WHITE-PAPER PRE-STUDIES

ABB META-ready

Proof of concept for industrial metaverse in energy management systems for ABB / Sumitomo Summit

- Overview of case study for implementation of OPC UA in an unreal environment running in the cloud (using Kubernetes in a docker environment)

Index

Abstract

Converging technologies in all industries are leading the way towards the industrial metaverse* (or metaverses). Being the result of emerging technologies led by the digitalization and ever-increasing computational capabilities. The intelligence of AI-enabled engines in the cloud and autonomous systems at edge, further research and development is

Goal: developing a real-time, true-to-reality simulation. ABB META-ready aims at bringing more creative possibilities and efficiency to project development and operations, including real-time data, visualization tools and AI.

Market forecast

Based on the Precedence Research, the current market size for the Metaverse is 40 USD billion, but it is expected to grow to around 1,600 USD billion in 2030, which is a 50% yearly growth on average.

Enhanced Digital Twin and World Simulation

The creation of digital twins early, in concept, pre-design and design phase, enables better cooperation and communication in project development, as well as offering accessible visual reference to customers and investors. This paper suggests a framework for how one can utilize a visualization-oriented workflow; supported with documentation of a case study of a Floating Sub Station (FSS), as a cooperative effort between ABB and Sumitomo. The goal has been to create physically accurate virtual replica of unique objects, processes, or environments—all constantly synchronized with real-world data inputs, enabled by AI and real-time raytracing. With the use of Unreal Engine, digital twins, 5G networks, power plants, OPC-UA data streams, all working in the cloud, the approach offers faster and at higher fidelity product development.

Accelerated Development of 3D Tools

The aim of ABB META-ready is leveraging innovative engines AI, and simulation technologies building a platform focused on interoperability. By modular and easily extensible assets from the early phase of project development, the solution offers increased cooperation, streamlined design process, and an iterative framework accelerating coordinative efforts in design. With low- and no-code Python-based development, Unreal-Engine environment, developers can build 3D environments quickly, efficiently, and sustainably – while offering better communication across groups.

Work methodologies, start of initiative

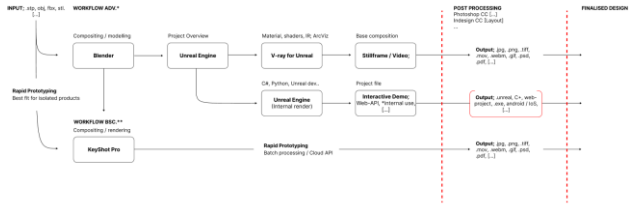

Figure 1: framework for initial development

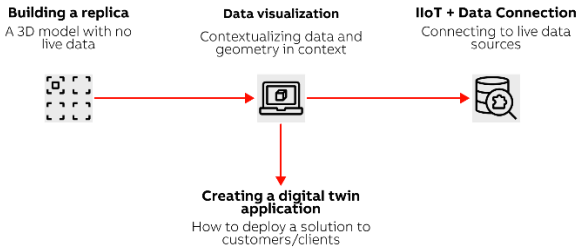

Figure 2: Overview of the development work-flow

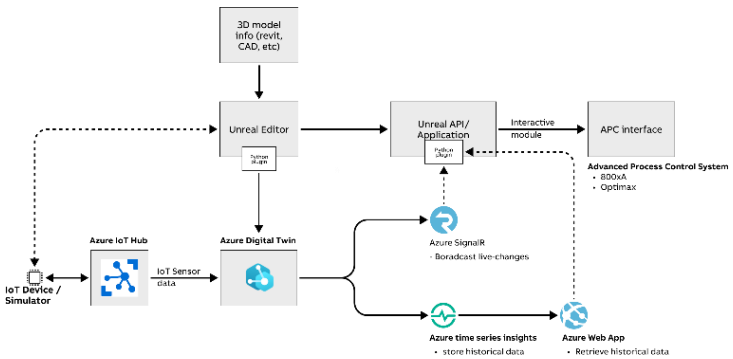

Figure 3: Overview of the development workflow

Current state of development

Features: Integrated live weather API data-streams; allowing for real-time visualization; weather simulation; real sun, and moon simulation, buoyancy based on wind direction.

Case for further development

Integration for control and further development of live data-streams. Unreal-API enabled module to be implemented in APCs.

