

TechArm of HIJAU

DIGITAL TRANSFORMATION OF CITIES & CRITICAL INFRASTRUCTURE

Pivoting cities a magnet for people and commerce

Cognitive & Parametric Digital Twins for the 21st Century Built Environment

Foreword



Datuk Dr. Francis Wong Co-Founder and CEO

Future-proofing our cities is a task no city authorities or planners can take for granted, not in an era of post-normal where complexities and uncertainties are now a norm. Similarly, city authorities and planners need to ask themselves the kind of cities they can build to support the needs of future urbanites, knowing pretty well that by 2050, over 70% of the world's population will live there. The cities ravaging metabolism for natural resources and energy will continue to impose hefty pressure on the ecological and carbon footprint. Globally, cities metabolize more than two-thirds of the world's energy and account for over 70% of global GHG emissions.

Creating future-proof cities requires thoughtful investment when prioritizing strategic plans and smart initiatives, including that of the global standards, the SGDs and New Urban Agenda. Cities and their critical infrastructure must be designed to withstand tough climatic conditions, characterized by their ability to attain resiliency in the face of extreme weather events and disasters. According to the World Bank, by 2050, disasters will cost cities a whopping \$415 billion, therefore, it is crucial that sound investment for city resiliency is addressed. The World Bank argues that investing in city resiliency is profitable, inter alia, for every \$1 invested in infrastructure resilience, we get \$4 in net benefits. Equally important is the preservation and regeneration of urban natural ecosystems and the adoption of sustainable urban design as a legitimate way to change city spatial and functional landscapes. Thus, supporting Nature-Based Solutions is necessary to truly affect the desired design and city resiliency.

Amidst the simultaneous arrival of many global megatrends such as Sustainability, Resiliency, Net-Zero and New Economy, building forward our cities can no longer be dealt with using conventional thinking and planning tool especially for cities that are still maintaining their chaotic order, a legacy of the past. I believe that to embed the many strategic planning, smart urban initiatives, SDGs and New Urban Agenda, the local and city authorities must now call upon another global megatrend to assist – Technology of IR4.0.

Concomitantly, with the advancement of IR4.0 and in rendering our services, Hijau gives due importance to the manner in which these megatrend buzzwords are defined, as wrong or inaccurate definitions can be costly. Take, for example, the buzzwords Sustainable Development and Resiliency, what do they actually mean? Do these current definitions make sense, and are they even useful? In the case of resiliency, is it about the ability to return to normal, and if it is, what constitutes this normalcy? Is past normal still considered normal when things are no longer the same, or when the past has evolved into the future? There is indeed no specific answer as to what constitutes a correct definition, but one thing, we in Hijau are pretty certain of is that resiliency, just like sustainability, must be seen as a process to attain all of the above, including the ability to tackle, manage, adapt and control negative stressors primarily from localism and proportionality perspective. It must not be treated as merely a physical and technical fix, but a whole system approach or process that facilitates social, economic, political, ecological and climatic interconnected interactions. It is something that needs to be managed instead of just built or engineered in (refer to my definitions attached).

Similarly, the policies and strategic plans of agencies and the goals of SDGs and NUA must be examined from various spectra, inter alia, their mutualistic, additive or even antagonistic interactions, including the side effects and trade-offs. We need to examine their interactions within the backdrop of Malaysia as a developing nation and within a constantly changing world.

In addition to sound science, sound data is extremely crucial for the accuracy of such examination. Luckily enough, with the arrival of

Foreword

digital megatrend especially the digital twin technology, attaining such sound data is now possible - data that are efficiently gathered, processed, analysed, interpreted, predicted and visualised for accurate examination and decision making. Most cities have access to vast amounts of data, collected from various sources but these data are not presented in such manner where their true and hidden value can be unlocked to drive meaningful data-driven decision making.

To assist our clients in this realm of data supremacy, we have set up a dedicated company for digital twin technology called Twinworks Sdn Bhd, which is a subsidiary arm of Hijau for our Cognitive and Parametric Digital Twin, the Urbanetic (U-CPDT). Our U-CPDT is one of the most efficient and innovative unified data platforms in the world for digitizing physical and built assets and critical infrastructure. With its parametric, analytical, predictive, AI and ML capabilities, it can be used to generate data, allowing data mastery and clear insights of our physical environment. Data long trapped from inefficiencies and non-interconnectedness of traditional data-gathering systems can now be released to attract greater opportunities for value creation and enhance efficiency in spatial planning and management, resource allocation, lower ecological and carbon footprint and availability of sources of capital investment. In addition, U-CPDT has the capability for city authorities and planners to undertake scenario planning and achieving a better sense of a particular policy or strategy effectiveness before its actual adoption and implementation. With complexities and uncertainties coupled with sustainability, resiliency, smart, and net-zero agendas and the ushering in of Nature-Based Solutions, scenario planning and testing of plans and strategies have never been more important than ever before.

