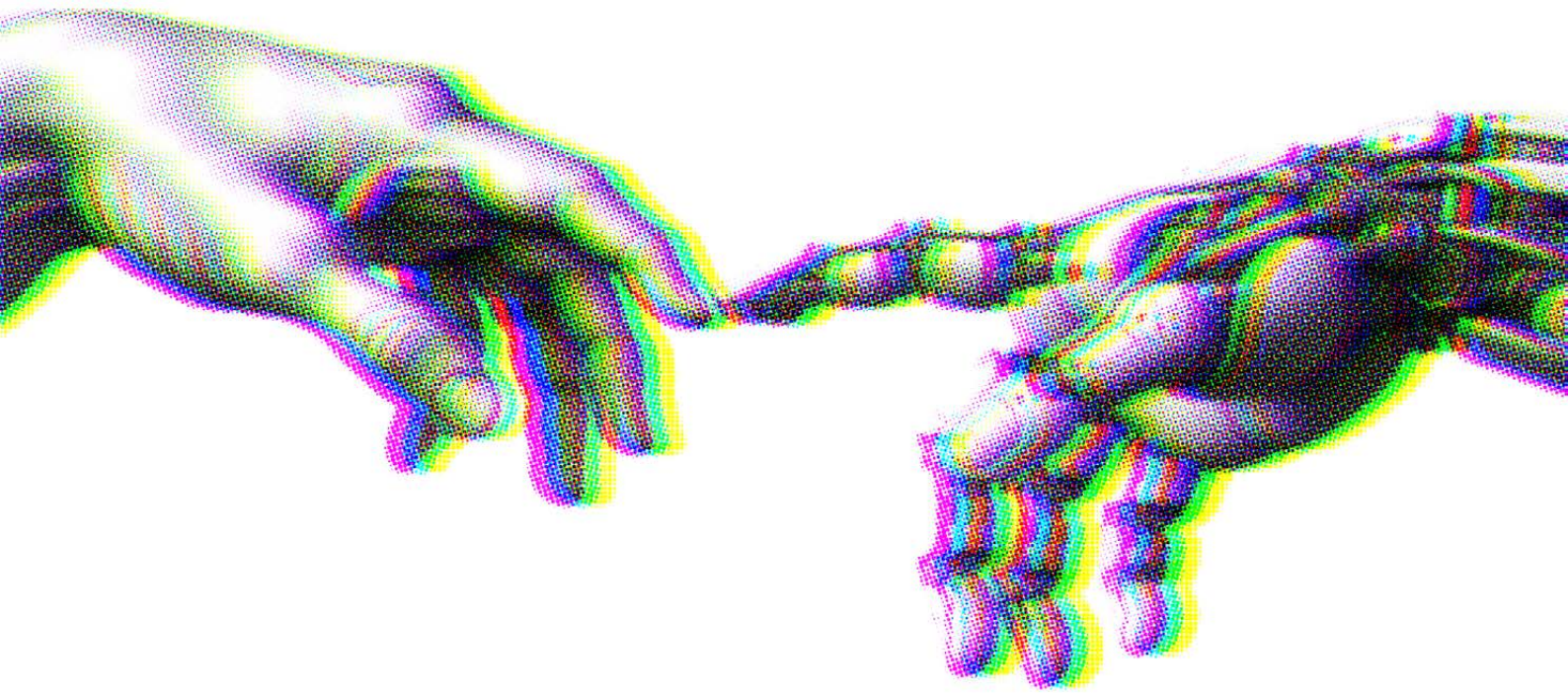
LAYERS



Decentralized infrastructure for AI value chain

White Paper v2.0

Lay3rs crosses blockchain and artificial intelligence technologies (large AI models and refined AI models), to provide a revolutionary infrastructure enabling the creation of AI materials, refined AI models and licenses of exports in a decentralized way.

Thanks to its innovative infrastructure, Lay3rs allows users to access rewards by providing AI materials to the ecosystem.

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Manifesto

The rapid diffusion of artificial intelligence (AI) is transforming industries and societies, generating significant doubts and profound questions regarding ethics, rights, and governance. As AI systems increasingly perform tasks traditionally done by humans—from composing art to making decisions—questions arise about ownership, copyright, and the fair distribution of economic gains. AI's ability to process content and generate new data based on existing contents challenges well established norms and legal frameworks, particularly around intellectual property.

- How can decentralized infrastructure clarify ownership and copyright of data used by generative AI? Why Could logging each contributor's input in a blockchain not only secure but also enhance the value of each contribution to automated content production?
- What mechanisms are needed to ensure that all data creators are fairly compensated through generative AI? Why couldn't envision smart contracts that automatically distribute revenues generated by derivatives taking into account original data contributors?
- How might decentralized technologies promote transparency and combat abusive uses of generative AI? Is it feasible for each piece of data used by AI to be publicly traceable and verifiable, thus reducing the risks of data manipulation and misuse?
- What are the technical challenges in integrating decentralized infrastructure into current generative AI applications? Can existing solutions be easily adapted to a decentralized model, or is a profound redesign of data architectures necessary?
- How can decentralized infrastructure positively influence public trust in generative AI? Would the ability to verify the origin and legitimacy of each data used increase social acceptance of generative technologies in sensitive sectors like healthcare or finance?
- Ultimately, could decentralized infrastructure democratize access to the benefits of generative AI? If each contributor is recognized and compensated, could this encourage broader and more diverse participation in the digital economy, thus contributing to more inclusive and balanced technological development?