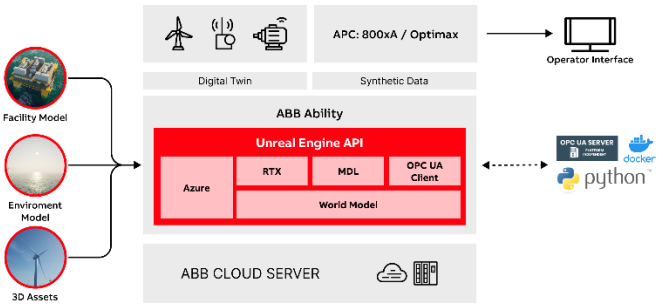

Figure 4: Proposed architecture for future development

3D asset library development

Even though many 3D models are available in the distributed groups in ABB, most of the models are of too detailed level for this use (production models). They are often too "heavy" to work with in a live virtual model, and can potentially also reveal technical information that ABB would not like to share. A library should be made of "simplified" 3D assets, that can be used more freely. The following process would be used to develop these:

- Gather 3D CAD models
- Export from CAD to poly-based model (i.e. .step ….) -> .fbx file.
- Edit .fbx file, simplify, reduce
- V-map (Automated function is often sufficient)
- Texturing
- Export to Unreal Engine as integrated. fbx (containing model geometry, texture information and physical material shader)
- Add to common library

Facility model library

The facility is normally designed specifically for a given project. Standard facilities can be created to give a starting point, but the layout will still need to be performed by skilled engineers. E.g. in relation to best practice, walkways, escape routes, center-of-gravity considerations for offshore assets, etc.

Environment library

In the pilot test already performed, an offshore environment has been built up. This environment can extend "indefinitely" and can include any number of facilities and 3D assets. The virtual location of the environment can be changed to any place in the world by changing the coordinates. And weather (wind, sun, clouds, etc) are automatically updated for the specific location selected.
Additional environments or extensions of the current should be added to an environment library, in-cluding onshore locations, near shore location, etc.
The environments can easily be re-used once built.

Live data-stream

Successful pilot testing has been done with live weather services. And similar methods can easily be used with asset data through for example Microsoft Azure.
Further live data-stream linking with tools such as PP Sim or other process simulation tools, will allow actual testing and simulation of the system to be performed directly in the virtual reality.

* Metaverse

The metaverse is a network of virtual places that are linked into a virtual universe. It is often described as a future version of the Internet.

In the Metaverse, customizable avatars and dynamic group experiences will enable a new era of social interaction. Weddings, happy hours, and religious ceremonies are increasingly taking place virtually, with individuals participating regardless of their geographic location, especially in the aftermath of COVID-19. Metaverse members will engage with and purchase digital and real-world apparel, sporting goods, and other items through virtual shopping malls. Virtual try-on software and augmented reality (AR) capabilities that help buyers in various ways are a natural fit for this use case.

Appendix CC-BY; Creative Commons Attribution License

Unreal® Engine End User License Agreement **Unreal Engine EULA**, key takeaways are:

- Royalty Addendum: 2. a. Royalty-Free Distribution.
- i. Non-Engine Products (e.g., Rendered Video Files)
  You will not owe us any royalty payments for Distributing Products that (i) do not include any Engine Code, (ii) do not require any Engine Code to run [...], rendered video files (e.g., broadcast or streamed video files, cartoons, movies, or images) created using the Engine Code (even if the video files include Starter Content).
- ii. Indirect Revenue
- iii. Other Royalty-Free Distributions
  You will not owe us any royalty payments for Distributing Products:

* *To the legal entities that are part of your company group, such as a parent company or a subsidiary, for their private use, so long as those entities do not further Distribute the Products outside of your company group.*

Industry references and online resources:

- **Unreal Engine API Reference**
  https://docs.unrealengine.com/5.0/en-US/API/
- **Deploying Unreal Engine 4 in Azure**
  https://docs.unrealengine.com/4.27/en-US/ProductionPipelines/CloudDeployments/Azure/
- **Visualizing Data in Digital Twins with Unreal Engine**
  https://youtu.be/TqUpTJhmxUc
- **How China Cloned Shanghai**
  https://www.theb1m.com/video/how-china-cloned-shanghai
  https://youtu.be/hOJZhsNtB6g
- **Buildmedia's Digital Twin of Wellington**
  https://youtu.be/Y-0m9GHl86I