

ARTIFICIAL INTELLIGENCE WITHIN CITIES

The Next Stage in Societal Digital Transformation



This White Paper is a collaboration between
FIWARE Foundation and Matthew James Bailey



CONTENTS

FOREWORD Emanuele Bompan	03
LIBERATING ARTIFICIAL INTELLIGENCE AS A DIGITAL CITIZEN Matthew James Bailey	05
FROM SMART CITY TO AIR POLLUTION TO STREET LIGHTING: BEST PRACTICES FROM THE FIWARE COMMUNITY Juanjo Hierro	12
VOICES FROM THOUGHT-LEADERS IN EUROPE	16
ARTIFICIAL INTELLIGENCE FOR GREEN CITIES Sonia Tovar, Andrea Gómez, & Antonio J. Jara	18
NOT YOUR AVERAGE LAMP POST Jim Craig & Leslie Hawthorn	19
DEFECT IDENTIFICATION IN THE PUBLIC INFRASTRUCTURE WITH THE S1 IOT PLATFORM Mathias Petri & Michael Falkenthal	20
USING AI TO EXTRACT INFORMATION FROM BIG DATA Andrea Chiancone	21
BOOSTING TERRITORY INNOVATION WITH MACHINE LEARNING AS A SERVICE Franck Le Gall	22
CONNECTING CITIES TO DATA SPACES FOR THE CREATION OF INNOVATIVE SERVICES Juanjo Hierro	23
AI MARKETPLACE: THE DIGITAL PLATFORM FOR TOMORROW'S INNOVATIONS Salome Leßmann	24

FOREWORD



Emanuele Bompan*

Environmental Journalist, Author,
Editor-in-Chief at [Renewable Matter](#)



We have growing awareness of the planetary challenges that we will face in the next 30 years: climate change, biodiversity crisis, soil scarcity, water deficit, growing aerial and terrestrial pollution. We need our civilization to stay inside our planetary boundaries, the essential preconditions for human development. Without soil, water, and climate stability we can't thrive.

In the last 150 years, we have developed an impressive global economy that has provided prosperity to many. We have achieved that whilst also creating an impressive debt with the environment, its resources and service.

It is not an environmental crisis, it is a human crisis. This system is in need of change to sustain rapid growth in the global middle class without being overwhelmed by negative environmental and social impacts.

Today we have billions of sensors, a multiplicity of devices, satellite dishes, cameras. [Artificial Intelligence](#) (AI) is able to make sense of this humongous quantity of information and produce brilliant outcomes, new procedures, and new services.

Many think we need more tech gadgets, more sensors. They are mistaken. What we need are smarter ways of using both the data we have and our AIs. AI can play an important role in enabling the ecological transition.

AI is a subset of the technologies enabling the emergent "Fourth Industrial Revolution" era, and deals with models and systems which perform functions generally associated with human intelligence, such as reasoning and learning. But most importantly, it allows humans to learn faster from feedback, deal more effectively with complexity, and make better sense of abundant data.



To solve the Earth crisis we need complexity, nature isn't simple. Therefore, when we deal with emissions, circular economies, and complex energy smart grids, this is where AIs are needed the most.

AI enhances and accelerates the development of new products, components, and materials fit for a circular and low carbon economy through iterative machine-learning-assisted design processes that allow for rapid prototyping and testing. AI can magnify the competitive strength of circular economy business models, such as product-as-a-service and leasing.

By combining real time and historical data from products and users, AI increases product circulation and asset utilization through pricing and demand prediction, predictive maintenance, and smart inventory management. Think how AI can advance the dream of SEALS, Shareable Electric Autonomous Lightweight Service vehicles, or decrease emissions with AI-powered BIMs.

AI helps build and improve the reverse logistics infrastructure required to "close the loop" on products and materials, by improving the processes to sort and disassemble products, remanufactured components, and recycle materials.

The potential value unlocked by AI in helping design out waste in a circular economy for food is up to \$127 billion a year in 2030. This is realized through opportunities at the farming, processing, logistics, and consumption stages.

Specific applications include using image recognition to determine when fruit is ready to pick, matching food supply and demand more effectively, and enhancing the valorization of food by-products.

The ethical use of AI surely goes beyond the circular economy spectrum. It is already a reality across many sectors. For instance, hospitals, utility and transport services, and other areas of public interest have already started deploying products and services that rely on AI in their daily activities.

Moreover, automation and AI are redesigning businesses and adding value to economic growth via contributions to productivity. This White Paper highlights the application of AI technology across various industries and the role it plays in tackling pressing societal challenges, from health to climate change to secure, clean and efficient energy, to mention but a few.



Emanuele has covered many of the UN Climate Change Conferences for several newspapers and radio channels. He is also the author of "[What is the circular economy - new edition](#)" (Ed.Ambiente, July 2021).

Liberating Artificial Intelligence as a Digital Citizen

By Matthew James Bailey*

Overview

Artificial Intelligence is destined to become the new digital citizen within smart cities. Its potential for delivering lightning-speed performance and optimizing citizen-centric services is limitless, transforming a smart jurisdictional experience into something that is no longer beyond our imaginations.

This digital intelligence can be guided as a powerful ally in the transformation of jurisdictions into green cities, restoring a balance between the environment and humans. Its potential is to realize a new economic model for a flourishing society.

Thanks to the IoT phenomena, Big Data, Advanced Analytics, the deployment of cloud to edge computing, advancement in telecoms, devices, and sensors, and the emergence of Digital Twin, smart cities are perfectly positioned to incorporate AI within the next stage of their digital transformation.



"With AI/Machine Learning (ML) being used increasingly across the public sector powering smart city platforms and solutions, the need for an ethical framework for AI is so important now more than ever"

Rhonda Binda, Queens Deputy Borough President, New York, U.S.



Ethically Liberating AI as a Digital Citizen

For cities to develop the right partnership with Artificial Intelligence, one that honors their cultures, diversity, and citizens' values, some important steps must be taken first. On that note, it is worth watching this [video](#).

