



Digital Currencies: from Paper to Production

By **Nicolas Kozakiewicz**,
Innovation Executive Advisor at Worldline

Executive Summary

After thousands of articles, papers, roundtables and conferences, the digital currency debate is far from over.

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Innovation Executive Advisor at Worldline



Digital Currency has evolved and become more sophisticated and nuanced. Now even people who do not believe in these currencies are able to make a distinction between unstable crypto-assets like bitcoin and ether on the one hand and stablecoins such as Libra/Diem and Central Bank Digital Currencies (CBDCs) on the other.

The first side effect of this development is that it is clear to most people involved in the debate that a Distributed Ledger Technology (DLT) can be efficiently used to operate new digital payment rails. Of course, other IT infrastructure could also deliver such a service, but DLTs are designed to provide exactly the features that are required, i.e. to notarise information in immutable distributed copies of the same ledger.

Whether one operates a centralised or a decentralised infrastructure, very specific and specialised expertise is needed to manage tens or hundreds of millions of users, billions of transactions in real time, all while coping with heavy peaks of usage and ensuring full security at all times.

Furthermore, while implementing the infrastructure required is part of the equation, it is far from being the most challenging element of ensuring a successful digital currency revolution. The challenge that needs to be addressed is how we ensure the optimal operation and execution of these platforms. In this paper, we use the term “digital currencies” to cover all payment methods based on DLT technologies which allow the acquisition, holding, transfer and the redeeming of assets that are backed up by tangible pre-existing assets whose intrinsic value is calculated outside of this system. Digital currencies include, but are not limited to, central bank digital currencies (CBDCs), stablecoins, utility tokens, ownership tokens and others.

Based on Worldline’s years of experience of going live with these projects, in this paper we describe the various steps involved in implementing a digital currency, from assessing the need to the actual implementation, from well-intentioned aspiration to an industry-grade service in operation at scale.

This document focuses on the technical feasibility of stablecoin platforms. The regulatory aspect, which needs to be assessed in parallel, is also of great importance and varies significantly depending on the usage and the location of the platform. All the examples discussed in this paper are in full compliance with applicable regulations.

Combining Physical And Online Payments

DLTs are much more than just another rail for digital transactions. While DLT technology does indeed enable payments, there are some key differences with existing payment technologies that are not immediately obvious at first glance.

Today's payment rails have evolved alongside changing demand and enabled a series of different use cases. Consequently, payments are now possible in a wide range of situations ranging from peer-to-peer to peer-to-machine, machine-to-peer, peer-to-online, online-online, and before long even machine-to-machine.

However when it comes to cash and therefore central bank money, only physical/in-store payments are possible for ordinary users of current payment rails. No online payments can be made. For cheques, wire transfers or even cards, ordinary payment rails do enable transactions but only at the expense of high complexity, high costs and fragile security.

Therefore the mission of digital currencies is to combine physical and online payments and to ensure simplicity and interoperability, all at a fair price. Safe, easy, and affordable use and operation will be key to their successful introduction.

DLT-based services can provide all these features for any digital payment use case for which there is a validated business model.

1. Blockchain Assessment

Services Requirements
Technical Validation

Applicability, business impact and deployment strategy assessment



The Digital Currency Vision



There are clear philosophical and ideological differences as well as technical differences between digital currencies and traditional currencies. It is worth briefly examining these differences in order to understand some of the drivers behind the digital currency movement and the rise of digital cash.

The original means of payment, namely cash, is obviously prepaid. Users have to make sure they have a sufficient amount of cash in their wallet prior to making a purchase. Subsequent payment rails offer a post-paid service, freeing the user from making constant trips to the bank or the ATM. That is true for all standard payment rails, whether cheques, wire transfers or card payments.

Digital currencies go back to basics: they are also prepaid. However, their digital nature allows them to eliminate the one reason that drove the switch from prepaid to post-paid: the burden of loading up one's wallet.

