Transportation and Urban dynamics

Transforming Transportation and Urban Planning with Digital Twin Technologies

Chairs:

Alessandra **Feliciotti** - MindEarth s.r.l.

Simone **Fratini** - Solenix Engineering GmbH

Destination Earth

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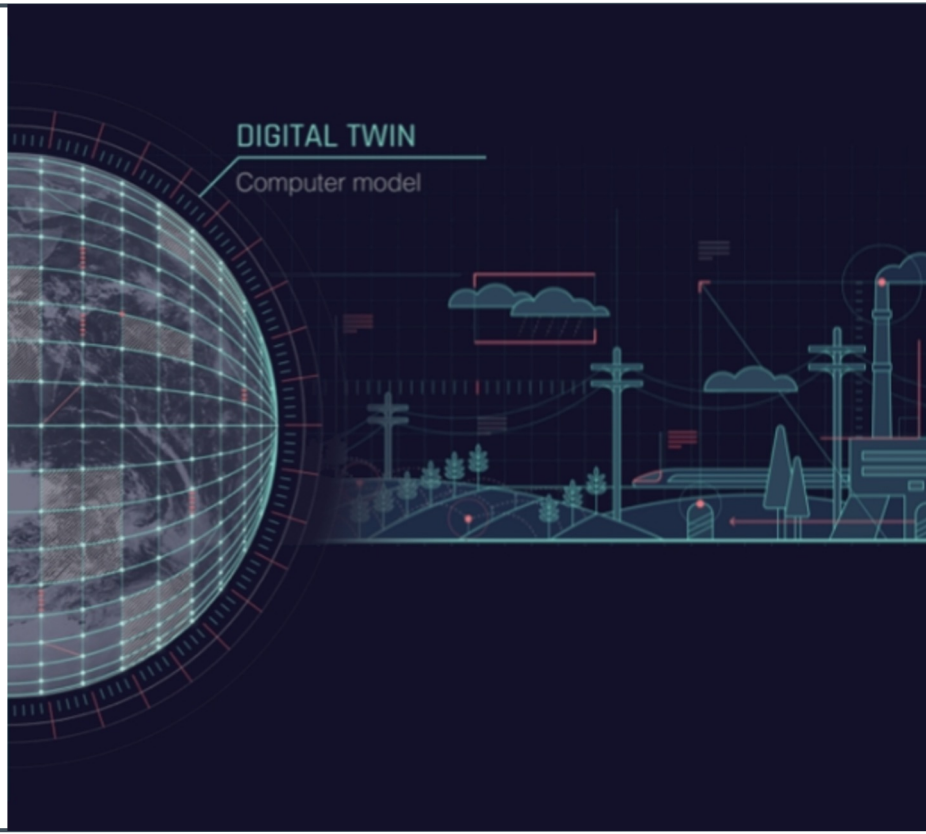
About this session

- Focus on digital twin technologies in sustainable **urban planning**.
- Highlights **urban challenges** like **accessibility, traffic, multi-hazard risks, air quality and heat stress.**
- Emphasizes the value of **Destination Earth** use cases in spatial and infrastructure planning as well as disaster risk management.



Key Challenges for Cities in the Context of Climate Change

Rising Temperatures and Urban Heat Islands (UHIs): Cities are facing increased temperatures, particularly due to dense infrastructure absorbing and retaining heat, disproportionately impacting vulnerable populations (e.g., elderly, low-income communities).

Extreme Weather Events: Increased frequency of floods, storms, and heat-waves, causing infrastructure damage, displacement, and economic loss. Here, coastal cities are at greater risk of sea-level rise and storm surges.

Air Quality Degradation: Climate change exacerbates pollution, with more intense heat and stagnant air increasing, Nitrogen dioxide, particulate matter and ozone levels.Increased urbanization leads to higher emissions from transportation and congestion, contributing to pollution with impacts on human health and mortality.