Ethics in Data Governance - AI Data Ethics

It is estimated that our world generates 2.5 quintillion bytes of data daily. Cities make a significant contribution to the global data lake. The shores of this global data lake will broaden and deepen, thanks to 55% of the world's population living

The digital body has matured to the point where AI can reside throughout a jurisdiction and serve government, corporations, and citizens in a new world experience. How can cities leap into the next stage of their digital transformation, mindfully taking the next evolutionary step with a digital intelligence, while ensuring that this digital citizen adheres to their democratic values? To address this, we must examine two areas of AI ethics: AI Data Ethics and AI Ethics.



in urban areas. This percentage is expected to grow.

The rapid growth of the smart city phenomenon has resulted in cities generating massive amounts of data. This is a necessary step for cities to become digital-centric. Data-driven cities can provide enormous benefits to their citizens by increasing the automation, efficiency, and experience of jurisdictional services as they move beyond economic, societal, and environmental challenges.

"Data is the digital DNA of Artificial Intelligence. It is the digital oxygen that gives this intelligence digital life. We must consider the ethical quality of data being used to train AI to ensure that we are giving it an ethical digital life"

Matthew James Bailey

Ethical Data Governance

Our world faces one of the biggest conversations of the decade regarding data sovereignty. For example, is an individual's data an extension of their sovereignty? What democratic rights must an individual have in order to govern their digital selves? These questions go to the core of data ethics and public trust.

With Europe's General Data Protection Regulations (GDPR), the European Union (EU) has taken a step in the right ethical direction in terms of personal data governance and ownership. It enables citizens to manage aspects of their digital selves. However, if citizen data is to be completely ethical, we must do better. EU citizens have no control over how their data is used and have little knowledge or say over what it is used for and by whom.

So, what about the United States? This global power takes a different view than the EU regarding the sovereignty and protection of the privacy of citizen data. This has been shown with the rejection by EU courts of the US-EU transatlantic agreement - Privacy Shield: a legal

Jurisdictions can use data generated within their borders to train and fine-tune AIs to be beneficial digital citizens, dedicated to deliver the brave new digital world in real time for society. But how do we ensure that this new world reality has an ethical foundation and aligns with the values of a democracy and those of its citizens?

"At every level of society, from localities to countries, the asymmetries of power are going to worsen due to AI. AI will control the algorithms driving media, educational materials, research in social sciences, and even election outcomes. Like the proverbial iceberg, AI is only partially visible: what we don't see is the dangerous stuff."

Rajiv Malhotra, Founder of the Infinity Foundation and Author of "AI and The Future of Power"

framework for sharing data between the two regions. As such, because of the relaxed legislation and incompatibility with GDPR, US-generated data used to train Artificial Intelligence, by default, lacks the same ethical quality compared to EU trained AIs.

The good news is, some U.S. states are changing the game. The Washington State Senate passed a data privacy law in Q2, 2021, granting citizens user agency over their data. California passed its GDPR-equivalent, the California Consumer Privacy Act (CCPA), in 2019. This could be viewed as digital secession from the federal government by regions.

Recommendations

The ethics governing data policies, ownership, governance, and usage have a direct impact on an AI's ethical quality. Therefore, as cities consider establishing an ethical partnership with AI, they must implement Ethical Data Governance to align the ethical quality of jurisdictional data with their democracy and values.

Data Ethics for AI is complex. Other factors to consider include its robust protection, impeccable guardianship, authenticity, as well as the environmental footprint of data. Furthermore, cities that import AIs - that have been trained using data from other jurisdictions - should consider whether the data ethics of these jurisdictions are consistent with their own ethical standards.

Because of GDPR, this should be the case in the EU, allowing cities to ethically collaborate across the region while adhering to the same ethical standards for data-centric services. For cities outside the EU, this will be problematic, as AI Data Ethics standards will vary or may not even be in place.

Finally, when training an AI algorithm, balanced data sets that represent the diversity of citizens within a jurisdiction will provide unbiased and inclusive service to all members of its society. For AI to be successful and well-accepted in society, it must embrace diversity within a democratic framework. After all, AI can only do what its masters train it to do.

Ethics in AI Governance - AI Ethics

AI Ethics are a set of frameworks and processes that ensure AI honours a democracy's culture and values, as well as diversity and citizen sovereignty. This intent is the sweet spot of smart cities. AI Ethics ensure that the digital and the organic worlds, namely the human-machine partnership, are ethically aligned.

"The future edge to cloud interaction must create and provide an environment which provides a consistent and trusted immersive experience. This removes the need for understanding the complex underlying computing which enables the interaction"

Katalin Bártfai-Walcott, CTO, Ambient Science, Intel Corporation





It is imperative that we ethically align these two worlds with a foundation of trust. Failure to do so may result in exponential isolation and an increasing failure to provide jurisdictional experiences that are consistent with the values of citizens.

As a society, AI Ethics enables us to take an evolutionary leap. An ethical foundation for intelligences within the digital world provides a trusted future-proofed platform for humans and AI. It allows both intelligences to coexist and evolve toward a common goal of continuous transformation that benefits today's and tomorrow's human experience.

AI Ethics: Regulation and Standards

In April 2019, the European Union became the first territory in the world to propose regulation of the trustworthy quality of AI residing within its borders. Although there remains much depth to be developed to finalise the European AI regulation, this is a step in the right direction.

This foresight into a more ethical world alters the global AI game. Effectively, the future of AI has entered a three-world split (EU – U.S. – China) where these civilisations are heading towards different digital futures.

Unlike the EU, the U.S. has no national AI Ethics standards or regulations to control the ethical quality of AI deployed within its borders. However, there are initiatives underway regarding trustworthy AI for federal agency services.

"AI is a powerful tool. Like any powerful tool, it needs to be used cautiously and with the right protections. Smart cities should have a deliberate, thoughtful, transparent approach to using AI in ways that improve specific issues, and they should be cognizant of how AI is being used by others"

Tyler Svitak, Executive Director, Colorado Smart Cities Alliance

"As the world advances and changes at paces we cannot fully imagine, AI will become the epicenter of that transformation. We have a tremendous opportunity to improve our world and create a just, equitable, inclusive, transparent, efficient, and eco-friendly world through the proper use of AI"

Mayor Eugene W. Grant, Seat Pleasant, Maryland, U.S.