This brochure provides a detailed explanation of the salient features and processes of U-CPDTS and its worldwide recognition and capabilities. I do hope you enjoy going through it.

My definitions

Sustainable Development is a Whole-System and Holistic Approach to Development that galvanises the Green Strategy to maintain Economic Resiliency for National Prosperity and Societal Well-Being via the deployment of the Nature and Science-Based Solutions, Emerging Technologies, Innovation and Sound Economic Instruments with a balanced consideration of Intra and Inter-Generational Interest, Nature-Capital Protection, Regeneration of Built Capital and a Target Oriented Net-Zero Future.

Net-Zero Future seeks to establish science and naturebased climate positive targets and safe balance of greenhouse gases between anthropogenic emissions and removal or sequestration thereof the equivalent amount from the atmosphere on timescales that allow the maintenance of a planetary-safe operating space and earth regenerative capacity and resiliency that are conducive to human-sustainable habitation.

Resiliency seeks to address a normalcy disruptive problem from a whole system and future-proofing perspective by adopting an integrated approach or process to acquire the necessary capability to withstand, mitigate, manage, recover, restore and adapt including bounce back to its original state of normalcy or bounce forward to such new state of normalcy where the original state of normalcy is no longer appropriate, relevant or beneficial.

Nature-Based Solutions (NBSs) recognize nature's genius and innate benefits and via a suite of science and nature positive actions, protect, restore, manage and regenerate the resiliency and ability of the natural ecosystems and services, thus in doing so, help to solve societal, ecological and climatic challenges as well as attaining a Sustainable and Net-Zero Future.

Singularity is a point in time in the future where an Artificial Intelligence or Agent created by humans have acquired the necessary capability to undergo self-awareness or self- improvement, or self-modification to achieve the level of intelligence that surpasses that of the humans that can either positively or negatively alter humanity future.

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Foreword



Dr. Fairoza Amira Hamzah President, Women in AI Malaysia

The digital twin technology, intertwined with AI advancements hold a transformative potential that I find incredibly transformative and vital for our journey towards sustainability, environmental stewardship and a Net-Zero future. As we navigate through the complexities and uncertainties of the 21st century, these emerging technologies are not merely a positive disruptive tool but a beacon of hope for humanity, guiding us towards a greener, more sustainable future.

At the heart of my optimism is the belief that digital twins can transform our interaction with our physical world. Picture a virtual model of Kuala Lumpur, pulsating with real-time data, allowing us to experiment with spatial planning and development policies in cyberspace before bringing them into our tangible world. This is not just about minimizing carbon emissions or optimizing city traffic flows, but it is about redefining our relationship with our environment, making data based informed decisions that balance development with preservation.

The power of AI and ML to analyse and interpret the vast amounts of data and those generated by IoTs and digital twin technology offer us insight that were previously unattainable. In agriculture, imagine AI algorithms that can predict weather patterns with astonishing accuracy, advising farmers on the optimal planting schedules to maximize yield and conserving water. In urban planning, AI could model traffic flows, suggesting adjustments to reduce congestion and pollution, making our cities more liveable and breathable.

Yet, as we chart this path towards a sustainable future powered by technology, we must also confront the myriad challenges head-on. The energy demands of these technologies are not insignificant. However, I remain hopeful by the rapid advancements in renewable energy sources and energy-efficient computing.

Education and digital literacy play a pivotal role in this journey. By fostering a deep understanding of digital twin and AI technologies, we can inspire our generation to envision and build a future where technology serves economic growth and ecological balance. It is about cultivating a mindset that sees environmental stewardship as a fundamental aspect of technological innovation.

I envision a Malaysia where technology and nature coexist in harmony, where the green landscapes of our nation thrives alongside the digital landscapes we create. This future is within our grasp, requiring a collective effort that spans governments, industries, and communities. It's a future where our technological ambitions and our environmental responsibilities are intertwined each strengthening the other.

