A brief review of web visualisation challenges and achievements for Power Plant at EDF

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Web-Wide Immersive 3D BoF, 1st August 2017
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EDF launched the EDF Pulse awards to foster future innovation. The aim was to showcase start-ups and provide solid support as they move into action, inventing and developing the world of tomorrow.

In 2017, for its 4th edition, the EDF Pulse awards are willing to shed light on and reward young & talented entrepreneurs’ projects, which innovate to make society advance by inventing our electric future.

This edition will reward 5 winners, with:

- 4 Jury Awards (1 per category), attributed by a Grand Jury made of experts and personalities
Power plant, an highly complex product

What is Plant Lifecycle Management? video [URL]
With millions of engineering documents and... their data!
Looking for the rosetta stone: 1D, 2D, 3D... for our engineers

Hieroglyphic (14 lines)

Demotic (32 lines)

Greek (54 lines)

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http://www.britishmuseum.org/research/collection_online/collection_object_details.aspx?objectId=117631&partId=1
Let’s build a digital rosetta stone for power plants!

What is Plant Lifecycle Management? : video [URL]
2014: first web 3D visualisation and online CAD editor demo

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https://youtu.be/-F-RKtnCAc0
From proprietary RVM file format to X3D, Collada, IFC open ISO standards: the opensource Plant Mock-Up Converter PMUC [URL](#) Available on GitHub

Opensource web CAD editor based on X3DOM Available on GitHub [URL](#)
2015: first massive CAD web 3D visualization

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See also page 317 of the free ebook WebGLInsights: URL
So here we are:

a full web-based engineering portal

Presenting thousands of engineering documents and data…

1D, 2D, 3D and more…

In a web portal!

Thanks to neo4j graph database and webVis/Instant3DHUB pipeline
A Plant Engineering "Digital Rosetta Stone":
Towards Data-centric Multidimensional CAD Web Portal

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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 Visualization Analytics Engine Integrating Visual Computing as a Service to mix 3D and 2D design engineering data in a full data-centric and web-accessible way.

Creating CAD Data
Massive 3D

3D On-Demand Delivery service

Linked Semantic Integration

 Federating, indexing and organizing Data

MOSAIC
Mixing & Organizing Access to Information in Context

Dynamic and on-Demand Distribution for Visual Analytics, BI

Access to the Information (Search, Navigation...)

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 multidimensional (CAD) data.

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

The main challenges are right now to combine adaptive semantic visualization we highlight in [Nazeri et al. 2012] and engineering semantic modeling based on CAD standards data.

We are confident that such agile development of engineering web portals will spread early in the industry and for the mass market, especially with the IBM emerging SmartCloud and new version of Things (IIoT) markets.


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 changing one perspective with information of another. The system will also allow the user during navigation and data browsing, thanks to a semantic query engine. Queries may be exploited (obtained by user interaction with the current perspective) as shown in the figure on the bottom right corner of this paper.

For the 2D model exploration, the portal allows one to locate all or some parts of the model. It displays 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 VSGP or middleware service presented in [Behr et al. 2016].


Linking Multidimensional CAD data

The foundation of this data-centric system is a "Digital Rosetta Stone" that links together the data about a product in a semantic way. This is achieved through federated databases. The relationships between these databases are defined by classification schemes that are inferred from an advanced semantic business model dedicated to nuclear power plant design, and a specific "RDF" a coding system which connects the parts of the plant [EPRI 1988].

The architecture of the system is based on a graph-oriented database as shown in the above figure. The main graph database chosen for its capacity to store nodes of data, label and relationships but also to allow the data manager on CAD teams to enrich in a pragmatic way, or simply add, new metadata 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.

Thank you for your attention

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