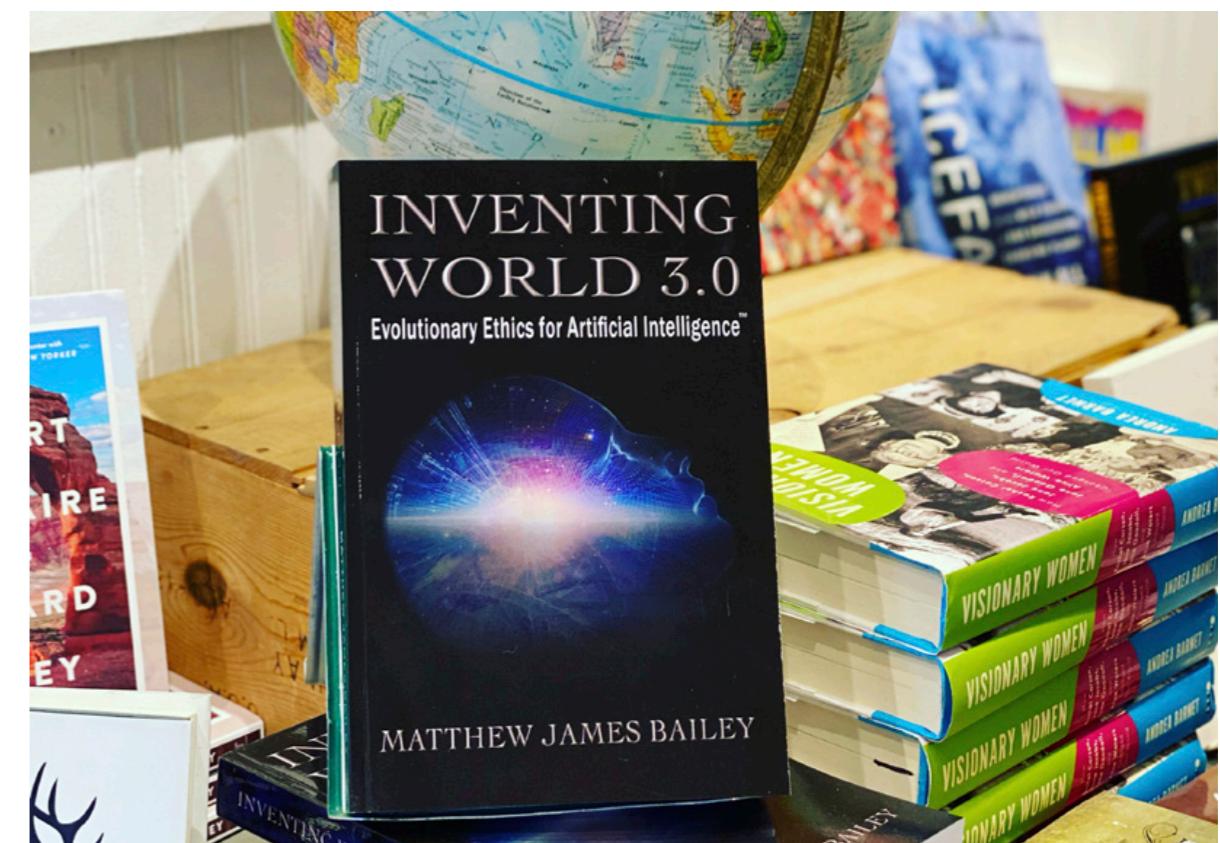


What do AI Ethics and AI regulation mean for smart cities? It is a call for local governments to instantiate their own digital border control and manage the ethical quality of AIs deployed within their jurisdictions. Thanks to the European AI regulation, EU smart cities will enjoy multitudes of benefits using a common framework to regulate and control the trustworthy quality of AI operating within their regions.

Recommendations

Inventing World 3.0 - Evolutionary Ethics for Artificial Intelligence™ explains how society can make the ethical and evolutionary step with AI. It provides comprehensive frameworks, strategies, and examples of how territories, nations, regions, and cities can liberate AI to honour their cultures and values, diversity, and citizen sovereignty.

These world-first models measure the ethical and trustworthy quality of AI to rank, certify and classify the compliance of AI to ensure alignment with the principles, cultures, and values of citizens within a jurisdiction. Check out page 11 to see how well AI is doing in social media and smart cities.



Inventing World 3.0. Copyright Matthew James Bailey.
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Recommendations for cities:

1. Create a task force to define your jurisdictional AI strategy

This team should be diverse, including government and city leaders, business, academia, investment, research, and citizens. Bring in one or two external experts.

2. Develop your AI Data Ethics and AI Ethics Frameworks

- a. Put in place ethical data and AI governance, policy, and regulatory frameworks;
- b. Create an AI Constitution to ensure that all AIs existing within your digital border comply with the values and cultures of your citizens.

3. Certification of AI - Digital Citizen Tests and Clearing House

- a. Formulate a certification process for AI to comply with your AI Constitution and AI Ethics standards. This is your digital border control;
- b. Design digital citizen tests to ensure ethical compliance of all AIs. Consider an ethical quality mark for AI such as the British Kitemark or the CE Mark;
- c. Set up a trusted AI clearing house to independently run the digital citizen tests to ensure that AI complies with your AI Ethics standards. This could be hosted at your smart city innovation centre, for example;
- d. Develop a strategy for easy access to super - exascale - quantum computers to fast track the training, deployment, and certification of AI.

4. Understand the status of AI within your jurisdiction

Undertake a census of the AI being invented, innovated, and deployed within your territory. Get a feel for how strong your innovation ecosystem is to invent the future. Find out who is inventing and deploying AI and for what purpose.

5. Design your AI innovation ecosystem

Successful smart cities are built on powerful multi-stakeholder ecosystems. Leverage this and start planning your AI innovation ecosystem. Prepare your jurisdiction for large-scale deployment.

6. Create an AI Ethics alliance throughout your territory

This will stimulate the participation of local stakeholders to assist in jurisdictional transformation.

7. Focus on what matters the most

Focus on high-pressure challenges where AI can assist. This could be a green city, green building, smart transportation, or pandemic resilience. Use AI to nurture the well-being of citizens.