It is time-consuming to have to go every other day to the bank or ATM to load up a wallet or purse. In contrast, with a simple Open Banking API users can recharge their wallets with digital currency in an instant.

The parallels with physical cash do not stop there. Both digital currencies and physical cash can be token-based. When one withdraws a €10 note from the ATM, the note is unique, with a serial number on it. Two €10 notes are non-fungible: they don't somehow turn into a €20 note.

This is in direct contrast to the money in our bank accounts. Transfers to our bank balance represent non-tangible euros. If we receive a €20 transfer, we cannot identify which were the first 10 euros we received.

Digital currencies can be either balance-based, like current accounts, or token-based, like cash. This enables them to provide a very powerful feature: digital currencies can support both online and offline commerce. Online here refers to any payment made using an internet connection, including apparently physical in-store payments on terminals which request a confirmation from the payer's bank before processing the transaction. Offline payment includes both cash payment and payment in digital payments which do not require an Internet connection.

Privacy concerns

There are key differences between standard payment rails and digital currencies when it comes to privacy. Of course, privacy has greatly decreased as payments evolve away from cash. With digital currencies, depending on the demands of service providers and on regulations, a specific level of privacy or anonymity can be set that may be closer to the privacy levels of cash.

A full scale of privacy arrangements is possible, from totally (pseudo-)anonymous to fully identified usage, based on the amount of the transaction, on the mode of the transaction (online or offline), or on any other parameters required to provide the service or to comply with regulations.

Distributed, not decentralised

Now may be a good moment to clear up one common inaccuracy when discussing digital currencies. Even though there is a lot to talk about “decentralisation”, it is more accurate to refer to DLT as “distributed” or “parallel”.

DLTs are centralised in the sense that the processing done is dictated by rules or scripts that are common to all the nodes executing the processing. Whether a transaction is processed north or south, the outcome will be the same. If the rules are ever amended by a decision, the changes will be applied to the entire DLT.

Safe, easy, and affordable payments

As with most digital services, digital payment solutions are not static services that can just be turned on and off. They are highly parameterised to adapt to all business cases, usage patterns, regulatory demands and geographical and technological requirements.

Let's explore the ramifications of this.

A digital currency service is provided by one and/or several parties for the use or benefit of parties who may be the same parties and/or different players.

As an example, if we take a look at how a CBDC could be implemented in Europe by different parties, first we would have to list the managing parties. In this case the parties would be the European Central Bank as the managing authority and the local Central Banks as the applying authorities. These would be the parties that define the requirements, rules and regulations.

It is these managing parties who determine who would be the user parties, and identify the operating parties and the interfacing parties, etc. In short, the managing parties would be responsible for the entire service definition and govern the service framework.

Interfacing parties would be commercial banks and other entities that would manage the end customer interface. Operating parties would include the provider of the technology and operations. Some of the above parties would also own a “node” and “copy” of the history. Once the service is available, these groups will be joined by the user parties.

Each of these parties would be assigned rights and duties, depicting what data they can see, what data they should provide, what part of the business flow is their responsibility, with all the regulations and Service Level Agreements that are applicable.

For example, it would be the responsibility of the managing parties to define the scope of the service in terms of the number of expected users, volumes, throughput (peak usage), geographies, wallet types, active/passive initiation processes, etc.

This arrangement of separate parties working together is often referred to as the governance part of the DLT project.

Toward a Trusted Digital Currency

What if you could create anything?



Business Centric

- Smart Currency
- Business Logic



Simple Intergration

- Currency Ecosystem
- Open to partners



Full Disclosure

- Real Time
- Traceability



Business Centric

- UX Centric
- Loyalty



Security First

- Payment Gateway
- Onboarding + KYC

Fine-Tuning The Digital Currency Business Model

The “acceptance” and buy-in of all these various parties is of paramount importance to an impactful digital currency initiative.

