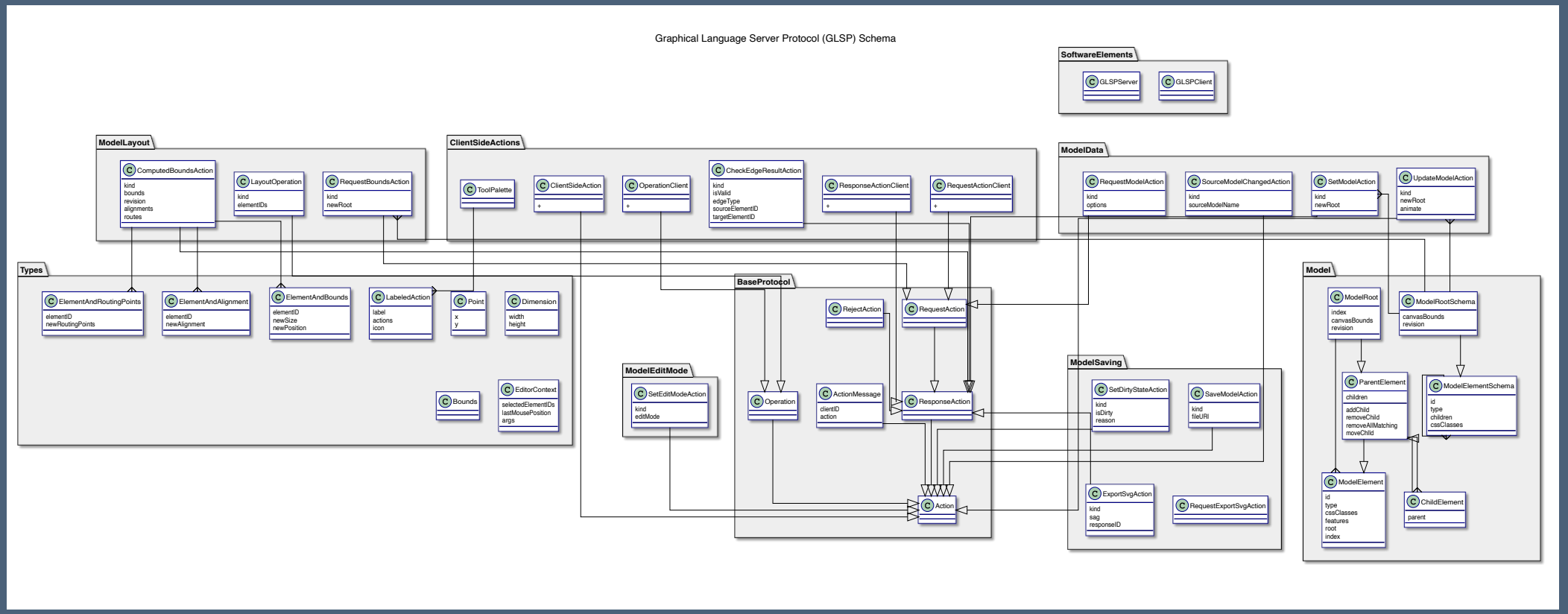
GLSP Data Model



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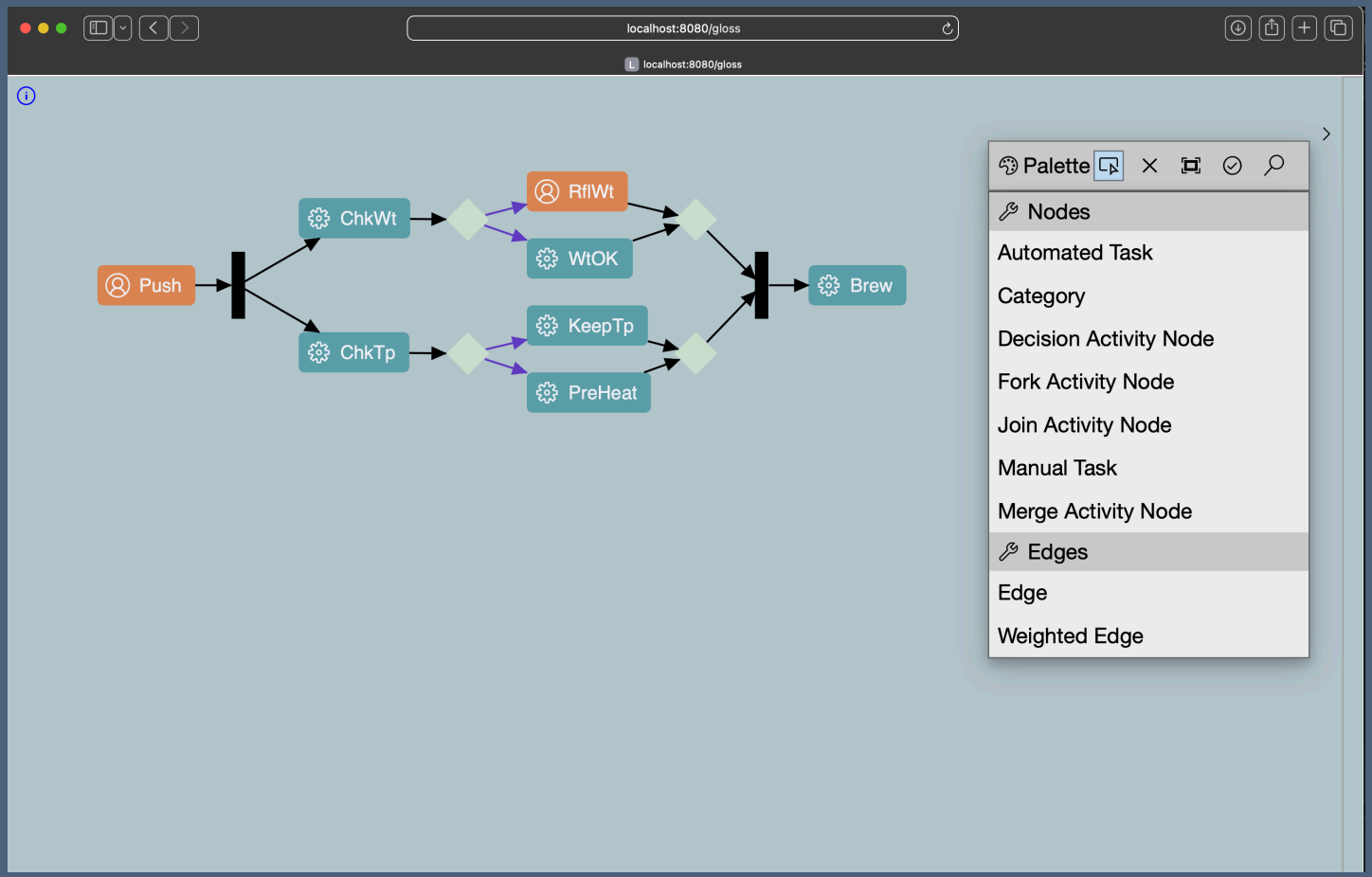
GLSP Client for Workflow



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Our Project

- Examined the documentation for GLSP
- Installed and ran the example application (TypeScript)
- Inspected the objects in the browser and the messages sent to and received from server
- Implemented Classes in Smalltalk to hold the model, respond to the requests / actions
- Added ability to hold multiple models
- Added ability to serve the symbols from the server
- Added container UI elements to allow selection of model type and model
- Allowed model to be saved under different name, or deleted

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Technology and Architecture

- Pharo as IDE
- Zinc for HTTP and Web Sockets
- Teapot for minimal Web Server / REST
- Roassal to visualise classes
- NeoJSON to serialise and deserialise JSON