Concluding Remarks

AI will change every aspect of society, every market, and the economy. The future of this digital citizen must be guided by AI Data Ethics and AI Ethics to ensure that AI can be trusted to honour the cultures, diversity, values, and sovereignty of their citizens.

Jurisdictions have a unique opportunity to liberate AI and ethically align the human-machine partnership to confidently leap beyond the challenges cities face today and enter a new tomorrow.

Let us choose our future wisely and build a digital foundation that mindfully advances the smart city experience to benefit generations of today and those of tomorrow.



A Measure of the Ethical Quality of AI Within Society

The two diagrams below are an example of a certification model from Inventing World 3.0. These Ethical AI Certification Medals, awarded to social media and non-EU smart cities show the ethical status of AI in these two markets.

Ethical AI—Social Media



Medal Colour	Ranking
Platinum	0%
Gold	12.5%
Silver	25%
Bronze	62.5%
Evolutionary Alignment	

World 1.0
Today/Old Paradigm

Ethical AI—Smart Cities



Medal Colour	Ranking
Platinum	18.75%
Gold	18.75%
Silver	0%
Bronze	62.5%
Evolutionary Alignment	

World 1.0 - 2.0
Today/Old Paradigm

Inventing World 3.0. Copyright Matthew James Bailey.
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To award a medal for an AI, we ask eight ethical questions. These can be viewed as equivalent to the Alan Turing Tests but focusing on the ethical classification of AI. Each response is ranked from Bronze (25% compliance) to Platinum (100% compliance).

These questions cover every aspect of the life cycle of AI, including digital (data and algorithm quality), governance, policy, human and environmental factors, to measure its alignment and steward its maturity towards an ethical and environmentally friendly world reality for humans and machines.



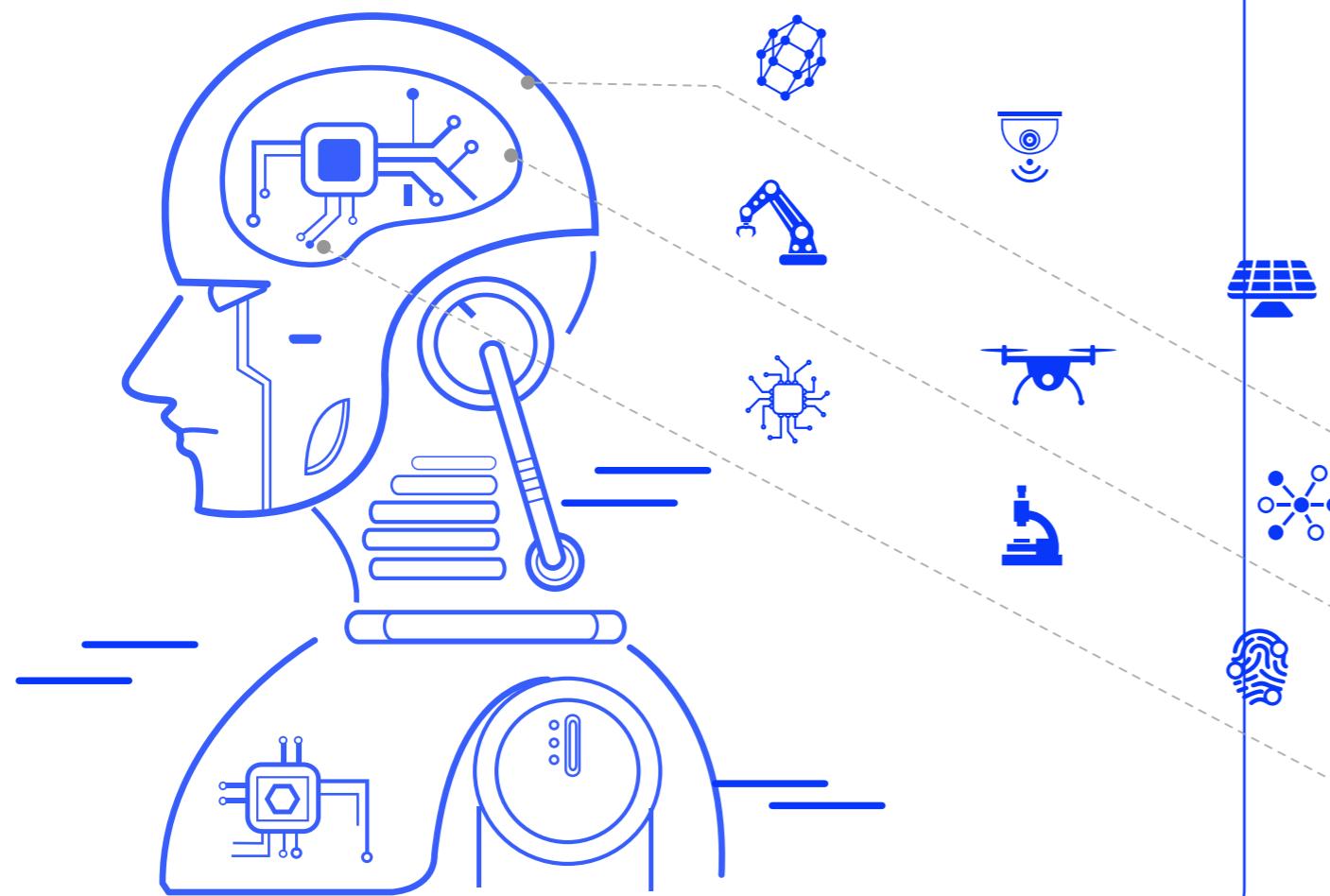
From Smart City to Air Pollution to Street Lighting: Best Practices from the FIWARE Community

By Juanjo Hierro, Chief Technology Officer, FIWARE Foundation

FIWARE was born with the ultimate goal of creating an open sustainable ecosystem around public, royalty-free and implementation-driven software platform standards, thereby easing the development of smart solutions as well as supporting organizations and cities in their digital transformation.

From a technical perspective, FIWARE brings a curated framework of open source software components - which can be assembled and combined with third-party platform components to build platforms - that facilitate the development of smart solutions and the integration of systems within smart organizations across multiple application domains, such as cities, manufacturing, utilities, agrifood, etc.

