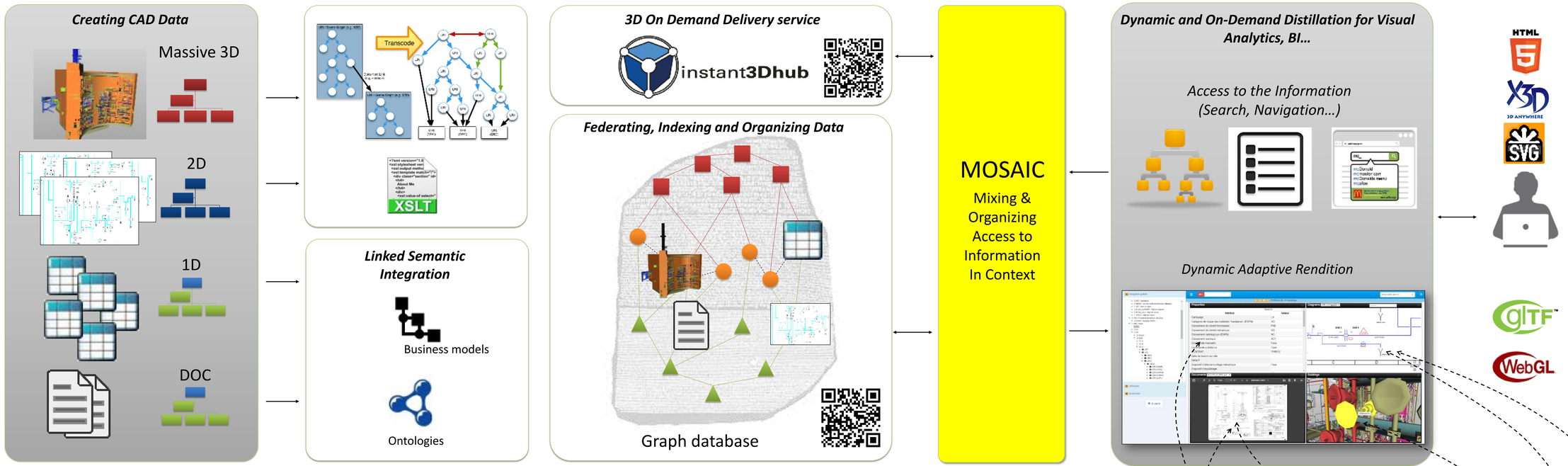
http://goo.gl/NGxIT6

A Plant Engineering ”Digital Rosetta Stone”: Towards Data-centric Multidimensional CAD Web Portal

Samuel Parfouru, Christophe Mouton
PLM Project, EDF, France

Max Limper, Johannes Behr
Fraunhofer IGD, TU Darmstadt
Germany

Engineering design phases in AEC and process industry projects produce large amounts of virtual CAD data that have to be linked together, specifically in the case of nuclear power plants, before being realized in the implementation and construction phases. In this poster we propose our ”Digital Rosetta Stone” web portal founded on two innovative pillars: a graph database and its agile connection to MOSAIC, a Visualisation Analytics Engine integrating Visual Computing as a Service to mix 1D, 2D and 3D engineering data in a full data-centric and web-accessible way.



Linking Multidimensional CAD data

The foundation of this data-centric system is a ”Digital Rosetta Stone” that links together engineering data thanks to a semantic index of all available information. The semantic indexing process maps several data sources e.g., 3D models, 2D P&ID (Piping and Instrumentation Diagram), piping isometrics drawings, PDF manufacturer documents complemented by classification schemes that are inferred from an advanced semantic business model dedicated to nuclear power plant design, and a specific ”key”: a coding system which names all the parts of the plant **[EPR 1998]**.

The architecture of the system is based on a graph-oriented database as shown in the above figure. The neo4j graph database was chosen for its capacity to store nodes of data, labels and relationships but also to allow the data manager or CAD teams to enrich in a pragmatic way, or simply add, new metamodels and classification schemes to existing ones without breaking and reloading the existing contents.

It offers a natural evolution of the structures of data and supports various paths for the users in terms of data exploration.

EPR. 1998. Creating a new data processing tool for designing the EPR. Nuclear Engineering International.

The MOSAIC (Mixing and Organizing Access to Information in Context) engine provides access to information with dynamic user perspectives in various dimensions. It supports synchronized displays through moving from one perspective to another and enriching one perspective with information of another. The system will also assist the user during navigation and data browsing, thanks to a semantic query engine. Queries may be explicit or implicit (derived by user interaction with the current perspective) as shown in the figure on the bottom-right corner of this poster.

For the 3D model exploration, the portal allows one to locate all or some parts of the model, to display engineering information directly in the 3D scene (”visually linked data”) and to access to other resources via a simple hyperlink. This was successfully achieved thanks to the declarative 3D API of the VCaaS or MMV service presented in **[Behr et al. 2015]**.

BEHR, J., MOUTON, C., PARFOURU, S., CHAMPEAU, J., JEULIN, C., THÖNER, M., STEIN, C., SCHMITT, M., LIMPER, M., DE SOUSA, M., FRANKE, T. A., AND VOSS, G. 2015. webvis/instant3dhub: Visual computing as a service infrastructure to deliver adaptive, secure and scalable user centric data visualisation. In Proceedings of the 20th International Conference on 3D Web Technology, ACM, New York, NY, USA, Web3D ’15, 39–47.

First Feedbacks and Conclusion

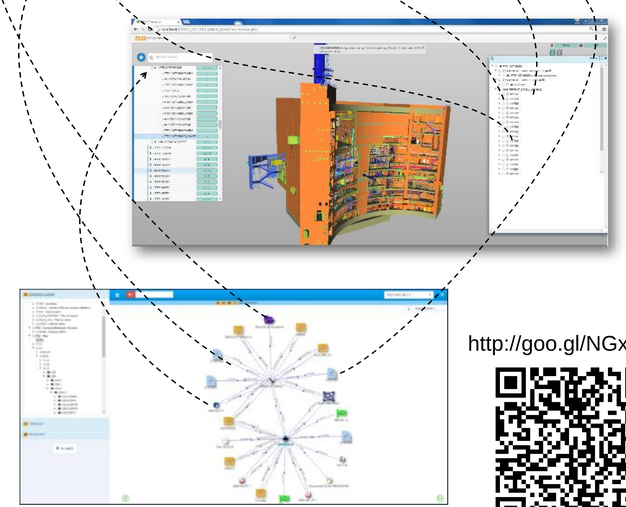
A prototype was implemented and the first experiments brought promising results to validate the capacity of such a portal to help the user to navigate into power plants multidimensionnal CAD data.

The neo4j graph database technology provides high-level performance to deal with millions of nodes and relationships because of the Big Data target of such tools [McColl et al. 2014]. It opens a large range of new ways of use.

The main challenges are right now to combine adaptive semantic visualization as highlighted in **[Nazemi et al. 2015]** and engineering semantic modeling based on CAD standards data.

We are confident that such agile development of engineering web portals will spread away in the industry and for the mass market, especially with the BIM, emerging SmartCities and new Internet of Things (IoT) markets.

NAZEMI, K., BURKHARDT, D., GINTERS, E., AND KOHLHAMMER, J. 2015. Semantics visualization definition, approaches and challenges. Procedia Computer Science 75, 75 – 83. 2015 International Conference Virtual and Augmented Reality in Education.



http://goo.gl/NGxIT6