APICA: THE DIGITAL TWIN SOLUTION TRANSFORMING THE PORT OF ANTWERP-BRUGES

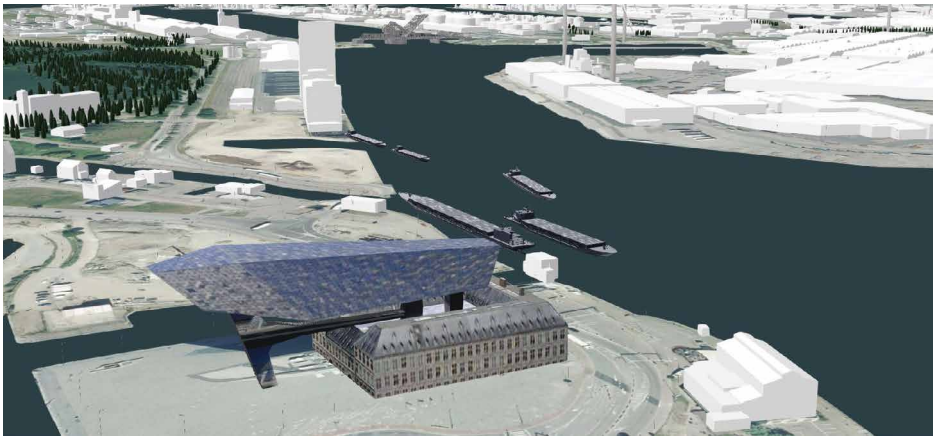
Port of Antwerp Bruges

Margherita Bruno, Editor, Port Technology International, in conversation with **Stefan Van Hooydonck**, Business Solutions Architect, Port of Antwerp-Bruges, and **Nico de Cauwer**, Business Architect Digitalisation & Port Community Projects, Port of Antwerp-Bruges

Can you briefly describe the concept of a Digital Twin, and how it is being implemented in the Port of Antwerp-Bruges?

The Port of Antwerp-Bruges (PoAB) has developed a Digital Twin, which is essentially a digital replica of all operations occurring within the port's territory. This cutting-edge technology was implemented to create situational awareness for all employees of the PoAB, acting as the central component that combines all the port's initiatives within its digital nervous system. The PoAB invested in various advanced technologies, such as 5G networks, drones, and IoT sensors, that work in conjunction with the Digital Twin. The Digital Twin was created from scratch in an iterative and incremental manner, using different information layers that are combined either on a geographical level, such as data from assets located in the same area, or a functional level, for instance, when two assets are connected to each other, like a ship connected to a shore-box for onshore power supply.

What specific challenges or problems does the APICA Digital Twin solution aim to solve, and how does it achieve this goal?



By providing situational awareness, the APICA Digital Twin solution enables real-time insights into the current state of assets within the port's territory, such as traffic situations, bridge and lock statuses, maritime infrastructure, and environmental sensor data. This solution effectively addresses these challenges by providing a comprehensive and detailed overview of the port's operations, allowing for efficient decision-making and problem-solving in a timely manner.

How does the APICA Digital Twin solution enhance the port's operational efficiency and effectiveness?

Our solution combines layers of information and assets to provide an improved understanding of the geographical situation, enabling efficient analysis and incident investigation. It also offers the ability to view historical data and near-future predictions, further enhancing situational awareness. To improve decision-making even further, the APICA team is currently investing in integrating simulations and predictions, such as traffic situation forecasts, into the Digital Twin solution. This integration will provide an even more comprehensive overview of the port's operations, facilitating effective planning and preparation for potential challenges.

"BY PROVIDING A COMPREHENSIVE AND DETAILED OVERVIEW OF THE PORT'S OPERATIONS, ALLOWING FOR EFFICIENT DECISION-MAKING AND PROBLEM-SOLVING IN A TIMELY MANNER."

Can you discuss some of the key features and capabilities of APICA, such as its data analytics and simulation tools?

APICA delivers real-time updates on ship movements, air quality, weather conditions, dangerous goods flow, maritime infrastructure inspections, and oil spill detection. By applying data science, APICA aims to achieve predictive and prescriptive capabilities over time. The platform's traffic simulation forecasts up to 30 minutes in advance, considering factors such as historic traffic flow, tidal windows, lock planning, vessel destinations, and current and predicted traffic situations. APICA aims to provide additional insights into potentially dangerous situations while also offering an understanding of the emissions impact of the simulated situation.