Artificial Intelligence (AI) and Machine Learning (ML) techniques are increasingly being incorporated in architectures powered by FIWARE to support the adoption of smarter decisions, or even going a step further in the automation of processes.



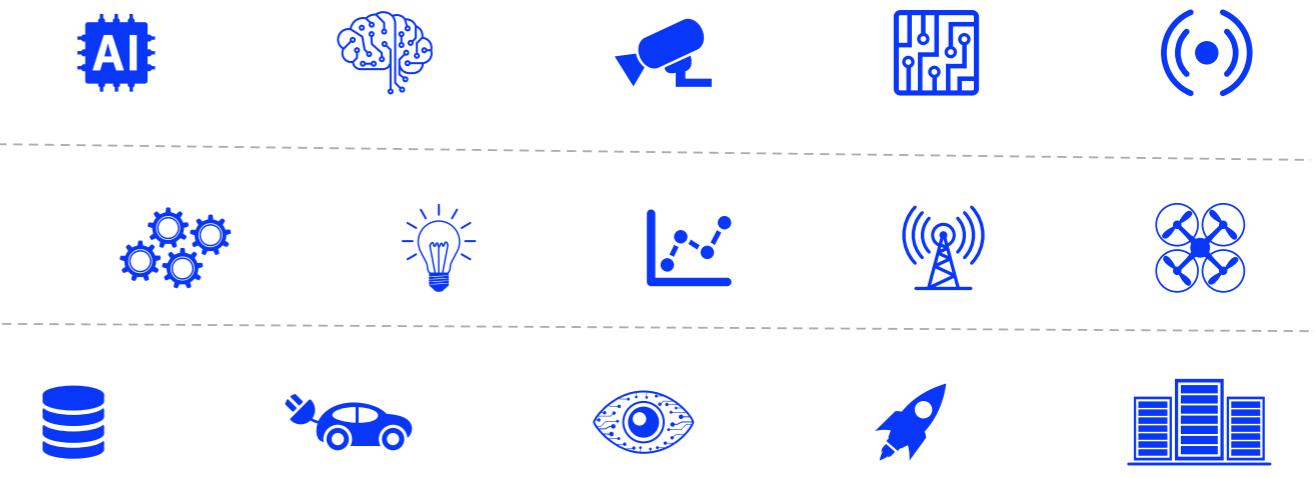
FIWARE architectures are designed around the management of a Digital Twin representation of the world, relying on two key elements: the API (Application Programming Interface) which enables updates and access to Digital Twin data, and the definition of models describing the attributes of the interfaces associated with Digital Twin classes.

On both fronts, together with its members and partners, FIWARE Foundation has decisively contributed to the development of reference standards, following an implementation-driven open source approach: the [ETSI NGSI-LD API standard](#). Additionally, it has also accomplished this with the Digital Twin data models published under the [Smart Data Models initiative](#).

FIWARE brings a rather genuine formula where the Digital Twin concept and AI/ML come together to disrupt how smart solutions of the future are designed. Think about cities where concrete smart vertical solutions (e.g. waste management solutions) or the entire smart city is powered by FIWARE. The Digital Twin representation of everything managed in the city will comprise entities representing its streets, waste containers and trucks, buses, electric vehicle chargers, parking lots, buildings, events, citizen claims, etc.

Digital Twins elements such as current traffic - in a street measured using sensors - current weather conditions - measured by meteorological stations - or the time at which certain city events will happen will fuel AI/ML algorithms, which will in turn publish their results in near real time by updating the value of certain Digital Twin attributes, such as the predicted traffic in 30 minutes.

This is the added value FIWARE brings by combining Digital Twins and AI/ML.





The Digital Twin representation of a given city on which applications are based, does not simply contain information on what one can see and measure, but also contains behind the scenes insights and real time predictions. Designed applications can therefore be far more powerful.

The definition of a standard mechanism (API + data models) to implement how AI/ML algorithms consume data they process and publish results, paves the way for the creation of marketplaces concerning AI/ML services. This will radically accelerate innovation in cities, as cities won't need to develop ad hoc AI/ML applications on their own but will be able to leverage on those provided as a service by companies bringing the necessary expertise and applying advanced AI/ML techniques.