We in Hijau are optimistic that as we move forward to build this Nation, let's embrace the digital twin technology with a sense of purpose and pride, recognizing their potential to shape a sustainable, prosperous future for everyone. I believe that this is an opportunity for all the government agencies and private co-operations alike to take advantage of our digital twin technology to redefine progress, not just in terms of economic metrics but as a measure of our ability to live responsibly and in harmony with our natural environment. This vision for Malaysia is an attainable mission. We must commit to a future where Humans, Nature and Technology can co-exist.

Meet The Team

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Datuk Dr. Francis Wong Transdisciplinary Expert



Khairul Anuar Ahmad Zainudin Policy Advocacy



Saibal D. Chowdhury Digital Twin Technology



Dr. Fairoza Amira Hamzah Artificial Intelligence



Ts. Dr. Noraini Rosli Environment & Green Technology



Dr. Sai Chong Yeh Artificial Intelligence



Natalie Wong Spatial Design



Amutha Valli Krishnan Environment & Biomimicry



David Chong Teak Wei Machine Learning



Mellissa Gassan GIS & Mapping



Ammar Abdullah Blockchain

Cognitive Digital Twins as Accelerators for sustainable built environment and critical infrastructure.

Cities and infrastructure ecosystems that are built around a data core - in the shape of parametrically modelled cognitive digital twins with advanced visualization, IoT and Distributed Ledger Technologies, are the building blocks of "city-as-a-Service" platforms - "city" representing the entire built environment. Such platforms enable digital transformation of businesses that deal with real-world asset. They can improve our understanding of the causes behind some of the intractable problems we face today and help improve our resilience to threats of climate change, recover quickly from disasters, improve resource productivity, free-up trapped liquidity associated with real-world assets and significantly boost economic, environmental and social performance of cities and make them magnets for people and businesses. The reward could be in the form of billions of dollars in annual savings and opportunities, globally.

VISION

To position Hijau as a regional leader in digital twin technology applications.

MISSION

To provide the most efficient and innovative unified data platform to help digitalize worlds cities and critical infrastructure.

To deliver significant impact on the total performance of the Built Environment- and liberalize financing towards impactful Smart and ESG outcomes.



A digital twinning and data intelligence platform for the built environment and infrastructure The goal of every city is to be a magnet for people to live in, and businesses to operate from. However, a vast majority of cities are struggling to build, create and maintain the level of vibrancy it needs due to the following challenges:

- The urban sustainability and sub-optimal performance of the built environment's assets.
- The trapped liquidity associated with real-world assets.
- Limited access to investment and financing options available in real estate and infrastructure

Universal problems that we aim to solve. \$1.6 trillion a year in productivity opportunity losses in the AEC industry



The chronic, sub-optimal performance of the Built Environment and its assets losing \$ 1.6Trillion in economic value a year".



The trapped liquidity associated with land, real estate and infrastructure assets.



Limited access to investment and financing options available in real estate and infrastructure.

Sub-optimal Performance of the Built Environment.

The declining state of many of our cities is largely because of inadequate planning, financing, operations management, lack of best practices, system tools and governance. One key sign of performance of a city or a region as a magnet is the optimal or healthy rate of urbanization. People and businesses flock where there are jobs, healthy environment, good education and healthcare, affordable housing, public facilities, convenience and conviviality.

Providing all the above requires a well-planned, well designed, well operated and well-maintained built environment and infrastructure services. Beside the city administration, construction industry is a major contributor to a liveable, sustainable built environment. The industry is one of the economy's largest sectors, with \$16 trillion spent on construction-related goods and services every year. Yet the industry has a seemingly intractable productivity problem. According to a McKinsey & Co research paper, this lag of productivity costs the global economy USD 1.6 trillion a year -If nothing changes, the industry will fail to deliver the infrastructure and housing the world desperately needs and by 2050, as many as two third of urban population could end up living in slum like conditions.

Trapped Value & Liquidity.

Urban planning requires land and land-based assets be constantly evaluated for their strategic value. Land use decisions are critical to economic, social and environmental outcomes and are results of analyzing large variety of data - economic, social and environmental. Adoption of digitized planning with big-data analytics and machine/ data intelligence can help in a big way to avoid adverse situations. Some examples of trapped liquidity are :

- Large banks of urban land occupied by slum dwellers
- Poor uptake of development on newly built infrastructure for cities
- Low environmental sustainability rating and ranking
- Unused or sparsely used assets due to overcapacity.

