WESTRIVEUP
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Digital Twin Event

15th of Nov. 2021 from 14.00-18.15 pm in cooperation with FH Salzburg, FH Kufstein and DIH West.

Experts: Hubert Lehner (Head of 3D-Modellierung & Services, City of Vienna), **Jiri Bouchal** (Senior Consultant IS Practice, Co-Founder & CEO InnoConnect), **Mario Döller** (Principal, University of Applied Sciences Kufstein), **Thomas Schmiedinger** (Deputy Program Director Smart Products & Solutions, University of Applied Sciences Kufstein), **Simon Kranzer** (Senior Lecturer, University of Applied Sciences Salzburg), **Gerald Lochner** (Head of Product Management COPA-DATA, Lecturer FH Salzburg), **Jaan Saar** (Head of Digital Construction, Estonian Ministry of Economic Affairs and Communications), **Pavel Kogut** (Researcher & Project Coordinator, 21c Consultancy), **Fabian Dembski** (Head of Competence Center for Global Systems Science, High Performance Computing Center Stuttgart), **Georg Güntner** (Senior Researcher, Salzburg Research Research Association)

Link to recording: https://we.tl/t-AIDDkkplOD

Introduction

How can processes be optimized in terms of sustainability and climate-related improvements? What potential does this hold for tourism?

In many countries around the world, digital twins - realistic, virtual models - are used to simulate changes or impacts of potential events without risk. Many cities, including Vienna or Plzeň, are pioneers here, also entire regions or countries already have a digital twin model.

Still not to be found in an alpine region. But especially in Austria, where tourism and sustainability play a central role, a digital twin could reveal potentials that have a massive positive impact.

Smart City Vienna – Hubert Lehner

For the city of Vienna, the goal is to map a complete, virtual 3D city model with a digital twin for **buildings, streets, sidewalks, bridges and paths**. Different data, facade structures, windows and doors can be mapped, extracted from images and fed back into the model. *Data* can be *linked* and thus *plan scenarios* can be *analyzed* and *simulated more frequently, faster* and in *more detail*. Use cases for this are, for example, the **measurement of solar radiation on roofs, the influence of trees on facades and flood simulations of buildings** with a projection of building damage. This data can also be used for PR/communication, science, and tourism and marketing of the city.

Smart City Plzen – Jiri Bouchal

With *sensors* in the city of Pilsen connected to a digital twin and the *connection of cars to mobile sim maps* for speed data, **traffic and crowd behavior can be simulated and observed**, e.g. during road closures or new construction. This traffic model is linked to **air quality** and **noise** and can *simulate* these *impacts* as well. Furthermore, the digital twin is used for *crisis management*, e.g. to prevent terror and cyber attacks. This *data connectivity can improve transportation, mobility and other areas as well as their use*.

Important for a digital twin is the technical know-how, the involvement of data enthusiasts and students to try out different tools with the provision of data as well as conducting hackatons. The goal for Pilsen is to support data-driven policymaking for a sustainable city.

Challenges of a digital twin:
- Stakeholder engagement
- Adapting technology to the daily work of public administration
- Investment in new technologies

Benefits of a digital twin:
- New tools to support policy
- Research and innovation as well as new technologies and experiences
- International contacts and reputation, EU funding

Approach to a digital twin project:
→Gradually introduce sensors as an independent, modular system - for more efficient management and funding
→Focus on achievable, realistic results - for long-term adaptation and funding.

Digital Twin Lienz – Mario Döller

The *digital image* of the future of a "*smart region*" is based on the *utilization of high-performance broadband* and *mobile communications infrastructures* and an *increased range of digital applications*.

Advantages of a digital twin:
- Obtaining framework data for planning and investment decisions.
- Optimized use of infrastructure
- Future-oriented and sustainable location services
- Demonstration of model implementations for the economy, public sector and private requirements
- Provision of decision-making bases for intercommunal development as the region's central regional impulse area

The prerequisite for this is a *broadband infrastructure*, which is very well developed in Tyrol and enables *fast data transmission*. Furthermore, communication via LoRa, a cost-efficient and wireless sensor-based *transmission method* for IoT components, which is growing rapidly and implementing worldwide projects, e.g. with the municipal utilities of Innsbruck and Kufstein.