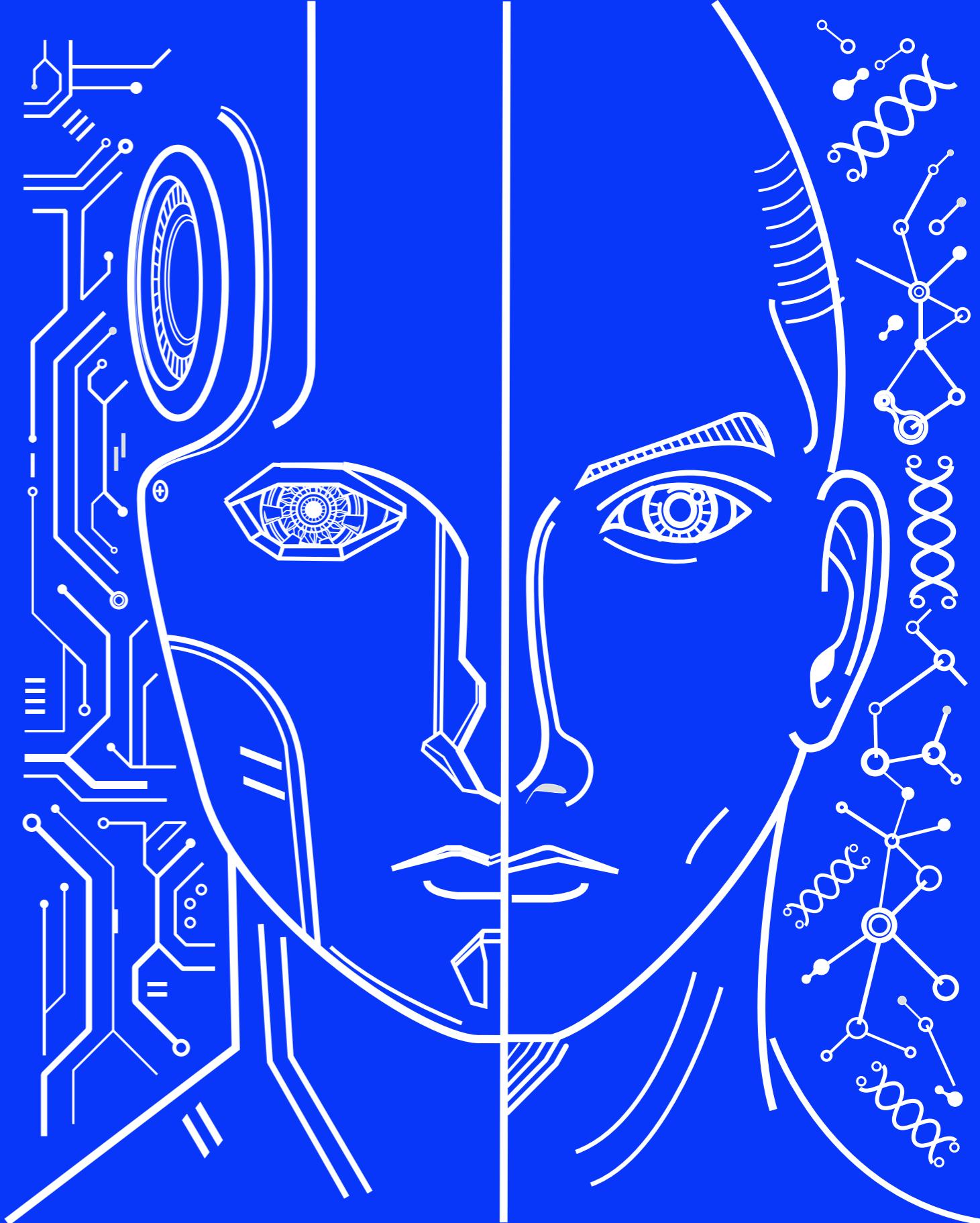
By leveraging components for the implementation of data and data app marketplaces, FIWARE brings support to a data economy in which plug&play AI/ML and big data services can emerge. FIWARE brings standard-based components that ensure Digital Twin data is accessed solely by users and applications with valid credentials.

In addition, FIWARE brings components that make it easy to configure how logs associated with selected Digital Twin transactions are stored on distributed ledger/blockchains, consequently supporting audit-proof traceability and the certification of processes as well as data provenance tracking. Both aspects are key to managing AI/ML ethics, a topic that Mathew James Bailey covers in great depth in the first part of this White Paper.

Since the creation of FIWARE Foundation in late 2016, a vibrant [FIWARE Community](#) has been formed with a true worldwide dimension, comprising more than 400 [members](#), including large corporations, SMEs, technology centres and universities, as well as hundreds of individual members. The number of organizations and [cities](#) adopting FIWARE continues to grow on a global scale.

This White Paper features some examples of projects and solutions developed by members* of the FIWARE Community that have AI/ML as a key factor. Companies such as HOPU, Red Hat, StoneOne, and WiseTown are behind some of these initiatives, coping with the management of air pollution, street lighting, infrastructure defects detection and smart decisions in a city, respectively. The AI/ML as a Service platform developed by EGM can, on the other hand, facilitate the development of concrete AI/ML services powered by FIWARE.

Last but not least, projects such as i4Trust and AI Marketplace are introducing the relevant framework for the creation of data spaces where different organizations share a Digital Twin representation of the world, publishing data they own and consuming data others publish. Plug&play AI/ML services can be offered in such data spaces through marketplaces, boosting the development of the data economy.



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VOICES FROM THOUGHT-LEADERS IN EUROPE

AI is the greatest new general purpose technology of the 21st century. Europe will not fail to maximize the benefits and minimize the risks in its application. Like any technology, AI must serve humanity, respect eternal fundamental rights and place users' trust at its heart. So let's embark on this huge global AI journey. Europe and North America share many values, and respect for the law. So, let's set up the right tools and mechanisms to ensure AI finds its place across all sectors of society.

Peter Fatzlrieg, Minister Counsellor for Digital Economy Policy, Delegation of the EU to the U.S.

Industrial AI focusing on green and urban production is the application area in which Europe is leading. Industrial AI is spearheading the next stage of Industrie 4.0 as the fourth industrial revolution shaping the future of value creation in Europe.

Prof. Wolfgang Wahlster, Founding Director and Chief Executive Advisor (CEA), German Research Center for AI (DFKI), Germany

Agency and autonomy in AI systems affords the duality of achieving greater good and/or imposing harmful acts. Those who design, develop and implement AI must balance human control with machine autonomy, and co-create solutions through governance, values, standardization and innovation, creating the currency of our time - trust.

Prof. Sally Eaves, Senior Policy Advisor of the Global Foundation of Cyber Studies

AI will be the most impactful technology of the coming years. It can propel us forward socially and economically or, if we miss the boat, leave us completely behind. We have to set the course today.

Vanessa Cann, Managing Director, German AI Association, the largest AI network in Germany

A wide adoption of AI-based solutions brings objects in a city - vehicles, buildings, street lighting, etc. - to life, giving them a social identity to be active participants in the city's economic ecosystem. I foresee a future where AI Agents and machines will have their own needs, thereby becoming a commercial target group by themselves, whilst also opening new industrial verticals and markets. I strongly believe cities need to approach AI technology with this perspective in mind so as to not miss its biggest benefits.

Katerina Zalamova, PhD, Smart City Expert and Advisor, CREA IDEA LAB SL

Artificial Intelligence is a key innovation factor for mastering the complex development of intelligent products, production systems and services. As we push the boundaries of technology to succeed in the global economy, we must ensure innovative, secure, trustworthy and ethical solutions.

Roman Dumitrescu, Director, Fraunhofer Institute for Mechatronic Systems Design



Artificial Intelligence for Green Cities

A sustainable city is a holistic concept, one in which taking the entire ecosystem into account is essential.