Solving these problems require considerable amount of analysis across volumes of a variety of data using a combination of technologies, that only a platform-based solution can solve with speed, accuracy and impact on the triple bottom line (SDG and ESG).

Limited access to investment and financing options available in real estate assets

Investing in real estate is out of reach for most investors and finding capital for major projects at optimum cost is near impossible. Luckily, Sustainable (ESG/SDG rated) real estate can readily find global capital - but the entire process and documentation challenges are daunting and often discourages asset owners, developers and investors from moving towards that direction. Asset tokenization is a trillion-dollar opportunity that is poised to unfold with cutting edge platforms that combine asset creation and curation with the mid- and down-stream activities involved in real estate transaction, radically simplifying the process through fractionalization and tokenization of assets. They aim to remove the processing and documentation related friction via automation – but the goal is to enable the vast investment community attracted to this otherwise out of reach and narrow option trillions of dollars asset class that can be directed to liberalize investments for impactful SDG and ESG outcomes.

Summarising the challenges

Challenges listed above are worth billions of dollars in opportunity. Though there are a number of solutions available today, none of them are incapable to scale to solve the problems. Our Digital Twin partner, urbanetic has been working to build solutions on a platform that would scale across cities and across problem areas, since 2015. We have come to conclude that only a combination solution would solve the problems with effectivity and efficiency of time and cost - And by combination we mean 3D geospatial parametric digital twins in combination with IoT and Blockchain/DLT supported by advanced visualization, data intelligence and high throughput computing.

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The Rise of City Digital Twins

The idea of transforming our cities into Green, Smart and Connected built environments using information technology solutions to solve the problems created by the rapid pace of urbanization and climate change is now nearly 15 years old – but the concept, along with an array of sophisticated technologies, has thus far failed to deliver the value it promised. An often cited reason for this is the absence of a fully functional cross-ecosystem platform of services – from healthcare, safety and security, energy, transportation, communication and water; to education, jobs, connectivity, waste management and personal fulfillment. While these services are available in most cities around the world, they are not always equally accessible to everyone and not available as a connected experience.



With Building Information Modelling already in practice in some form or the other, the need for a City Information Modelling tool gathered pace when demand for connected experience created the need for massive amount of data, parametric modelling and the need for having the whole city in one place. Thus, was born, the concept of Digital Twinning of cities and infrastructure, initially as a 3D planning tool and most recently, with IoT integration as Connected Digital Twins of cities.

Our focus has been to provide cities and infrastructure operators with a software platform to create a fuller and richer user experience beginning with land and urban planning, financing and design to operational and lifecycle management such that value can be created, captured and traded on a single platform.

Our Digital Twin Technology, Urbanetic Fabric is one of the first platforms to create parametrically modelled digital twins of cities, combined with IoT and Distributed Ledger (Blockchain) technology poised to transform the built environment towards impactful SDG and ESG outcomes and the AEC industry, which suffers from historically low productivity (less than one percent) - on par with other industries. With added cognition functions on the platform virtual models can autocorrect themselves and provide prediction and action plans for the real, to move towards and maintain desired performance levels. Such digital twins are known as Cognitive Digital Twins.

	The Business Case	e for Cognitiv	ve Digital Twi	ins
	As demand for better markets kept increasing and critical infrastructu communities as earlier required performance. finding meaningful info	g, need for better are kept the pressu products and so With enormous	technology for dig are up on the resea plutions were simp	ital twinning of cities arch and development ly not delivering the
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Digital Found Cloud/O Platform In Colle Asset Info Manag	Integration Predictive Maintenance In-Prem Asset Performance Integration Management Integration Real Time Analytics ormation Imagement	Prescriptive Digital Twin What if Simulations Optimization Remote Diagnosis	Transformative Digital Twin Augmented Operations Remote Collaboration Immersive Training	Cognitive Digital Twin Autonomous Operations Drone Assisted Maintenance Virtual to Physical Convergence