The blockchain-based solutions offered by Lay3rs solve many aspects of those questions and make it possible to take the lead on these issues by creating a virtuous, inclusive and open value chain.

Problems that Lay3rs solve

Sustainability

In the artificial intelligence (AI) value-creation chain, numerous entities contribute to the development and deployment of technologies. This chain includes data providers, algorithm developers, researchers, and end-users, among others. Still, the lack of transparency of the AI field and the habit of the industry often leave aside some key contributors such as the individuals who label training data or the open-source communities that develop foundational algorithms remaining anonymous or unrecognized.

The lack of visibility of these stakeholders poses a challenge in equitably distributing the economic value generated by AI. Without proper attribution, essential contributors might not receive due compensation or credit, disincentivizing future contributions and potentially stifling innovation. This scenario undermines the potential for a sustainable ecosystem where each contributor is incentivized to continue their engagement.

A sustainable AI ecosystem relies on the continuous cycle of investment, development, and return. For this cycle to function effectively, there must be a system that ensures value is recognized and rewarded appropriately, fostering a culture of collaboration and fair play. Addressing this issue requires transparent mechanisms for tracking contributions and distributing rewards, possibly leveraging blockchain or other decentralized technologies for traceability and fair value distribution.

Developing such mechanisms not only promotes fairness but also fosters a broader participation in the AI field, leading to a more diverse and robust technological landscape and continuous production of original data. Ensuring that every stakeholder in the AI value chain is identified and compensated is not just a matter of ethics; it's a compulsory element for a thriving, innovative, and equitable AI future.

Contamination

When artificial intelligence (AI) generates outputs, it often does so by drawing on extensive existing AI materials, including texts, images, and other media. These materials may contain copyrighted elements, but AI doesn't always distinguish between copyrighted and non-copyrighted material. Consequently, AI-generated results might inadvertently infringe copyrights if protected elements are reproduced or altered without permission.

This issue presents a significant problem: if AI-generated outputs, potentially containing copyrighted material, are used to train other AI systems, the infringement can propagate. This means that copyright violations are not isolated but can spread across entire chains of data used for training new AI systems.

This spread complicates compliance with copyright laws for downstream AI materials. Companies and developers need to be particularly vigilant when using AI-generated data or pre-constructed large dataset to ensure that they do not violate copyrights, which could lead to substantial and complex legal and ethical consequences. This highlights the importance of developing robust monitoring mechanisms to oversee and filter copyrighted content in the AI data creation and usage processes.

Compliance

The Data Act is an emerging regulation within the European Union that aims to govern the access to and use of data. For AI providers, this regulation is set to introduce a new layer of complexity to the already intricate compliance landscape. As the Act is designed to enhance data sharing and reuse across sectors, it will impose stricter requirements on how AI companies handle, store, and process data. This means that AI providers will have to be more diligent in their data management practices, ensuring that data privacy, sovereignty, and security are upheld to new standards.

For global AI providers, the challenge is twofold: they must navigate not only the EU's regulations but also the varying data protection laws of other regions. Ensuring compliance with the Data Act could require significant changes in their operational, legal, and technical frameworks. As data is the lifeblood of AI, any restrictions on its flow can impact the development and deployment of AI solutions. Providers may need to invest in enhanced data infrastructure, adopt new protocols for data sharing, and ensure transparent data lineage—tasks that are resource-intensive and require careful planning.

Moreover, the Data Act may necessitate AI providers to demonstrate the provenance of their data and obtain more explicit consent from data subjects, making the process of data collection and usage more rigorous. The intricacies of these new obligations could slow down AI innovation and increase the cost of AI products and services, as providers strive to meet the heightened compliance demands.

Data interoperability

Interoperability of databases for AI is a pivotal issue at the crossroad of technological challenges, regulation, and innovation. As artificial intelligence relies on diverse and

voluminous data to learn and perform tasks, the ability of systems to operate seamlessly in between various AI materials are gettings crucial. This calls for standardized data formats, exchange protocols, and application programming interfaces (APIs).

Interoperability not only facilitates the exchange and integration of data from multiple sources but also ensures that AI can draw from a rich pool of heterogeneous knowledge resources to develop deeper insights. However, this process is hindered by proprietary formats, incompatible protocols, and stringent regulations on data transfer, especially regarding personal and sensitive data.