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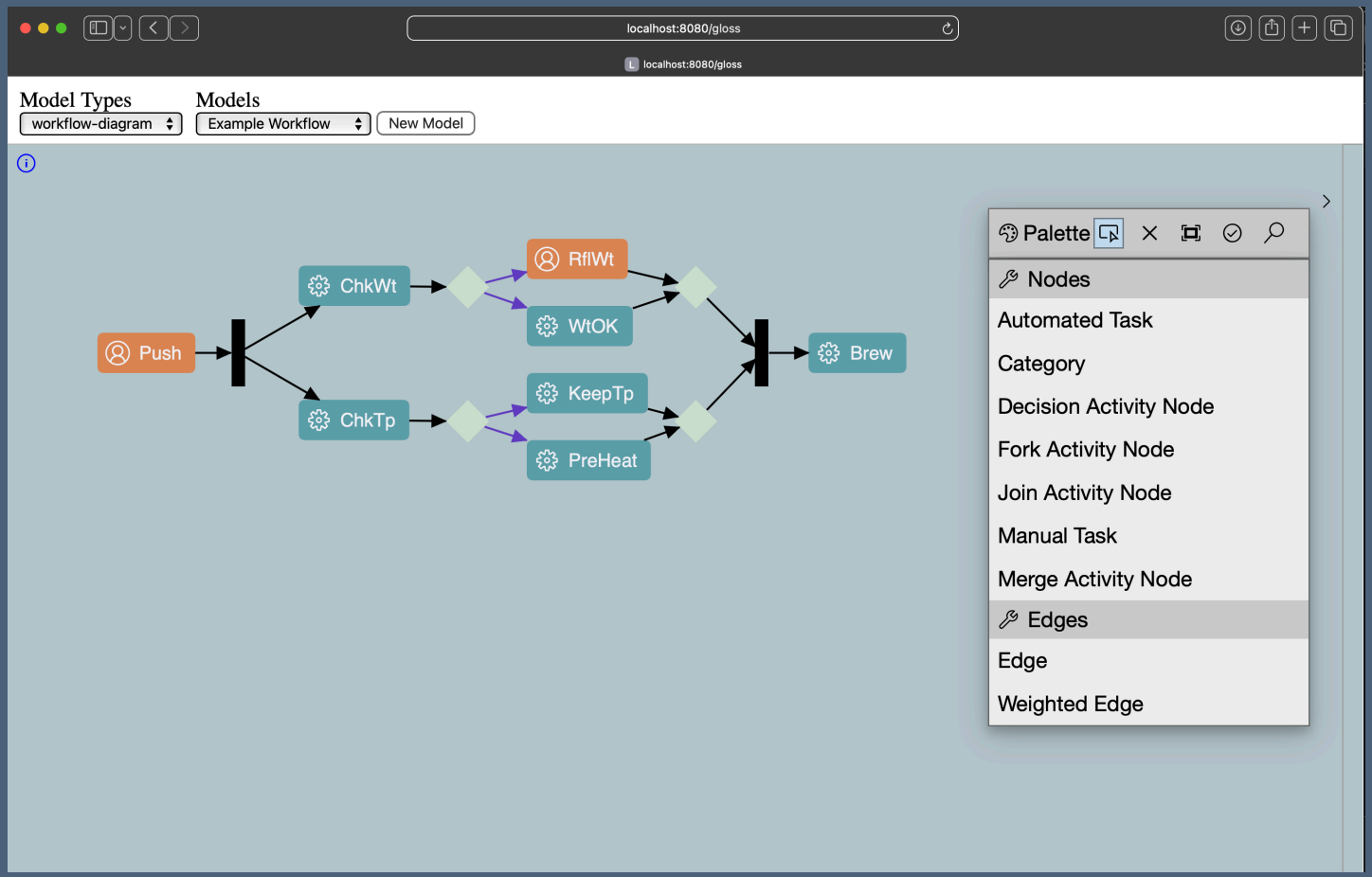
GLSP Client for Workflow