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Technology Maturity

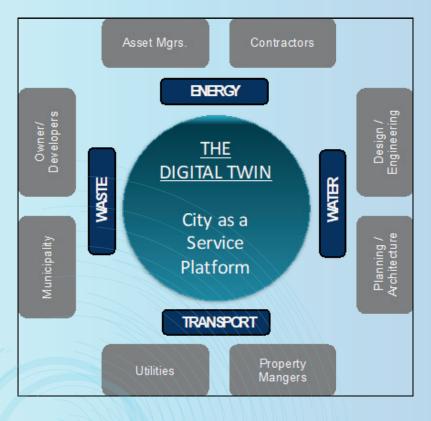
Urbanetic in 2023-

Early digital twins of cities and their features provided the insights about what data can do and helped set expectation and vision. While availability of data is still a major challenge along with knowledge and understanding of different ways of doing things for the users, the hope and optimism created by advancement of AI kept the investment in technology continuing. Our Digital Twins Technology, Urbanetic Fab has successfully internally demonstrated cognitive digital twins and its business value in the case of Cell Tower infrastructure, promising 10 times to market in site automation. Going forward it will continue to improve adopting more sophisticated foundation models – to generate information, insights and action plans.

The benefits include are shorter time to market, right timing of product and project launch, new revenue generation and reduced operating cost by 12 to 15 percent. Tower site automation that takes up to 2 days with conventional IoT technologies can now take just thirty minutes. The revenue opportunity cost saving for a thousand tower sites could be in millions over two years.

The Bold Idea

Combining Parametric Digital Twins with IoT & Data Intelligence

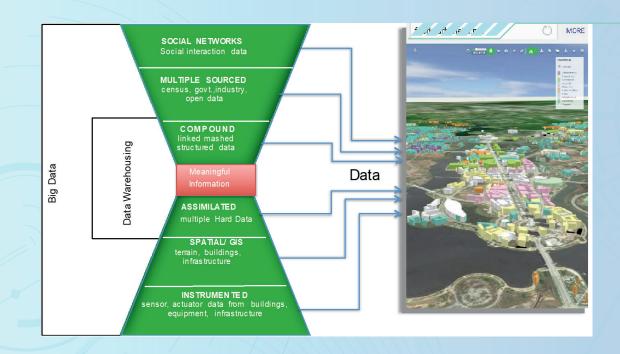


Innovative 3D geospatial software platform combining data intelligence and parametric digital twins to generate information, insights and actionable plans for spatial planning, built environment, cities and critical infrastructure.

Data intelligence comes in many forms and one of them is to spotting a pattern, a trend or a relationship and predicting a future event from an ocean of data. Having all the data at one place is one thing but deriving meaningful information, insight and taking actions - is how true value is created, through cognition combining data intelligence with IoT and parametric digital twins.

The idea of federated data models is not new but doing it in context of a city is a bold new undertaking as cities are far more dynamic and complex with tremendous volume and veracity of data to work with. Benefits of a successful implementation, that can scale is enormous. Data itself comes from disparate sources – static and changing.

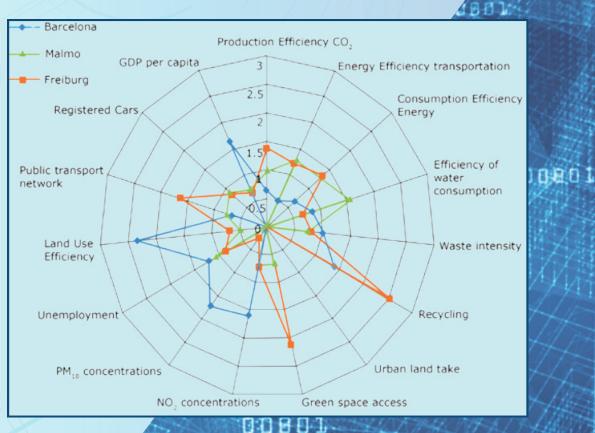
We through Urbanetic's has built one of the industry's first unified data model of the city – a city grammar or DNA that would accommodate all kind of data and organize them to explore, analyze and visualize the city in interactive 3D, perform multiple scenario simulations and provide information, insights and action plans by syncing the physical with the virtual via edge control and IoT gateway devices. Also, at the same time allow specialist applications to connect to solve specific problems in environmental sustainability – energy, power, waste, water, sanitation and transportation management, asset life cycle management, security & safety and more.



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The idea behind the solution is to combine a number of core technologies on top of a unified data platform that would radically simplify our current ways of investing in multiple technologies and in the process generating new difficult to manage complexities.