The technology factor is of course essential – without the right technology, the service cannot be properly delivered – but without a high level of buy-in from participating parties and end-users, the service will not be a success.

So what is the motivation for all parties and for end-users to buy into a DLT initiative? How do we fine-tune a business model that generates benefits for all these players and helps drive a successful digital currency service?

For managing parties, who are at the origin of the service, motivations for embarking on a digital currency project include widening their scope of operations, introducing new services, making their corporate image more innovative, and generating cost savings, alongside a wide range of additional benefits.

Other providing parties can also have a vested interest in the success of a digital currency, or simply be remunerated for the provided actions. They will participate in a project only if their interest is served.

And the same goes for using parties of the service. They must be willing to enjoy the benefits of a digital currency service if it is to prosper in the real world. Throughout history, many fantastic products have failed to gain traction and develop because of a lack of user adoption and enthusiasm. Digital currencies will be no exception unless they abide by the same principles.

Tapping into the digital currency advantage

Based on external observations and internal insights from our experience of digital currencies at Worldline, we can clearly see a range of possible business models which satisfy the needs of all the participating parties and ensure they benefit from this new payments rail.

When compared to other existing rails, where multiple piles or layers are required to carry out a transaction, including issuing, acceptance, acquiring, processing, settling, fraud management and more, DLT-based digital currencies benefit from the intrinsic qualities of the underlying technology:

- Since all information in the system is immutable, and a single point of truth is guaranteed, issuing, accepting and acquiring become simpler by design.
- Settlement is also greatly simplified, and in the case of token-based services may not even be required anymore. Settlement is needed when one pays by an “I Owe You” type of rail, such as cheques, wire transfer or card payment. No settlement occurs when one pays in cash or traveller’s cheques.

In terms of integrating the innovations of the underlying technology for digital currencies, it should be noted that the DLT architecture and data flow replicate existing payments services, but in a digital format and with an automated notarial system to anchor all the required information.

There is no need to reinvent the wheel. Parties can plug in the DLT service at the appropriate hinges and points of contact in the existing service. This will allow the platform to notarise current features and introduce new ones seamlessly.

2. Blockchain Analysis

**Participants, Inputs/
outputs,
Dues/duties,
Governance,
Data content & flow**

Exploring blockchain toolsets to build an MVP, customised Proofs of Concept and Proof of Value Business Model & Pricing



Making The Right Technology Decision

First and foremost, developing a DLT-based service is still a “classical” IT project. At Worldline, we estimate that the DLT part of the project represents up to 30% of the overall solution. The rest consists of more usual digital tasks such as deployment, operation, integration, UX, dashboards, etc.

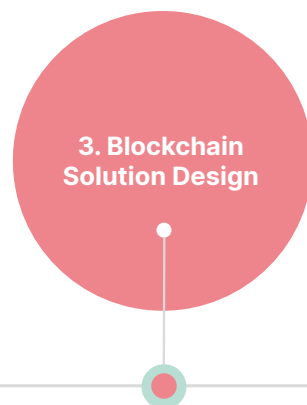
There are already hundreds if not more DLT technologies available off-the-shelf in the marketplace. Although many of these packages are based on similar architecture, they can be customised to address various types of projects. Based on the requirements of the business case and preferred governance structure, the choice of which solution to use is usually a straightforward process.

At Worldline, we have learnt from our experience of operating industrial-grade DLT-based services that the gap from Proof of Concept (PoC) to production is high. Several aspects in particular require very close attention:

- **The geographical footprint of users**, usage, data exchange and data processing.
- **The Peer-to-Peer network architecture to be used**, as we have discovered that some of the most prominent off-the-shelf technologies are not capable of scaling up. We experienced loss of connections between nodes that were “only” 100 miles away despite being connected with a dedicated optical fibre.
- **The overall transaction distribution and load balancing**, as well as peak of usage management.
- **The in-chain and out-of-chain split of data**, business logic, external systems integration.
- **End-to-end timings** as DLT ‘speed’ is often scrutinised; if the rest of the ecosystem is lagging behind, the service cannot run properly.