Rising Temperatures and Urban Heat Islands (UHIs)

Why this matters?

- **Urban Heat Islands by Region**: **74%** European Cities already experience heat island effects, with **cities in Southern Europe** seeing some of the largest increases in average temperatures (EEA).
- **Heat-Related Mortality**: It is estimated that by **2050**, heat-related deaths in cities could increase by **257%**, driven largely by UHIs and rising global temperatures (Lancet Countdown, 2020).
- **Global Warming Projections**: if global temperatures rise by **2°C**, extreme heat events in urban areas could become **2-3 times more frequent**, leading to longer and more intense heatwaves (IPCC).
- **Energy Consumption**: Higher urban temperatures can lead to **20-30% higher** energy consumption for cooling systems, straining power grids and increasing greenhouse gas emissions (IEA).

Extreme weather events

Why this matters?

- Over the past 40 years, Europe has seen a **60% increase** in extreme weather events, including floods, storms, and heatwaves (European Environment Agency, 2021).
- Extreme weather events have cost Europe an estimated **€450 billion** between 1980 and 2020, with **70%** of those costs attributed to floods and storms (European Environment Agency).
- In March 2023,during the Emilia-Romagna flood, 23 rivers overflowed after receiving more than 200 mm of rain in just 36 hours, caused over **€6 billion** in damages, killed **15 people**, and **displaced 36,000**.
- By 2100, climate models predict a **30% increase in extreme precipitation events** in Central and Eastern Europe, leading to more frequent and intense flooding (IPCC, 2021).

Air Quality Degradation

Why this matters?

- Over the past 40 years, Europe has seen a **60% increase** in extreme weather events, including floods, storms, and heatwaves (European Environment Agency, 2021).
- Air pollution causes around **400,000 premature deaths annually** in Europe, with **97%** of urban populations exposed to harmful **PM2.5 levels**.
- **Traffic-induced air pollution** is a major contributor to poor air quality in **European** cities, responsible for up to **40%** of **NO2 emissions.**
- Cities like **Milan** and **Rome** frequently exceed EU air quality standards, with Milan recording average PM2.5 levels of **19 µg/m³** in 2021, far above the WHO limit of **5 µg/m³** (European Environment Agency).

Use cases

CityNexus

SOLENIX

MindEarth

UrbanSquare

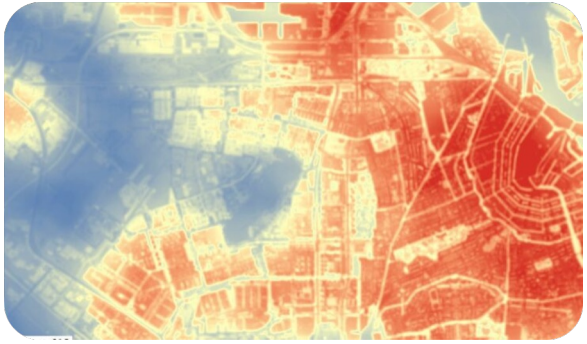
SISTEMA
ENVIRONMENTAL INFORMATION MINING

MOZAIKA

MURMURATION

imperative space

Addressing UHI



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Guest Speaker

Rasmus Sune Reeh

Founder of UrbanDigital and Former Senior Consultant of City of Copenhagen‘s Copenhagen Solutions Lab