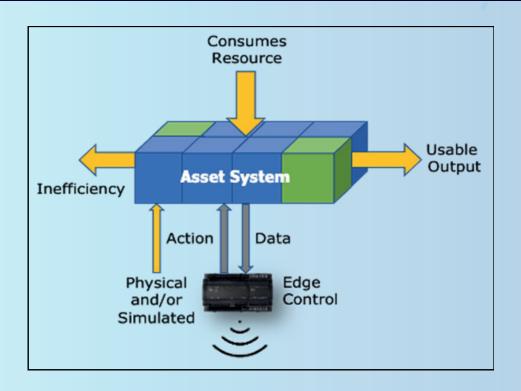


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Converging the Physical with the Virtual on the Web

The same principal can be applied to critical infrastructure by building and adding data dictionaries. Multiple data dictionaries need to be kept in sync all the time adding interoperability and interpretability requirements. We have built data dictionaries for cities and for the telecommunication industries while the others will follow.

The basic requirement of cognitive digital twin is to bring the real asset and its virtual counterpart to converge in one-space - using sensors and edge devices capable of connecting to web via internet. To reduce risk of data loss and security breaches, edge control is used where needed. Data from several of edge devices is assimilated and processed together with associated virtual replica assets, on the web to generate information, insights and actions using data/machine intelligence and interactively visualized in real-time. with "what-if" simulations. Both 'narrow' and 'general' AI 'foundation models' are used.



The core application software is named "Fabric". Apart from its own repository, it also performs the central functions of managing the entire data-pipe, data transformation, data exchange, data interpretation and routing, 3D rendering and administration. A powerful tool that only gets better by feeding more data into it.

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The Platform

The three pillars

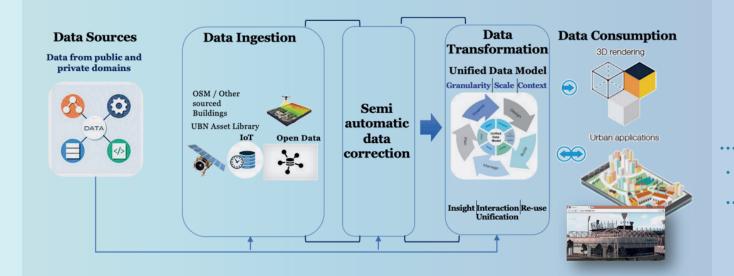
The core platform, Fabric has three pillars :

- Data pillar
- Analysis pillar
- Visualization planner

DATA BLOCK ANALYTIC BLOOK VI SUALIZATION BLOOK APPLICATIONS SUSTAINABILITY 3D RENDERER FILE CAPACITY r PREDICTION DISTRIBUTEDLEDGER . NAVIGATION DEVELOPMENT FEASIBILITY IE TE C TIO N REAL TIME DASHBOARD DATA TRANSLATION SMAR CONTRACTS DIST. APPS.

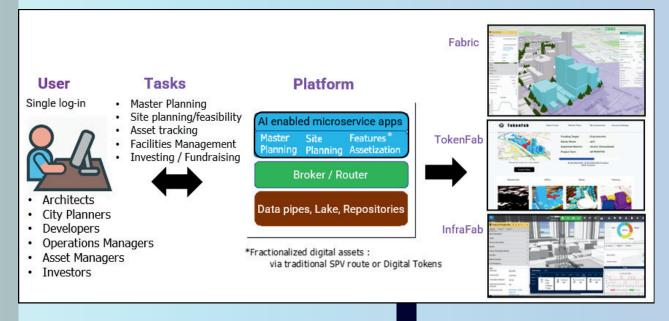
The Innovation

Fabric is designed ground up as a cloud native platform and is designed to operate on multiple cloud infrastructure with multiple application specific data dictionaries capable of communication between each other. Fabric's uniqueness is its versatility, adaptability, enabled by its architecture.



Execution - From Data to End User Application Processing.

The platform nature of its design, Fabric can be configured to serve a range of segments when the data dictionaries and the data are made available. Data intelligence and cognition is used at multiple levels - from correcting data, filling incomplete data to synthesizing and transforming multiple data sets to generate new information, insights and actions - for example sending a note to the tower operator to disable or adjust power for sites that are likely to consume much less energy.