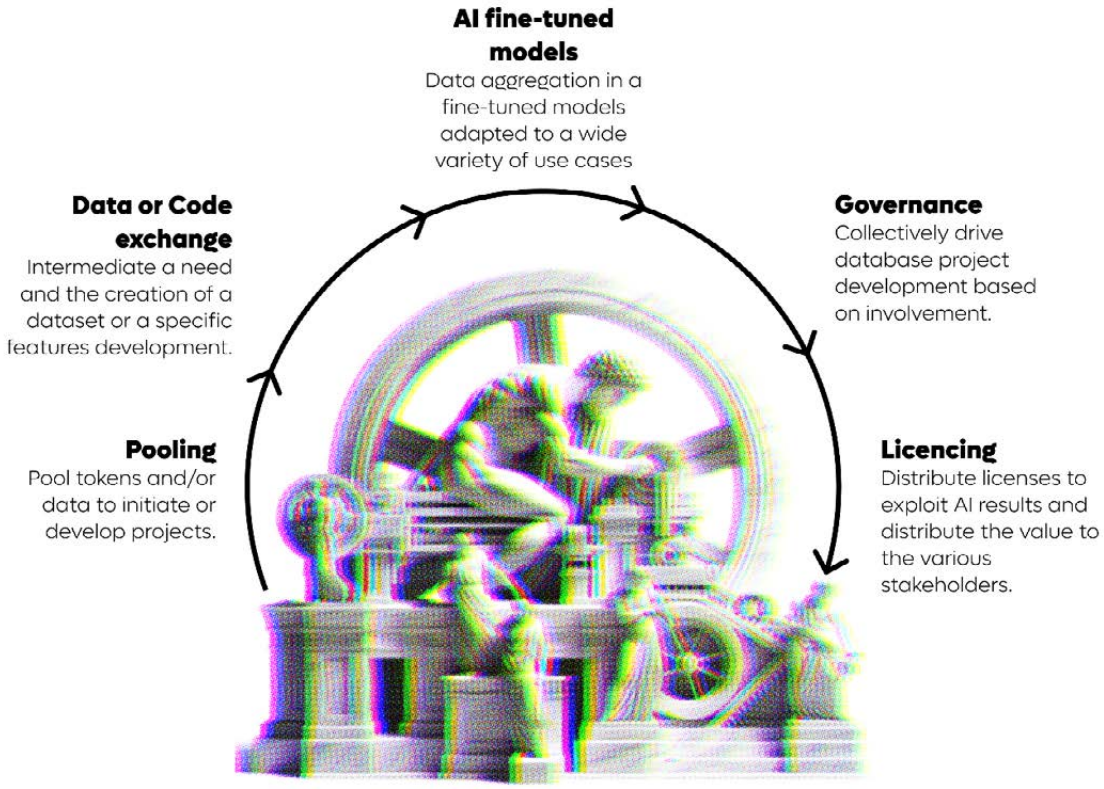
Establishing robust frameworks for interoperability is also vital for the emergence of collaborative AI systems, where different applications can share learnings and capabilities. Moreover, interoperability has profound implications for business competitiveness, allowing enterprises to leverage the complementary nature of available data.

A lack of interoperability can lead to data silos, stifling innovation and limiting AI systems' ability to evolve and adapt to new information or changing contexts. To overcome this, some industry-led initiatives are gaining momentum to create open standards and data-sharing frameworks. Finally, database interoperability is inextricably linked to data governance, requiring oversight and policies that balance the free flow of data with protection and security measures.

Lay3rs solution

Technological components

A sustainable ecosystem of features powered by LAY token



Lay3rs are deploying 5 interoperable or autonomous technological building blocks to develop a sustainable ecosystem.

Token-based Collaborative Projects (Pooling)

Every holder of LAY tokens is empowered to spearhead collective projects initiatives, crafting AI materials (ERC 721) designed to compile diverse types of data. They can foster a community centered around specific themes or topics by launching a token pool. Accessible to all LAY token owners, this pool is dedicated to funding a variety of project-specific objectives: from data procurement and digital twin creation to the

development of fine-tuned AI models. The realm of potential use cases is vast and ripe for discovery.

Each phase of this collaborative effort is termed a milestone, setting the stage for each project's commencement and subsequent evolution. Milestones may be entirely or partly self-funded, with each new external funding request diluting the influence of individual contributors.

AI Materials Exchange

In this hub, Lay3rs leverages LAY tokens to bridge the gap between data or code providers and projects requiring specific AI materials. This platform not only facilitates a robust environment for data or code transactions but also integrates data or code providers into the ecosystem by offering a platform for intermediation. The use of LAY tokens here rewards providers not only with direct compensation but also with royalties over time, secured through token issuance for each AI material. This simple and automated system ensures transparent financial traceability and equitable distribution of future revenues, all orchestrated through the dynamics of LAY token transactions.

AI Fine-Tuning Services

Lay3rs offers the creation of fine-tuned AI models tailored to the unique AI material of each project, unlocking the full potential of the collected data. These models make the data immediately actionable, whether by humans or other AI systems through embedding techniques. Moreover, these models provide a traceable lineage of the original data, thereby distributing the generated value according to the project-specific guidelines. Here, LAY tokens are utilized to pay for the computation time on these models, allowing users to access advanced computational resources efficiently.

Presently, our technology aggregates data (initially focusing on photos and videos) into 3D environments tailored for industries such as filmmaking, video gaming, and advertising. Although we are currently leveraging NeRF and 3D Gaussian splatting algorithms, we are incorporating additional AI generative model types (e.g., language models and diffusion models).

The development and enhancement of these fine-tuned models is based on 2 complementary approaches:

- Internal development, focusing on the core functionalities of the technology and its infrastructure

- External development, by developers in the ecosystem, to add new functionalities to meet an ever-growing number of increasingly specific use cases. In this case, just like data providers, code providers will be remunerated in proportion to the use of their code by end-users of fine-tuned models.