Participate to the discussion

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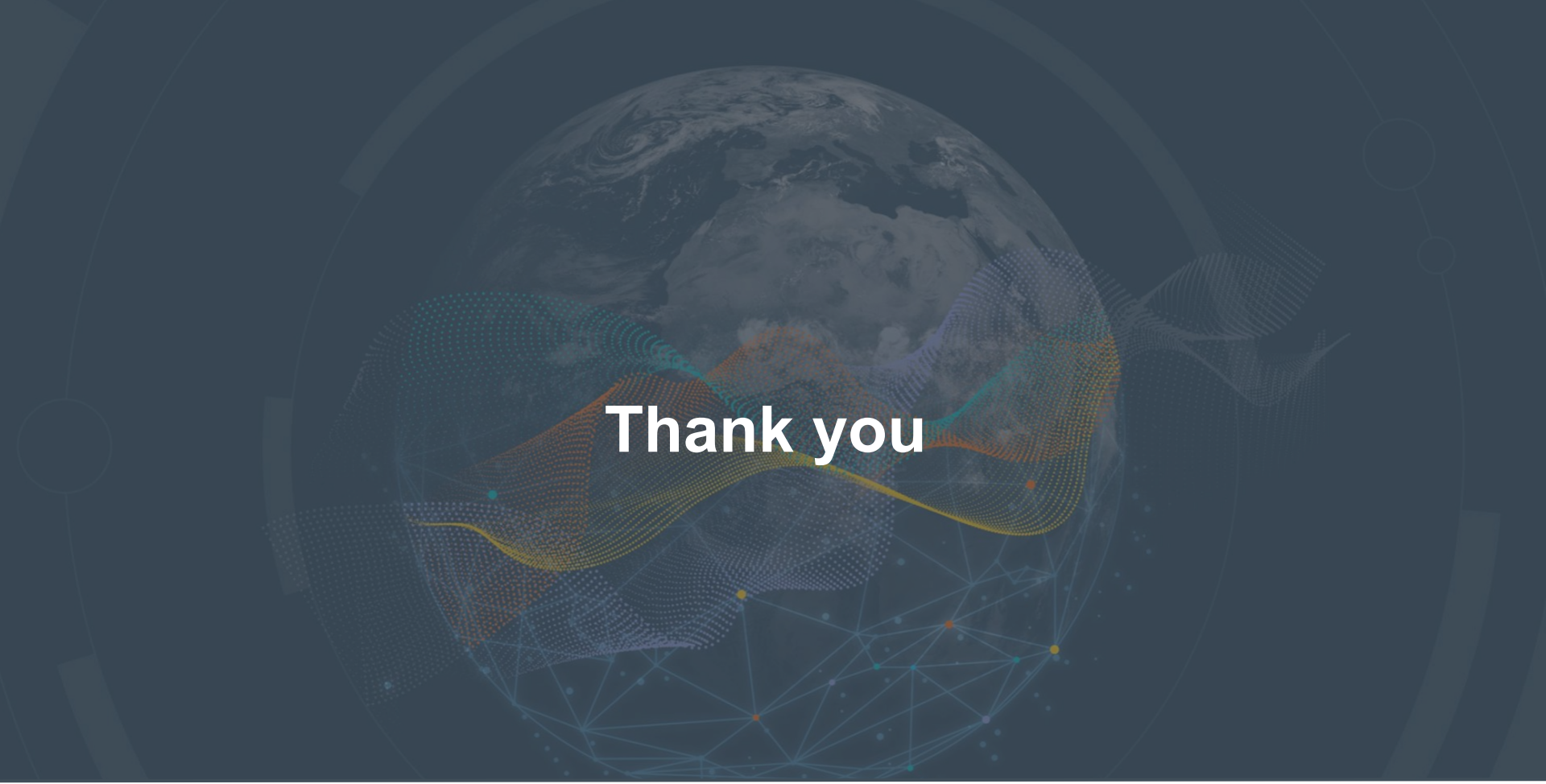

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When you hear the word "digital twin", what concepts or keywords come to mind?

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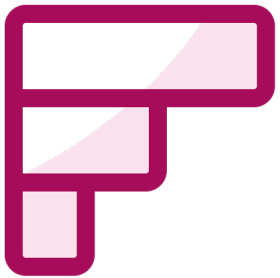

Which type of information is most critical for urban digital twins to effectively support urban planning in response to climate change?

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What aspects of urban digital twin development would you like to see prioritized in future city planning initiatives?

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