Of course, a DLT-based service that provides transaction processing also needs all the capabilities, expertise, integration, automation that any transaction processing service requires.

The strongest guarantee of a successful DLT-based service is for the operator to have a track record of dealing with high volumes, real-time, regulated, peak usage, sensitive transactions. Expertise of leveraging DLTs in a processing environment is another powerful advantage.



High-level solution architecture to leverage:

- Infrastructure
- Wallets
- Services

Testing and piloting your digital currency

As with any successful IT project, testing and piloting is a crucial step, both for validation of the integration and for assessing the responses, reactions and approval of end users.

Imagining something on paper is one thing. Bringing it to life and especially at great scale is a completely different challenge. So the standard practice is then to confirm and complete the service's requirements using live tests and pilots.

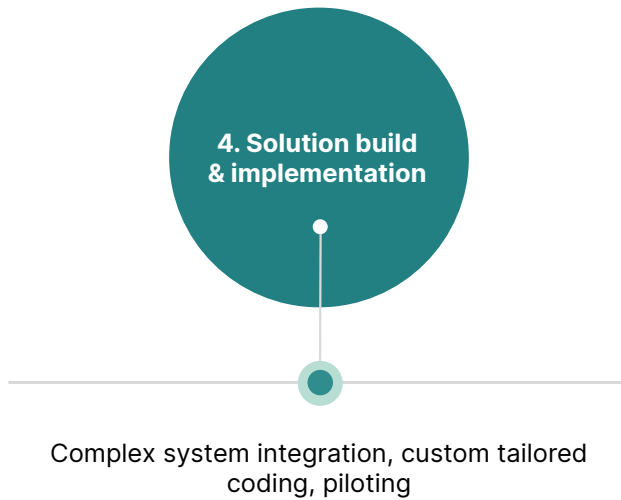
A mandatory step is to run a pilot phase after establishing the governance structure. While there is no requirement for this pilot to be exhaustive or on a massive scale, it has to cover, in one step or several depending on the complexity of the service, all the possible parties involved, as well as the different types of usage and the types of interconnection needed.

This is often achieved by selecting a region or group of participants that are representative of the global scope that the project is aiming for. The pilot then functions as a testbed, confirming or correcting the hypotheses made during the governance stage.

The technology itself is not corner tested. Instead, the business case is pulled and pushed and torn in all directions to validate the overall service.

To stress-test the specific complexity embedded in the service, parallel performance tests are carried out which are designed to guarantee the performance of the technological engine that powers the service.

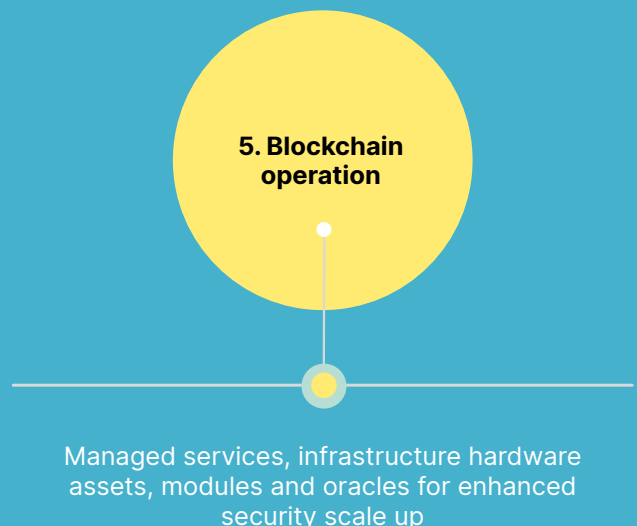
At all stages of the pilot, it is important to bear in mind that the DLT engine is just one part of the overall End-to-End solution. All the other major blocks must be as performing just as well as the core central system.