Decentralized Governance

Beyond simple token pooling, Lay3rs introduces a governance framework applicable to individual projects and soon to be expanded to include all LAY token holders globally. This democratic system allows each stakeholder to cast votes within the project community, with voting power proportionate to their token contribution. This voting mechanism is essential for enabling specific functionalities within other smart contracts (such as AI material creation, licenses, and project launches), reinforcing the principles of decentralization and autonomous governance within the LAY ecosystem.

Licensing and Monetization

To enable the monetization and compliant use of outputs (e.g., heritage preservation institutions in the Laygacy initiative) from fine-tuned models, Lay3rs introduces a Web3 licensing service grounded in the ERC 1155 standard and powered by LAY tokens. This service facilitates the sale of fine-tuned model outputs, whether individually or in bulk, using LAY tokens to ensure a fair distribution of generated revenues among all stakeholders—data contributors, token holders, and external rights holders. This approach not only promotes compliance and monetization but also supports a sustainable ecosystem where LAY tokens are central to value creation and distribution

Products

Product approach

Lay3rs' suite of features is designed not just for standalone operation but for synergy, allowing for the assembly of comprehensive solutions tailored to diverse and complex needs. This integration capacity underlines the infrastructure's versatility and its ability to address specific use cases through combined functionalities.

Complementarity and Integration

The inherent design of each service within Lay3rs ensures that they complement each other, enhancing the overall utility when used collectively.

- For instance, the Token-based Collaborative Projects can seamlessly integrate with the Data or Code Exchange to not only pool resources but also ensure that data or code flows are compensated fairly, creating a dynamic ecosystem of data or code sharing and funding.
- Similarly, the 3D AI Fine-Tuning Services benefit from the data aggregated through collaborative projects and the Data or Code Exchange, applying sophisticated models to refine this data into valuable assets. These assets can then be governed effectively by the Decentralized Governance system, which relies on the equitable stakeholder involvement made possible through the token-based infrastructure.
- Finally, the outputs from the AI services can be brought to market and monetized through the Licensing and Monetization framework, which ensures that all contributions are recognized and rewarded. This framework not only supports compliance but also facilitates a distribution model that rewards all participants involved in the data lifecycle.

Strategic Assembly of Components into Products

By strategically combining these Components, Lay3rs is able to craft bespoke products that address specific challenges faced by different sectors. This modular yet integrative approach allows Lay3rs to present tailored solutions in a product lineup that will be detailed below.

Expanding the Ecosystem

Moreover, the ability to combine these services flexibly means that Lay3rs can continually adapt to emerging needs and opportunities, potentially expanding its user base. This accessibility invites not only seasoned blockchain users but also newcomers, including other AI technologies and community groups, to explore and integrate Lay3rs' solutions into their projects and workflows.

Projects platforms

Description

Projects platforms aggregate all or part of Lay3rs' technological components around themes of decentralized projects focusing on the creation of common databases and the refinement of AI fine-tuned models derived from them or creation of a new AI feature. They provide a user-friendly interface enabling both web3 and web2 users to contribute to projects by providing LAY tokens, data or code, participate in their governance, and sell/buy licenses to exploit the results of fine-tuned models, with revenue sharing among stakeholders.

These platforms can be deployed directly by Lay3rs, on behalf of third parties (e.g., Laygacy, as presented later as use case), or directly by third parties through the SDK.

Business model

As the project platforms integrate all the various Lay3rs technical components, their business model is an aggregation of their own models, described below for Zigg-E and the licensing service. Upon that, the platforms' business model also integrates:

- **Project and platform management fees** deducted from each milestone.
- **Platform licensing**: Project platforms can be duplicated for white label use, and the price of such a license will depend on several factors (Geographical area, Duration of the license, Intended uses and applications, Exclusivity or non-exclusivity, etc.)

Aggregated AI platforms

Description

Aggregated AI platforms bring together, within a single user interface, various AI models created by Lay3rs or developed by third-party developers (organizations or individuals). By aggregating and making available third-party artificial intelligences, they facilitate access to a multitude of AI services dedicated to specific use cases. Designed to meet the varied needs of users, they offer a user-friendly interface for exploring and using different AIs for tasks such as creating 3D models, images and videos, generating all kinds of creative content, document analysis and more. By

centralizing these advanced tools, the platform enables users to maximize their productivity and creativity, while simplifying the process of selecting and integrating the best AI services.

These platforms can be deployed directly by Lay3rs, on behalf of third parties (e.g., Laygacy, as presented later as use case), or directly by third parties through the SDK.

Business model

Inference Fees : To use the AI, the user will be able to use tokens directly to pay for the computing time required for the query. They can use tokens directly from their wallet, or acquire them via à la carte purchases or subscriptions.

These fees are also payable in LAY tokens by those who wish to use the fine-tuned model to generate, edit, or export a result in the form of a 3D file. Clients pay based on their usage of computational power, either through pay-per-action, by purchasing packs of computational time in advance, or through a recurring subscription.

AI materials reward (potentially developed internally)

Depending on the AI materials mobilized for this request, these tokens are distributed among all the AI Materials providers whose contributions were mobilized to generate an answer.

3D AI fine-tuned model : Zigg-e

Description

Zigg-E, developed by Lay3rs, is a cutting-edge AI-driven tool designed to facilitate the creation and edition of 3D assets in a variety of fields. This system enables users to aggregate heterogeneous image data (photo and video) into a complete 3D representation, making it suitable for a variety of applications.