[Demo]



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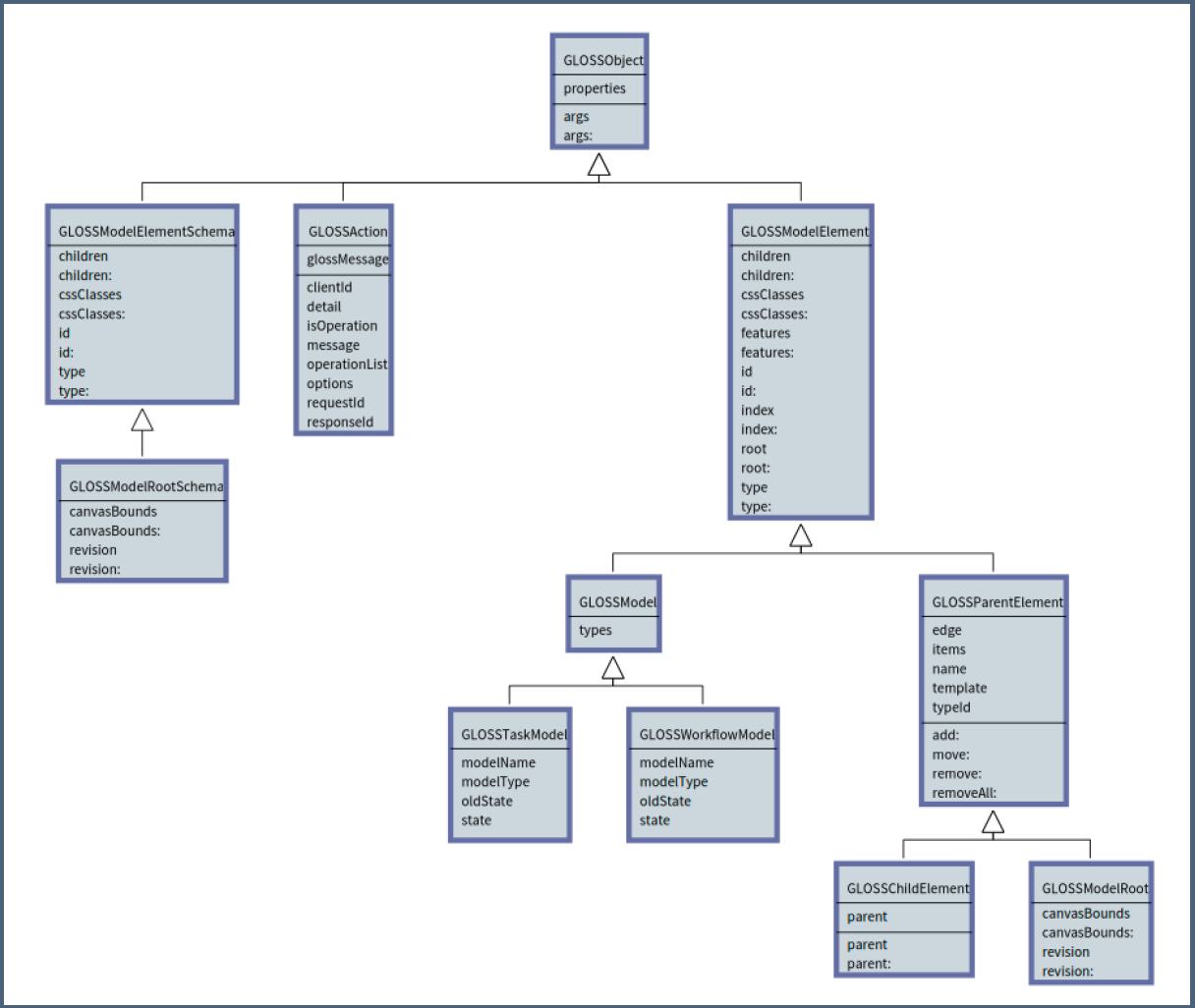
GLOSS Classes