Implemented applications in East Tyrolean communities:
- Leisach: Spring catchments (water management).
- Lienz: Parking space management and warning app for municipal infrastructure
- Thurn: Energy data monitoring of public buildings such as fire departments and schools
- Tristach: Wastewater pump management (warning, filling level)
- Schlaiten: Elevated tank measurements

A concrete example in relation to the warning app is that due to snowfall, a large number of distribution boxes, hydrants, etc. are not visible, these are damaged by snow removal, resulting in a high amount of damage. The solution to this is a **warning app** with a map on which obstacles are displayed and tracked by GPS. The app gives **visual** and **audible warnings, new obstacles** can be **added** and thus **damage** can be **prevented**. Another example from parking management is AI based **visual detection** of **vehicles**. In addition, real-time parking management can be performed by processing statistical data (occupancy duration, etc.), with the possibility of expanding to a **real-time parking guidance system**.

Introduction Technology – Thomas Schmiedinger

In the data flow in a digital twin, *data* is *drawn* from a *physical object*, e.g. weather forecasts by various sensors from weather stations and satellites. This *information* in turn *goes from* the *virtual object back* to the *physical one*. An expanded network infrastructure, falling hardware costs, miniaturization, integrated sensor technology and new possibilities in information retrieval enable and facilitate digital twin projects. The dimensions of a digital twin include the virtual and physical unit with different modeling variants, the use and handling of data, service, communication and security.

Added value of smart connected products as a prerequisite for a digital twin:
- Acquisition of data on states and their environment, e.g., through satellite data.
- Control of functions, e.g. snowmaking and grooming for slope maintenance
- Optimization through the use of algorithms, predictive monitoring and scenario generation
- Autonomy through self-coordination of functions and self-diagnosis tools, e.g. self-optimizing and self-sufficient piste system

One possibility for data acquisition is stationary measurement by sensors, e.g. **snow cannons with integrated weather station and measurement** of air temperature, humidity, wind direction, wind speed, snow depth, precipitation and dew point. In addition, **lift systems** and the **slope management system** can collect data and the accuracy of the ground station can be increased after a prior terrain scan. **Snow groomers** are integrated and send **feedback** during grooming. The other option for data collection is location-variable, such as **sensors** in the **skiers' smartphones**.

Introduction Security – Simon Kranzer & Gerald Lochner

The *Industrial Internet of Things* has a strong focus on machine-to-machine communication, big data and machine learning. It enables industries and companies to operate *more efficiently and reliably. Machines* and *processes* can be *intelligently networked* with the help of information and communication technology, e.g., *self-driving forklifts load high shelves with goods*.

It is important to protect sensitive, private information from unauthorized access or modification, and the data should be available and user-friendly. To give optimal protection through *cyber security*, many applicable measures are needed, such as user authentication and monitoring of all communications.

Security must be provided from the beginning, in all areas, throughout the entire time and until the end. It should also be affordable, applicable (process compatibility), user-friendly, clear, and not interfere with data exchange. Furthermore, government, research and society should cooperate to develop applicable and usable security.

Digital Twin Estonia - Jaan Saar

For the Digital Twin in Estonia, an *open source software* is used in which many different *public and unbiased data sources are linked together*. This can be used, for example, to perform **shadow surveys** or to create **floor plans**. It is shown what the current state of the data is, which gives the **basis for improvement**, since not all data is perfect. This can be used to visualize missing data for improvements. For example, if height data of a building is missing, only the area is visualized, but not the standing building. "This is all our path of improvement and we can have a peek into the future."

Use cases of the digital twin in Estonia:
- Visualization of approved buildings
- Performing basic measurements
- Area boundaries
- Flood risks
- No-fly zones/height restrictions (e.g., windmills too tall)
- Upload and share designs for real estate developers and designers
- Transparent ground mode e.g. for train or to better visualize how buildings can be connected (see pipes and cables)

EU-Project DUET - Pavel Kogut

Use case Antwerp: **Monitoring crowds** using multimodal data - for example, during road closures or lockdowns, it is possible to see what the crowds and traffic are like in different parts of the city. This is done using *automated data from smart traffic light systems, moving cars and telecommunication data*.

Use case Athen: Mapping **shaded areas**; mapping **natural paths** used by pedestrians and cyclists during road closures due to traffic problems.

Basically, a digital twin has a *central data broker* to which different data sets, models, endpoints and visualization clients are connected. Through this bidirectional, *dynamic communication link*, the digital twin can be monitored and *synchronized* with the *physical, changing environment*.

The DUET digital twin project includes various phases involving *workshops* and *testing* with different *end users*, such as internal employees, public administration staff and the general public. During these phases, data can be uploaded, visualized in an easily understandable way, used for measurements in a meaningful way and tested. The data can be specially used for *internal government decision-making* purposes.