In our roadmap, we first prioritized the development of the pipeline dedicated to the production of 3D assets because there was no commercial solution in 2023 and this is still the case today. Available solutions for the generation of texts (GPT4, Llama, Claude, Bard), images (Midjourney, Stable Diffusion, Dall-E, Imagen) and videos (Sora, Runway, Gen2, Pika) do not allow the production of 3D assets because they are other types of algorithms. We have developed a pipeline that allows us to integrate the 2 current 3D representation methods (NeRF and 3D Gaussian Splatting) and future 3D representation methods. Following this, we started to integrate into our pipeline other

methods that rely on 3D representation in order to work in 3D as for example generation of missing parts, transfer style or segmentation.

Data generation

Zigg-E's strength lies firstly in its ability to produce accurate 3D representations. But Zigg-E also generates missing data or missing parts after training to complete the 3D scene. This capability is crucial for projects requiring detailed and accurate 3D representations, notably in the fields of industrial design, heritage preservation, urban planning and interactive media...

Segmentation

Zigg-E supports panoptic segmentation (combination of semantic and instance segmentations), identifying and isolating each individual element in a 3D scene, such as architectural features or textures (door, chair, statue, floor, column, etc.). This capability is particularly valuable for the detailed analysis and customization of 3D assets according to specific needs.

Editing

Zigg-e also allows for editing scenes or individual elements extracted from them, working either from style sheets or textual prompts. This functionality enables the generation of 3D assets tailored to the artistic direction of a video game, an animated film, a metaverse, etc., from any 3D scene as well as homogeneity regarding the different elements generated.

Licenses

Additionally, Zigg-E enables optimized data export in formats suitable for various uses, including augmented reality (AR), virtual reality (VR), and 3D modeling for printing or other forms of digital visualization. These exports consist of geometry (optimized in terms of polygons for their use case), textures (with the usual layers), and HDRI. Each export is linked to an exploitation license managed through smart contracts, ensuring rights protection and transparent management of uses.

Embeddings

Zigg-e can produce embeddings of the different output (3D representation, geometries, textures, lighting, 3D masks, text/3D pairs, etc.) that can be directly used by other AIs who use them as input data for their training.

Traceability

Through its tight integration with blockchain technologies, Zigg-E offers complete and secure traceability of data used by the algorithms, essential in fields requiring data authenticity and integrity.

Business model

The economic model of Lay3rs' fine-tuned 3D model, zigg-E, is based on two revenue streams.

Training, Improvement & Maintenance Fees

These fees are payable in LAY tokens by the creators of the fine-tuned model, such as project communities, data providers, and others. Clients incur a training cost based on the volume of training data and a regular maintenance and retraining cost based on new incoming data.

Inference Fees

These fees are also payable in LAY tokens by those who wish to use the fine-tuned model to generate, edit, or export a result in the form of a 3D file. Clients pay based on their usage of computational power, either through pay-per-action, by purchasing packs of computational time in advance, or through a recurring subscription.

This dual-stream economic model ensures that Lay3rs' zigg-E remains sustainable and accessible, providing a robust solution for continuous improvement and utilization of fine-tuned 3D models.

Licenses service

Description

Lay3rs plans to develop a licensing service that will enable each AI to contribute to a virtuous ecosystem.

Indeed, this service will be a decentralized infrastructure, that will help to handle copyright and ownership of the data used by every third party Generative AI, then enabling fair distribution of the value created across data providers.

How does it work ?

Lay3rs will reference all data that has been used by its data providers through AI materials.

Then, each time a user is generating a license of an export through it from any AI who implemented the service, these data providers will perceive royalties from the future sale in LAY of the license related to the export using this data.

For their part, users benefit from a license management system that enables them to use their license consistently and reliably, thanks to immutable records. They can therefore use this export in any project in a totally legal and fair way.

Lay3rs also features a license explorer, enabling the user or anyone else to find and view data linked to a license of export and its compliance.

Business model

User generates an operating license from the interface of any AI who integrate Lay3rs infrastructure. Depending on the choice of AI provider, the user can either pay directly for the license in LAY on the corresponding license contract, or pay the AI provider. In the latter case, the transaction is not handled by Lay3rs services.

Each time a new license is generated, the corresponding ERC-1155 token is exported and paid for in LAY to this contract by the user or the IA provider, whichever is chosen.

This LAY amount is then split between:

- **Data providers:** They will receive LAY tokens for the commercial use of their data in generating a license of export. This remuneration is proportional to the use of the data in generating the export and weighted by the level of scarcity assigned to each AI material.
- **Code providers (if any):** They will receive LAY tokens for the commercial use of their code in generating a license of export. This remuneration is linked to the number of times the code is used.
- **Project & contributors (if any):** If the data is pooled from a project created through one of Lay3rs' project platforms or another operator, part of this amount will be directed towards the project contract and its contributors in proportion to their contribution.
- **Lay3rs:** A portion of this amount is returned to Lay3rs for service operation, enhancement and maintenance.

Percentages and amounts are defined algorithmically in smart contracts.

SDK for AI Provider

Description

Lay3rs' SDK is a powerful and versatile toolkit designed for developers looking to integrate Lay3rs' innovative features into their Blockchain and/or AI applications. It facilitates easy management of cryptocurrency wallets, performs inferences on fine-

tuned AI models, and effectively interacts with various types of smart contracts on the blockchain. The main contracts that can be managed include LAY (ERC-20), Material token (ERC-721), and License token (ERC-1155).