By **Sonia Tovar** (Communication and Business Development), **Andrea Gómez**, PhD (CMO), and **Antonio J. Jara** (CEO), [HOPU](#)

A lack of contextual data is one of the key challenges faced by cities when endeavouring to align with groundbreaking regulations and the UN's SDGs. Environmental indicators play a key role in assisting decision-makers in the creation of effective infrastructures, increasing innovative investment and contributing to the reduction of air pollution.

Smart cities funding requires a deeper compromise, the monitoring of KPIs and sustainable development actions. Cities must meet regulatory compliance, and enable a comprehensive understanding of their urban context.

[HOPU](#), a company focused on the research and development of IoT (Internet of Things) and smart cities solutions - and a [FIWARE Foundation](#) Gold member - brings data-based urban innovation which simplifies city data in unique indicators that monitor and forecast the environment.

The process is based on AI data models which correlate data linked to air quality, mobility, urban health, and socioeconomics from different sources. These indicators support decision-making for climate change mitigation and help to analyze and forecast the city's state and the impact of mitigation actions.

The solution is based on heterogeneous data analysis integrated using the [FIWARE Context Broker](#), the core mandatory component in any "Powered by FIWARE" architecture, and [FIWARE open standards](#).

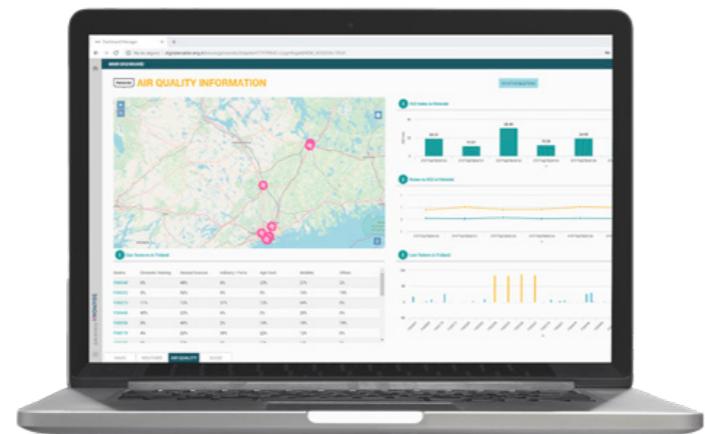


Image provided courtesy of HOPU.

HOPU enriches the AI data by installing air quality sensors called [Smart Spots devices](#), which monitor nocive and greenhouse gases, particulate matter and other parameters such as noise and crowds.



Not Your Average Lamp Post

Smart cities delivered by machine learning, Artificial Intelligence and lamp posts.

By **Jim Craig** (Product Manager), [Red Hat](#) Global Government, and **Leslie Hawthorn** (Manager), [Red Hat Open Source Program Office](#)

Why ML? Before we can create intelligent systems, they first have to learn the problem domain. Combining Machine Learning (ML) and Artificial Intelligence (AI) offers new ways to design and deploy smart cities, manage related infrastructure, and deliver improved experiences to citizens.

Pre-trained models understand the basic operations of the city. These models are then constantly updated and improved through the consumption of large volumes of video and sensor data.

In this paradigm, an everyday object such as a street lamp becomes both a consumer and processor of data, with information coming from multiple sources. Some decisions are made at the edge - the lamp can detect "it's dark, switch on" - and others are fed back to a central cloud based system, creating a city-wide view of traffic flow, for example.

Multiple sensors feed the system - the [FIWARE Context Broker](#) - with data on water levels (flood monitoring), air quality, noise (environmental monitoring), vehicles, pedestrians, parking, public safety (images), photocells (smart lighting), WiFi and mobile (communications) and electric vehicle charging (mobility).

All this functionality can be rapidly deployed using a container platform, such as [Red Hat OpenShift](#). Containerization allows applications to be seamlessly deployed between edge, cloud, and private data centres, all without changing the underlying code. This approach allows cities to start small, iterate quickly, scale rapidly, and do so with in-built end-to-end security mechanisms.

To learn more about how more transparent and fast AI solutions can result in greater efficiencies for the public service, read Red Hat's [white paper](#) that hits the nail on the head.



Image by [FelixMittermeier](#) from [Pixabay](#).



Defect Identification in the Public Infrastructure with the S1 IoT Platform

Focus is on the evaluation of past data, recognition of trends and classification of data in clusters.

By **Mathias Petri**, PhD (Chief Sales and Marketing Officer),
and **Michael Falkenthal** (Team Lead, Software Architect
and Senior Developer Quantum Computing and AI), both at StoneOne

The S1 IoT platform is used to connect various sensors, among others from the areas of energy measurement/heating/charging stations, building services, mobility/route planning, pollutant/fine dust/defect identification. The data is recorded using various FIWARE components (FIWARE Context Broker, FIWARE (STH) - COMET, Open MTC), then transferred to a backend and stored in data pools.

In this way, data of various subject areas is recorded in a structured manner in these data pools and stored for presentation and subsequent evaluations. This data is available for use in AI processes, for example in the area of defect identification in public infrastructure (buildings, roads, bridges, rails, etc.).



Image provided courtesy of StoneOne.

The focus is on the evaluation of past data, recognition of trends and classification of data in clusters, for instance, to carry out an automated classification of new data objects on the basis of AI-trained knowledge from existing data.

This new data can also be used to further improve trained knowledge. In a first step, the data from the data pools must be transformed into a processable format, then various AI methods are evaluated for best results. These have to be interpreted in order to provide the desired knowledge for the respective case.

In the future, quantum-supported apps will also be used on the platform for very complex tasks. The data provided by the sensors is used to train suitable QC / AI methods to detect defects in new data.



Using AI to Extract Information from Big Data

For over 15 years digital data has been defined as “the new oil” (Clive Humby) and everyone’s attention has been focused on storing as much data as possible.

By **Andrea Chiancone**, PhD (Engineer and Project Manager), WiseTown®

Companies, institutions, public administrations, and digital giants are committed to increasing and regulating a market that is currently estimated at over 140 billion dollars. Subsequently, it was understood that having a lot of data does not necessarily mean having a lot of information.

Drowning in a data lake or groping in the dark of boundless data space is often not useful. On the contrary, it increases the complexity of the problems and prevents us from grasping the actual insights necessary to support our decisions.