Operating Challenges

Regardless of the payment rail envisioned for a digital currency service, transactional operations always require full mastery of turnaround times, privacy, processing volumes and usage peaks, as well as of the geographical distribution of the service and of the various other IT systems to interface with.

In this respect, digital currency deployment requires a set of skills and expertise that only Payment Service Providers possess. Only an operator with all the expertise, processes and monitoring tools for existing payment rails can guarantee a flawless and seamless real-time infrastructure for a digital currency service.



Open System Leading To Scalability

One of the strongest features of DLT-based solutions for digital currencies is their native openness.



Firstly, they are open in the sense that users can be onboarded digitally and instantaneously, i.e. as soon as KYC (Know Your Customer) is confirmed.

Secondly, they are open in the sense that many different parties can leverage the same infrastructure, without having to mix any assets or share information. Parties can have totally hermetic environments next to each other.

Thirdly, the openness of DLT refers to the fact that once parties have created a given asset in a given environment, these parties can immediately create other types of assets in the same environment, or in a sub-environment, or in a discrete environment. They can mix and match them at will, with specific rules for trading and transacting.

And fourthly, DLT infrastructure is open because it is API-based, enabling straightforward natural automation with any external system.

All these different but related forms of openness make it easy to scale up DLT-based digital currency platforms and add new users and services.

While many digital currency projects start off small, they all have a well-defined path to notarise more and more assets, for increasing volumes of users or for sub-groups of users on top of the same infrastructure. There is a clear analogy with the rise of cloud computing in the corporate world: initially, only some specific applications were migrated to the Cloud, but subsequently Cloud began to provide most of the services that companies use every day.

Interconnections made easy

The nature of a DLT-based system is to be a notarised business interconnect, supported by APIs which interconnect discrete infrastructure.

As an example, let's imagine two geographies each with their own state digital currencies. For someone to possess both digital currencies, they would need two wallets, i.e. one per infrastructure. Of course, this still simplifies foreign exchange compared to existing systems, and the advantages do not stop there:

With the approval of State B, State A could provide digital wallets connected to the infrastructure of State B. State A would "freeze" X tokens of Currency A and ask State B to create X tokens of Currency A in infrastructure B. Each token on both sides would represent the same asset one being frozen, the other one being usable.

Any holder of Wallet B could then be in simultaneous possession of Currency A and B on the same infrastructure, enabling seamless FX transactions.

Digital Asset Management (WL DAM)

To enable this new world of seamless digital currency transactions, Worldline has created the Digital Asset Management (WL DAM) platform. WL DAM can pilot and operate any type of stablecoin, the digital currencies that peg its value to a real-world FIAT, commodity or asset.

One of our clients, an AMF-certified, gold-pegged service provider, uses the WL DAM platform to transact with gold-backed stablecoins, whether they are bars, coins or gold dust.

[Read the press release here](#)

We are working with another AMF-certified client that plans to provide community stablecoins, pegged to a cart of fiat currencies, to global football fans. These "soccer-coins" would be used by members of the huge fanbase of football supporters and will launch before the 2022 FIFA World Cup.

And we are at various stages of development with other major players to explore opportunities to leverage the WL DAM to create new digital currencies.

Accelerating adoption

The successful adoption of a new digital currency will require not only a solid business model and world-class DLT-based infrastructure, but also all the tools and processes needed to implement the supporting services.

These include:

- Bulk onboarding
- KYC
- AML (Anti-Money Laundering)
- Escrow
- Fraud in usage detection
- Automated "settlement" / Asset burn
- Cross-asset trading
- Real time user animation / interfacing / promotion
- Interfacing with external tools (Marketing, CRM...)
- Automated (PIS) wallet load-up

Conclusion

Digital currencies are creating incredible possibilities for more integrated, more seamless, cross-usage and automated payment services.