The SDK also simplifies interactions with project milestones, investments, donations, and governance mechanisms, thus supporting deep integration into the Lay3rs ecosystem. For instance, it enables the creation and management of licenses of exports, purchasing exploitation licenses, and retrieving detailed information about each license, such as the purchase price of the license, the active status of the export, and associated metadata.

Another innovative aspect of the SDK is its support for a Software-as-a-Service (SaaS) subscription model, which allows users to access Lay3rs' services via cryptocurrency-based subscriptions. This feature is crucial for facilitating widespread adoption of Lay3rs' services and promoting increased accessibility.

In terms of specific functionalities, the SDK offers operations such as connecting and disconnecting wallets, approving and transferring tokens, as well as checking balances and approval statuses. For AI material and license tokens, it enables operations like minting, buying licenses, and managing information associated with each token.

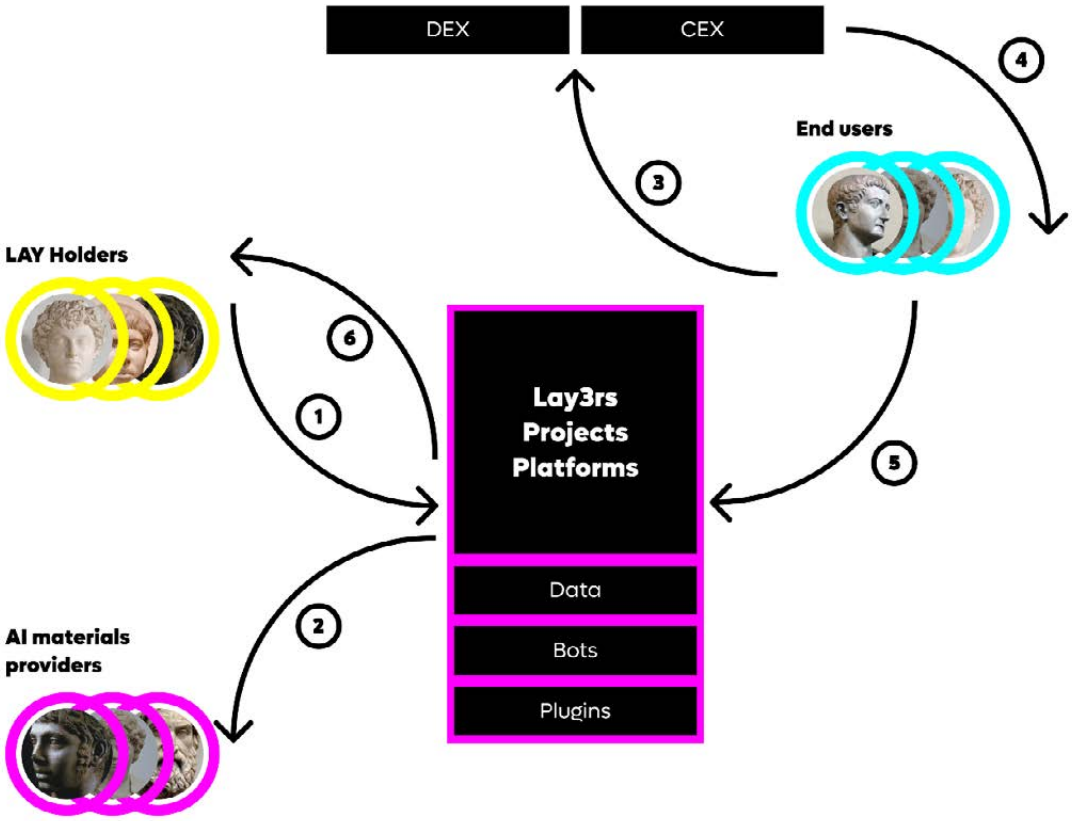
Overall, Lay3rs' SDK is an indispensable tool for developers working within the blockchain LAY ecosystem, offering increased flexibility, security, and efficiency for developing sophisticated decentralized applications.

Business model

The economic model of the Lay3rs SDK is based on a free download with a subscription required for its use (API key). Users can freely access the SDK, but to fully utilize its features, a subscription is necessary. This subscription is implemented through an ERC-1137 smart contract, which enables recurring payments in LAY tokens. This innovative subscription payment system ensures continuous access to Lay3rs' advanced services and features, while facilitating decentralized and secure payment management. This model aims to promote widespread and accessible adoption of Lay3rs' services among other AI projects, while ensuring a stable and sustainable revenue stream for the company.