Artificial Intelligence, considered as “the new electricity” (Andrew Ng) is revolutionizing entire sectors with a fundamental impact in the analysis of big data and the retrieval of useful and synthetic information in fields such as industry, agriculture, health, etc.

In the smart city sector, for instance, technologies powered by FIWARE such as WiseTown®, allow both the retrieval of large amounts of heterogeneous data and its analysis through AI algorithms to process and support strategic decisions made by humans.

For more details on how AI and WiseTown® can help city governments to explore all the available opportunities that new technologies offer for cities and communities, visit the website.



Image provided courtesy of WiseTown®.



Boosting Territory Innovation with Machine Learning as a Service

A new service to upload AI models aimed at improving decision making in the city.

By Franck Le Gall (CEO), EGM

Smart cities and smart territory platforms are multi-stakeholders' environments involving data producers, data consumers and data processors. They aim at providing an innovation ecosystem in which data is consumed not only by one application but is shared through several cross-domain usages.

In that context, machine learning, and Artificial Intelligence algorithms are playing a particular role. As data processors, these systems are animating Digital Twin, the digital equivalent of the physical assets of the territories.

The deployment of new algorithms must be facilitated in a way that any organisation is able to test, deploy and possibly monetize its concept without losing its competitive advantage, in relation to the development of such an algorithm.

To that end, EGM, a French-based company specialized in the design and implementation of interoperable systems - based on open standards and validated technologies - has developed the Machine Learning as a Service (MLaaS) concept within the FIWARE ecosystem. Building upon the NGSI-LD context information management specification - to which the FIWARE Community has led the definition of - the MLaaS allows the deployment of models consuming and generating enriched context information.

The developed system packages the model within a software container, delivers it to the cloud and sets up all the in/out data connections. A practical demonstration of such an approach is being conducted in the context of smart water management under the Fiware4water European project.



Image provided courtesy of EGM.



Connecting Cities to Data Spaces for the Creation of Innovative Services

Data spaces play a crucial role in the development of a data economy where cities can benefit from and boost the development of innovative AI/ML services.

By Juanjo Hierro (Chief Technology Officer), FIWARE Foundation and the i4Trust project Coordinator

i4Trust is a joint initiative between FIWARE Foundation, iSHARE and FundingBox created to accelerate the creation of data spaces. i4Trust aims to boost the development of first pioneer use cases through open calls, bringing up to 3,2 M€ in grants for SMEs and slightly bigger companies.

Participants of any i4Trust data space share a Digital Twin representation of the world and exchange Digital Twin data using the standard NGSI-LD API defined by ETSI. FIWARE brings all the open source building blocks that participants need to deploy.

First and foremost, the FIWARE Context Broker technology implements the NGSI-LD standard. Secondly, a robust FIWARE Identity and Access Management (IAM) framework compliant with open standards (OpenID Connect, XACML) adopted in the iSHARE scheme for trusted data exchange.

FIWARE also brings an open source implementation of crucial services like data/apps marketplace or components facilitating the integration with private distributed ledger or blockchains for logging information of selected transactions.

All these building blocks are compatible with core CEF Digital Building Blocks, namely Context Broker, eIDAS and EBSI, which the European Commission recommends for the creation of digital service infrastructures able to work across Europe.

Smart cities powered by FIWARE can connect to i4Trust data spaces and immediately benefit from the data services third-parties offer and, at the same time, provide data services that will fuel the development of innovative services.

This means, for example, cities can benefit from traffic prediction services a SME has developed, built upon their expertise not only in the traffic field but also in advanced AI/ML techniques.





AI Marketplace: The Digital Platform for Tomorrow's Innovations

The product creation process is a major driver for innovation since, for example, about 85% of the manufacturing costs are already determined in this stage.

By **Salome Leßmann** (International Relations and Marketing),
it's OWL Cluster Management

There is immense potential for optimisation through AI. This is exactly where the AI Marketplace comes in: a digital platform that brings together providers and users of AI solutions. Officially launched in March 2021, the platform will be set up in four consecutive stages:

Stage 1: The platform brings manufacturing companies together with AI providers via an “intelligent matching service”.



Image source: Adobe Stock

Stage 2: The AI Marketplace provides a protected data room for development and test data to continuously improve AI applications and adapt them to customers' needs.

Stage 3: It will provide concrete AI applications that can be used by manufacturing companies with a manageable amount of adaptation.

Stage 4: The construction of a toolkit allows standardized AI modules to be combined with each other.

With this platform, whose architecture relies heavily on FIWARE standards and models, the AI Marketplace wants to be instrumental in making product development processes in the manufacturing sector leaner, more efficient and thus more sustainable.

Its success is thanks to the ongoing joint work of a consortium of 19 renowned research institutions, networks, companies and non-for-profit (including FIWARE Foundation), under the leadership of the Heinz Nixdorf Institute, an interdisciplinary research institute, located in Germany.

The AI Marketplace emerged from the Leading-Edge Cluster it's OWL (Intelligent Technical Systems OstWestfalenLippe), considered one of the largest German initiatives for Industry 4.0 in medium-sized companies.

About FIWARE Foundation

FIWARE Foundation is a non-profit organization that drives the definition and encourages the adoption of open standards – implemented using Open Source technologies and reference architectures – to ease the development of smart digital solutions across multiple domains, based on FIWARE technology.

The foundation achieves this through the support of a fast-growing global community that shares a common vision and combines their efforts toward making FIWARE the Open Source technology of choice for industries, governments, universities and associations to reach their full potential and scale up their activities, thereby, entering new markets and growing their businesses. Founded in 2016, the foundation has **Atos, Engineering, Red Hat, NEC, Telefónica** and **Trigyn Technologies** among its 400+ members.

About Matthew James Bailey

An internationally recognised pioneer and authority in the fields of Innovation, Artificial Intelligence, Smart Cities and The Internet of Things, Matthew's leadership is widely acknowledged throughout governments and the private sector. Bailey operates at the intersection of innovation and leading edge technologies to enable positive economic, social, and environmental change.

Matthew's vision for society, guiding innovation, and technologies that advance humanity into its future (what he terms World 3.0) has inspired governments, business and citizens. He is a sought-after advisor and keynote speaker.



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