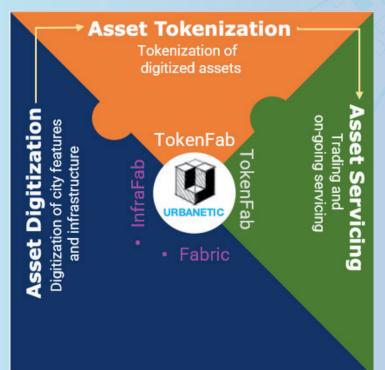
- Urban sustainability measurement
- Development feasibility analysis
- Infrastructure capacity planning
- Nature based solutions.
- Digitized urban planning.
- Asset performance and tracking
- Tenant on-boarding
- Remote operation management
- Asset tokenization and servicing

In the illustration above, the bottom two layers and the topmost are largely generic but it is the third and fourth layers that imparts the platform its flexibility (switching), cognitive character and user experience. This gives fabric its uniqueness and helps us achieve both - economy of scales and economy of scope.

Integrated Product

Fabric, InfraFab, TokenFab

Three distinct but interconnected products are at the foundation of Urbanetic's platform. In order to maximize value and use, the platform's application architecture follows а typical life cycle of a real-world asset [Plan \rightarrow finance \rightarrow detailed design \rightarrow build \rightarrow manage] through the three [Fabric, InfraFab products and TokenFab]. All data is accessible by the applications native to each of the three products. An all-encompassing single unified data platform for sustainable built assets - that starts with feature planning and modelling then to Assetization and tokenization and finally to transacting asset and servicing.





Fabric

A highly scalable repository of urban data and associated services to build parametrically modelled Digital Twin of cities, enabling any city to be explored, analysed and visualized the same way on the webwith impactful "triple bottom-line" and ESG outcomes.



InfraFab

The infrastructure extension of Fabric®, InfraFab helps infrastructure owners and Services Providers, in telecommunication, Power and AEC industries in optimizing their asset count and asset performance through digitalisation.



TokenFab

A digital platform that enables digitized real-world features of the built environment to be owned and traded globally as fractionalized assets in the form of digital tokens - opening new access to investing in and fund raising for real estate and urban infrastructure.

Customer Segments We Serve.



What People From the Industry Say About Us.



Conclusion

We have developed a data intelligence platform for cities to attain their sustainability, resiliency, net-zero, liveability and smart criteria in the most time and cost-efficient way in line with the Malaysia Smart City Framework of PlanMalaysia, MS ISO 37122:2019 for Sustainable Cities and Communities (Indicators for Smart Cities) and the many related Policies and Strategic Plans of respective ministries, departments, agencies and local authorities.

Our Cognitive and Parametric Digital Twin Software Platform is an internationally recognised platform for city digitalisation and amongst the many worldwide and national applications, includes the study sponsored by EPU in 2012 for a Green Smart and Connected Putrajaya.

In essence, our Digital Twin Fabric can ingest and unifying large variety and volume of disparate data in public and private domains to predict and solve problems like dilapidated infrastructure, overcrowding, urban flooding, urban heat, ecological and carbon footprint, food and public security, mobility and traffic flows as well as to increase revenues, attract investments, reduce infrastructure development cost, improve liveability, city resident wellbeing, urban resiliency and environmental sustainability.

Our Digital Twin Fabric can help city authorities and planners to produce digital master plans that are interactive and unlike its non-digital counterparts, is also a living document and an effective tool to communicate urban development plans to the community from the earliest stages of conceptualisation to the point of issuing a development order.

It is also our aim to mainstream digital twin technology application throughout the country in line with National Fourth Industrial Revolution (41R) Policy and National New Industrial Master Plan 2030 (NIMP 2030).



Recognition



World Economic Forum - 2022



MIPIM- 2021



Schneider Electric - 2018

A statement from our Prime Minister on NIMP 2030:

"Pelan Induk Perindustrian Baharu 2030 (NIMP 2030)- menjadikan Malaysia sebagai sebuah Negara Industri Berteknologi Tinggi dengan Transformasi Digital dan menjadikan Malaysia sebagai destinasi pelaburan tinggi dan meningkatkan keupayaan

Negara."

NILAI (HEADQUARTERS) PT7359 & PT7360, Jalan BBN 1/2K, Putra Point, 71800 Nilai, Negeri Sembilan. Tel: 06-7209861, 011-26535385, 016-7409496

BINTULU No. 149, Lot 3435, 1st Floor, Parkcity Commerce Square, 97000, Bintulu, Sarawak

KUCHING Lot 9951, 1st Floor, Pending Point, Jalan Pending, 93450 Kuching, Sarawak.