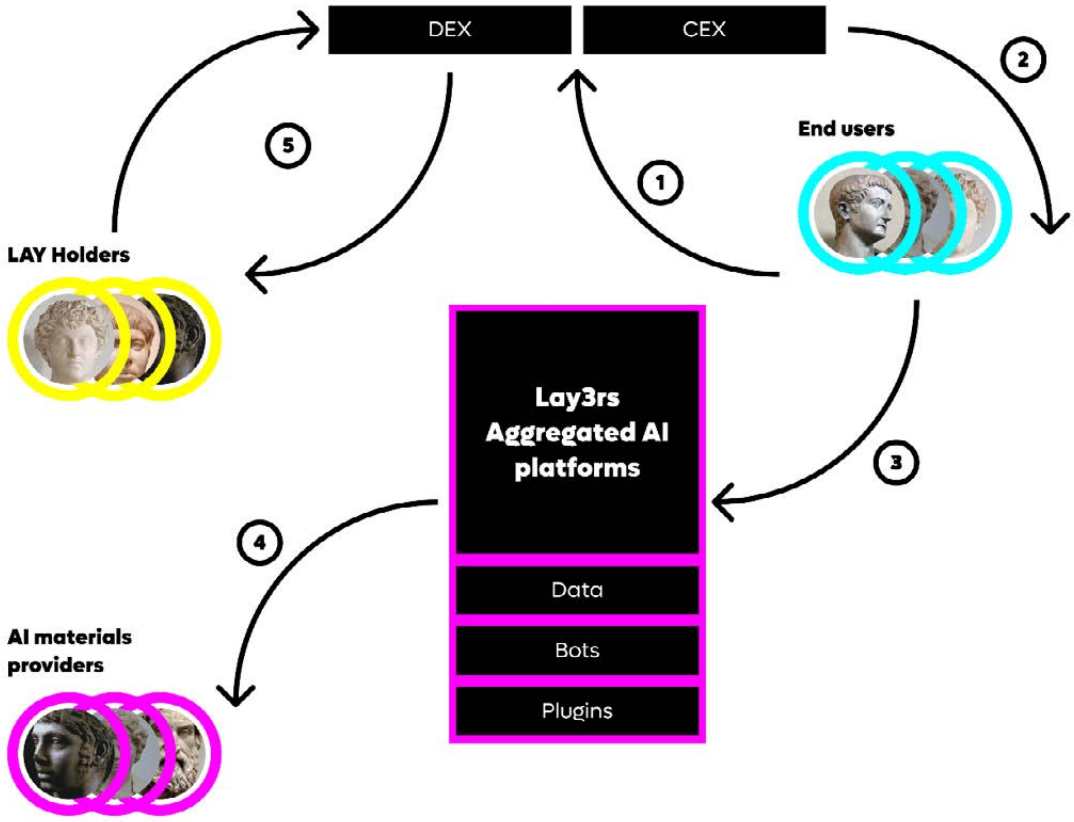
Tokens circulation models

Project-centric model



1. A LAY Holder first invests his LAY in a milestone of a Project smart contract
2. AI materials providers get paid by the Project smart contract which needs to acquire data to build exports
3. End users buy LAY from DEX or CEX to hold some LAY, so they could use it to use Lay3rs services
4. End users receive their LAY in their own wallets from the exchange
5. End users can then buy a license of use of an export using their LAY to the Project smart contract
6. Finally, LAY contributors receive rewards from the sale of the license, as well as AI materials providers who provide for instance a dataset that has been used to generate the export which has been sold

AI-centric model



1. End users first buy some LAY from DEX (against crypto/token on liquidity pools) or CEX (against fiat currencies mainly), so they could hold some
2. The exchange delivers these LAY to end users' wallets so they could use it in Lay3rs AI platforms
3. End users can then subscribe to Lay3rs AI services using their LAY to buy licences of exports for instance (or other services)
4. Then, AI materials providers, who have data used in the export that has been bought, are rewarded in LAY regarding the share of use of their materials
5. LAY holders can also generate passive revenue by providing liquidity to a DEX and accumulating fees of swaps of the liquidity pool

Rewards model for data or code providers

Lay3rs is dedicated to building a sustainable economic ecosystem by integrating a unique system of revenue sharing and value distribution. This innovative approach involves data providers and AI model providers. Through this system, contributors are rewarded fairly based on their input and the usage of their AI materials in various fine-tuned models projects. Lay3rs employs blockchain technology to ensure transparency and automate payments, enhancing trust and efficiency.

General principles of remuneration for data or code providers

The redistribution of value to data or code providers can take two cumulative forms:

Purchase of data or code

When a milestone is reached on a project platform, or when a community member creates a request for specific data or functionalities, a mission is created and a sum of money is allocated to its execution. This sum is paid directly and in full to the service provider who fulfills the objective. This sum is paid to the service provider according to the procedures described below.

Share of rewards

When an export license is sold, referencing all the AI materials (dataset and code bricks) used to produce it, rewards are distributed to data providers, code providers and contributors and weighted according to their actual use and the terms defined in the corresponding project.