While payment will not entirely disappear from the purchase experience, thanks to these new solutions, it will become almost invisible.

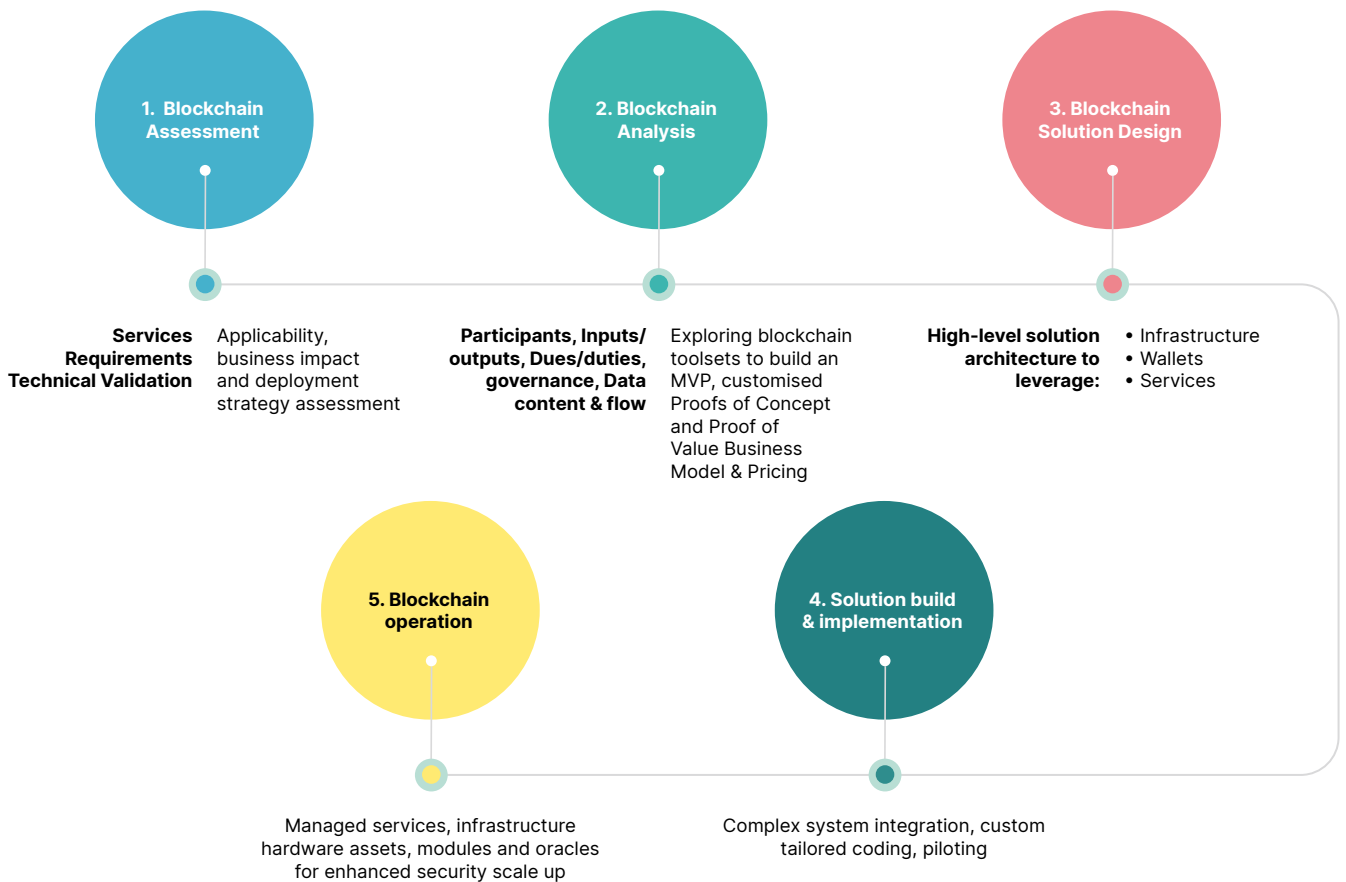
The technological solutions that enable this vision exist today. They are already at industrial scale. They leverage the rock-solid technologies of recent decades (peer-to-peer networks, hash functions and cryptographic signatures). By bringing these building blocks together and applying years of experience in IT integration and project

development, operating parties such as Worldline can bring the digital currency revolution to life.