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GLSP Recommendations (1)

	Limitation	Suggested Remedy
1	No explicit understanding of a Model Type	Extend protocol to include notion of a Model Type having a defined set of concepts, relationships and associated symbols. This should be achieved in data rather than code.
2	Ditto	Provide for requests for list of Model Types by client and response by server
3	No provision for dealing with multiple model instances	Extend protocol to allow for requesting models of a given type
4	Symbols defined in code and in client	Define symbols in data (still SVG) and on server. Provide for transfer of required symbols for model type to client
5	Symbol types limited to SVG	Could extend to allow lists and images
6	Does not allow re-use of model item across model instances (naming issue; item not managed separately from model)	Manage items as objects with own identity. Associate with models by reference.

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GLSP Recommendations (2)

	Limitation	Suggested Remedy
7	Does not support including items already on server in models.	Extend protocol to allow fetching item instance lists to facilitate this behaviour
8	Does not support fetching item details for editing purposes	Extend protocol to allow fetching item details and returning captured details to server. These could be exchanged as a JSON map.
9	No support for identifying related items to facilitate rapid visual model construction	Extend protocol to allow fetching items related to current focus item (name and type) where these are consistent with the current model type (permitted types and relationships)
10	Position and size of items is held as property of item, not per model. Inhibits reuse of item in multiple models	Refactor item location, size, etc which varies per model to the model. Keep domain details of item with item.
11	Does not provide for “expansion” of a model element to a drill down model	Extend the protocol to allow such a request from the client to the server and recording the related model with the item in the upper model.

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Project Observations (1)

- Example GLSP Implementations in Javascript and Typescript
- We worked with the Typescript example
- GLSP architecture assumes a client deals with only one model type!
- Connection between a concept and representation is realised in the client and is hard coded
- Symbols are implemented as functions returning SVG, again hard coded
- There is no explicit meta data about model type, mapping of concepts to visual representation etc.
- No edit of model elements (can probably be done via other Eclipse / LSP features, but not in examples)
- Efficiency and Responsiveness - Full model render for every change
- Low level of abstraction - Class per concept in the model type
  - Symbols hard coded for a given concrete syntax (Function per symbol with embedded SVG paths)
  - Large number of classes to deal with Actions and Responses (Class each - could just be methods on a couple of classes)
  - Only dealt with 1 endPoint, 1 Model Type, 1 Notation

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Project Observations (2)

	TypeScript	**Smalltalk**
Server	58k SLOC / 7,6 Mb	3k SLOC / <1 Mb
Client.	95k SLOC / 9,8 Mb (1 model type)	20k SLOC ~400k (unlimited model types, >> functionality)

- Our own antique Graphical Modeller
  - Handles many model types
  - Does meta and instance models
  - Does arbitrary (user extensible) symbols
  - Supports multiple symbol styles (vector, raster, container, list)
  - Has advanced features (Sessions and security, expand node as model, alignment, size, summarise models, visually compare models, launch node editing UI, store rendered model on server,§ etc.)
  - <20k SLOC

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Future Work

- Extend GOSS to return Smalltalk class properties and relationships allowing suitable client to display Smalltalk models (beyond just inheritance tree)
- May port the GLSP support to our EVA Server
- May use GLSP or extension thereof to allow our GM to access GLSP servers
- Could create our own GLSP client in the browser, but this will require vector graphics support (e.g. via CUIS and Morphic 3 or similar)
- Collaborate?

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