What kind of data is collected and analysed by APICA, and how is this data used to improve port operations?

The APICA Digital Twin solution integrates a wide range of data sources, including IoT data, real-time ship positions, and air quality measurements, as well as static and live data streams and prediction models. This comprehensive data gathering approach facilitates efficient decision-making by providing all relevant information from the field to supervisors at a control centre or field officers. Such access to detailed and timely information improves decision-making quality by enhancing decision support, allowing for prompt action, and ultimately resulting in better outcomes.

How does the APICA Digital Twin solution interact with other systems and stakeholders in the port ecosystem, such as shipping lines and logistics providers?

Currently, the APICA Digital Twin solution primarily focuses on assets owned by the Port of Antwerp-Bruges, as well as data provided by partners such as suppliers of IoT sensors and data, and third-party contractors supplying shore power and windmill data. Additionally, APICA is built on an open architecture which enables quick data and application integration (plug-and-play).

However, the team is open to exploring possibilities for expanding capabilities within the Ports community - such as incorporating data from emergency services operating within the port and opening the Digital Twin to different stakeholders (i.e. emergency services). This collaborative approach can further enhance the solution's capabilities, providing even more comprehensive insights and improving decision-making in the port's operations.

Can you discuss any success stories or specific examples of how APICA has helped improve port operations and performance?

iNoses are specialised sensors designed to detect air pollution and gas emissions. In the case of berths for inland barges, diesel generators are prohibited while

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at berth due to the availability of shore power supply. The APICA Digital Twin solution leverages data from various sources, including ship positions, shore boxes, and air quality measurements to detect potential violators of this rule. Once detected, the system dispatches a port authority officer to the situation for prompt intervention, minimising the impact of pollution on the environment and maintaining the overall sustainability of the port's operations.

How does the Port of Antwerp-Bruges plan to further develop and expand the use of Digital Twin technology in the future?

Our team follows an agile approach in managing our roadmap, allowing us to continually prioritise based on new innovations, insights, and use cases. This iterative process enables us to remain adaptable and responsive to emerging needs and changes in the landscape, ensuring that we are always delivering the most value to our users.

What kind of challenges and opportunities do you see in the wider adoption of Digital Twin technology in the maritime industry?

The challenge of data sharing between private and public entities, as well as within communities and companies, is well-known. Furthermore, there is a hurdle in adopting new tools that could potentially replace longstanding applications. However, there are also significant opportunities to be seized . Our team is able to rapidly connect and visualise any data source or data pipeline thanks to the framework and the open architecture we have developed. This allows us to integrate all types of data in a seamless manner. Additionally, there is great potential within the community or intra-ports to connect various data sources and further enrich existing datasets. By leveraging these opportunities, we can overcome the challenges of data sharing and drive greater value for all stakeholders.

Lastly, what advice would you give to other ports or organisations looking to implement a Digital Twin solution?

Building a Digital Twin should not be done just for the sake of creating an additional application. It is important to first establish a vision, define the scope and work towards a clear goal. By creating an open architecture and building incrementally, block by block, and use case by use case, tangible results can be delivered. This will enable more insights into what is possible and facilitate greater response and usage from the intended audience. The key is to focus on delivering value and demonstrating the benefits of the Digital Twin.

ABOUT THE COMPANY:

With a throughput of 287 million tonnes, the Port of Antwerp-Bruges is a critical hub in worldwide trade and industry. It is home to 1,400 companies and accommodates the largest chemical cluster in Europe. The port provides a total of 164,000 jobs and generates an added value of €21 billion (approximately $23 billion).

ABOUT THE AUTHORS:

Stefan Van Hooydonck started as a Business Solution Architect at the Port of Antwerp-Bruges back in 2019. His main focus is asset management which is one of the main pillars of the Port Authority, together with nautical traffic management. He was the IT Project Lead on the Operational Digital Twin project from the start. This project won the DataNews (Large) ICT Project of the year in 2022.

Nico de Cauwer is Secretary-General of the International Port Community Systems Association (IPCSA) as of 1 May, 2023. Nico has 30 years of experience in the port and maritime sector, involved in a variety of digitalisation and innovation projects at the Port of Antwerp where he worked on the implementation of the most major projects, and joined the Antwerp Port Community System as a Senior Business Developer back in 2011.