Tip: Focus on use cases that matter to citizens and city - based on this, look for datasets and models on how a digital twin can help achieve specific goals - very important to involve end users in testing and vali-dation to get feedback.

Digital Twin Schwarzwald - Fabian Dembski

The digital twin in the Schwarzwald is mainly about **sensitive strategies** for the **energy transition** and the **implementation of renewable energy sources**. In detail, it is about the construction of a pumped storage power plant, which has massive impacts on the environment and local structures. Risks are analyzed and simulated to assess technical consequences. The *integration of mechanical engineering/BIM* is important. For example, for **water flow simu-lation** through **turbines** and in the **river bed**, **noise simulation** e.g. to assess **sound propagation**, as well as **visualization** of **construction phases** including *geological data* and *land use*. This can be used as a *planning and decision support tool* for testing options.

Furthermore, the digital twin is used for visualization and simulation for "**virtual tourism**", e.g. **paragliding with virtual and augmented reality**. **Natural and environmental hazards** such as **flooding** in risky areas which can also be simulated and provisions be made for them.

An example of a digital twin for urban green is Talin in Estalnd. The focus here is on the built landscape and environment and their interaction. The *main goal* in these projects is *sustainable regional development and transformation of natural/urban areas*. It is especially important to involve all stakeholders from the beginning.

Digital Twins in the Plant Life Cycle - Georg Güntner

Digital Mountain: Use and exploitation of data in a mountain region.
- Network infrastructure: required communication infrastructure for data transport
- Data infrastructure: required interfaces and standards for skiers and gondolas
- Linking terrain topology and weather data
- Benefits and value creation: justification for the construction, benefits and operation of the infra-structure

Data flow of a digital twin:
Through *sensory data acquisition* (sensors on the real object), data about states of the object are transmitted and building a digital image. This data flows back into the real object, controls it, and decisions are made by the digital object, whereby *changes to the real object are data-driven and automatic*.

Digital twins can be used in a variety of ways for industry, smart city, healthcare, aerospace, and more. Among other things, predictions can be made in asset management, such as **plant runtime** and **how long the quality of production** can be **maintained**. An example for the use in the plant sector is the optimization of a pump operation. **Efficiency analyses** based on recorded data and measured values and the **most important parameters of a pump** can be **mapped**. If the pumps or measured values are not running normally, the operator receives a *notification* that the respective pump needs to be *checked*. Another example is a **railcar** from the ICE of the German railroad. Many parts contain *sensory information* that *indicates critical conditions* and *automatically intervenes* and *reacts in the control of the railcar*. A power plant also contains very good sensory records of the individual components, which record *data from the environment* and the *control center* in order to map, **monitor** and predict the **power plant**.

The "orientation towards clear use cases and their implementation" has great importance. In addition, a digital twin is an *interdisciplinary project*. Therefore, *all participants*, both IT and sensor specialists, as well as, for example, gondola and lift manufacturers, ski manufacturers, ticketing system and access control system providers, etc., should be *involved*.

Discussion / Résumé

Optimization opportunities in the region:
- Visitor flow management
- Mobility: e.g. public individual transport, parking space planning, traffic improvements in case of road/bridge/tunnel closures with effects on air and noise
- Agriculture: e.g. use of mountain roads/trails; mountain pasture management at different times of the year
- Environmental hazards: e.g., simulation of increased avalanche risk due to lack of/reduced alpine grazing
- Architecture, use of space: e.g. visualization of new buildings, shadow studies
- Ecological footprint

- Crisis management: e.g. opening of winter season in times of covid
- Slope management: e.g. maintenance (snowmaking, grooming), optimized system
- Virtual tourism
- Water management
- Strategies for energy transition and renewable energies

The benefits of a digital twin are far-reaching and contribute to increasing the value of the region, location attractiveness, growth and innovation. A digital twin project requires a vision of the future and goals. Questions that can be asked include: What does a valuable habitat look like? What will tourism look like in X years? In addition, there must be a clear added value for all stakeholders - residents, city administration/authorities, agriculture, associations, companies (such as architectural firms, construction industry, lift operators, etc.) and visitors, etc. Then it is important to determine the current state with the available data and, based on that, start with implementable projects that have achievable and realistic goals. The commitment of the stakeholders, working with the technologies and the involvement of all stakeholders and the population play a major role in order to exploit the benefits of a promising digital twin.

Thank you for your participation!