The critical challenge now is not to develop new technological solutions. The technology is here now – and it works. The challenge lies elsewhere. Digital currencies will involve enormous numbers of users (payers and payees), massive volumes of transactions and sudden usage peaks, at the same time as facing strict regulatory requirements and the need for broad, even global geographical coverage. The challenge

now is to ensure the optimal operation and execution of these platforms. As with all payment rails, this will be of paramount importance to the success of digital currencies.

To transform the world’s payment ecosystem, experienced payment rail providers such as Worldline are embracing the enabling technologies for digital currencies. Supported by global scale and decades of expertise, we are here to help turn the digital currency vision into a reality.



Glossary

AIS/PIS refer to Account Information Service (AIS) and Payment Initiation Service (PIS), new services (regulated in Europe by PSD2) that allow users to access bank account information, such as the balance of the account, and initiate a payment from a bank account.

APIs are Application Programming Interfaces, i.e. interfaces that enable applications to communicate with one another.

Business logic refers to the logic that underpins the rendered service itself.

Dashboards are a visual way of showing the important data of a service, including KYC (Know Your Customer).

DLT stands for Distributed Ledger Technology. Definitions vary. In this context, DLT represents any technology that is based on a shared immutable ledger in between a service's parties. When the ledger takes the form of blocks it can be defined as a blockchain.

FX is Foreign eXchange, which is the process of trading a given type of asset against another type of asset, commonly one fiat currency for another, like trading euros for British pounds.

In-chain and out-of-chain refers to information exchanged between parties, either "in" the DLT, i.e. with possible control and/or storage of the DLT, or "out" of the DLT, i.e. no visibility at all from the DLT.

Ownership tokens are stablecoins that point a "ownership of an asset". A land property act is a form of ownership token. These tokens can be used for the identification, authentication and ownership of an asset.

Stablecoins, as opposed to unstable coins like well-known public blockchain tokens (e.g. bitcoin and Ether), are coins or tokens that are linked to an external recognised asset that determines its selling value. In other words, it is a tradable digital countermark of another valorised asset. For example, DaVinci tokens represent physical identified gold coins, and hence are valued based on the price of gold. These tokens are used as a means of payment.

Utility tokens are stablecoins that point a "right to use a service". A return ticket is a form of utility token. These tokens can be used as a means of accessing a given (prepaid) service.

UX stands for User eXperience. It is the science of rendering a service as efficient, intuitive and seamless as possible, in order to minimise the difficulties of learning how to use a service.

About Worldline

Worldline [Euronext: WLN] is the European leader in the payments and transactional services industry and #4 player worldwide. With its global reach and its commitment to innovation, Worldline is the technology partner of choice for merchants, banks and third-party acquirers as well as public transport operators, government agencies and industrial companies in all sectors. Powered by over 20,000 employees in more than 50 countries, Worldline provides its clients with sustainable, trusted and secure solutions across the payment value chain, fostering their business growth wherever they are. Services offered by Worldline in the areas of Merchant Services; Terminals, Solutions & Services; Financial Services and Mobility & e-Transactional Services include domestic and cross-border commercial acquiring, both in-store and online, highly-secure payment transaction processing, a broad portfolio of payment terminals as well as e-ticketing and digital services in the industrial environment. In 2020 Worldline generated a proforma revenue of 4.8 billion euros.

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infoWL@worldline.com



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