Ways of acquiring data or developing AI functionalities thanks to the ecosystem

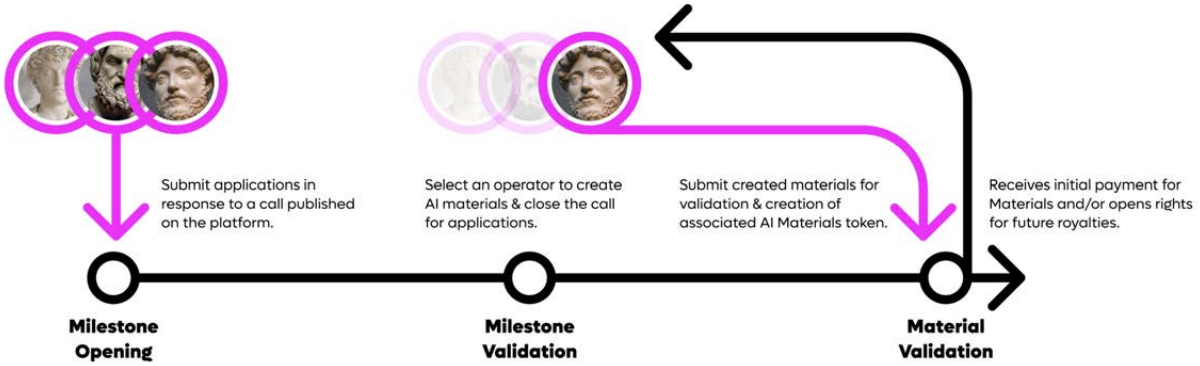
In order to benefit efficiently from the contributions of members of the LAY token ecosystem, be it in the form of data or code, Lay3rs has set up 3 methods of managing these missions, enabling the nature of contributions to be adapted to the specific nature of the request.

Call to applications

In the case of data or code to be created whose entry requires significant cost or know-how and is not present in the project community, the call for contributions will take the form of a call for applications.

Applications will be examined by the project curation team, and the selected candidate will receive the full amount defined in Milestone once data has been submitted and validated.

Depending on the level of scarcity defined in the Milestone, this validation opens rights to future rewards.

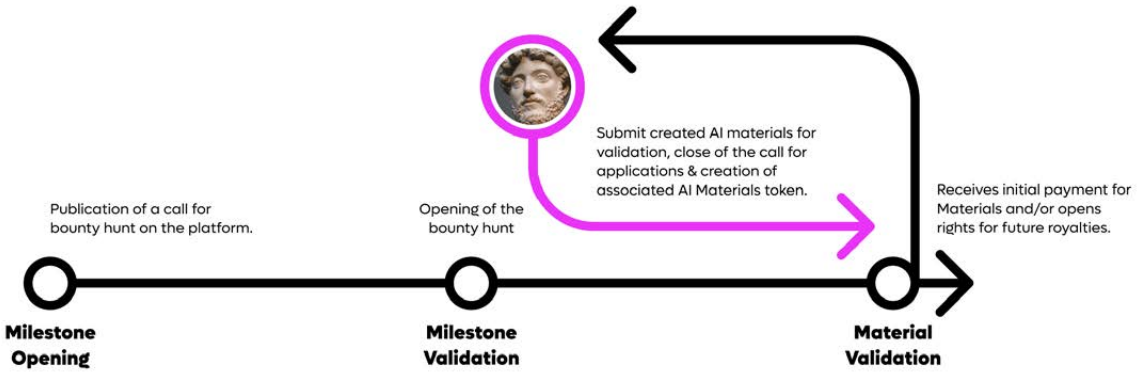


Race

In the case of specific data to be captured or code to be developed but not requiring specific access rights or skills, the call for contributions then takes the form of a contest.

A request for data is published in advance, and once the Milestone has been validated, the first community member to submit a validated data by the project curation team set receive the full amount set aside when the Milestone was created.

Depending on the level of scarcity defined in the Milestone, this validation opens rights to future rewards.

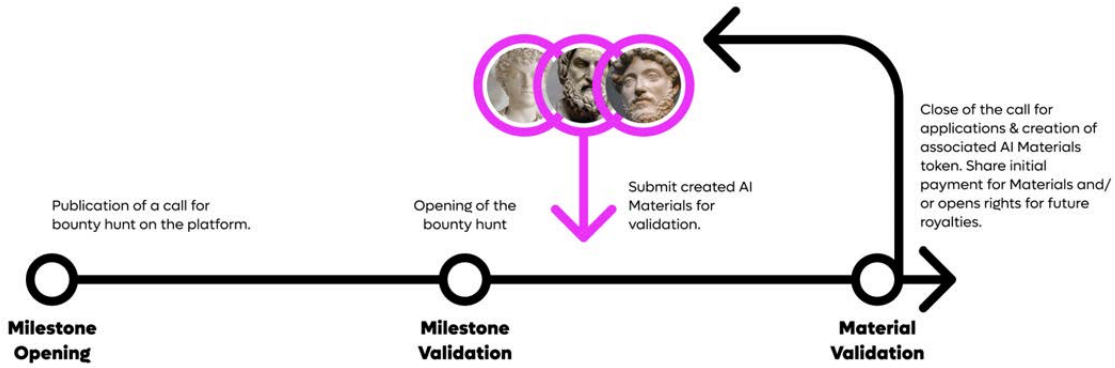


Mass collecting

In the case of requests where the number of respondents is paramount (e.g.: in the case of generic data requiring no specific access or skills, or development actions such as testing, etc.), the call for contributions takes the form of mass aggregation.

A request is published and opened upstream, all validated contributions are integrated and the sum allocated to this call is shared between suppliers according to the volume of their contribution.

Depending on the level of scarcity (probably low in this case) defined in the Milestone, this validation opens up rights to future rewards.



On-chain Organization

Smart Contract 1: Token LAY (ERC-20)

This smart contract is fundamental to the economic and governance operations within the Lay3rs ecosystem, enabling fluid financial operations, community-driven project development, and the rewarding of active participants.

Functionality

This smart contract manages the LAY token, which is an ERC-20 fungible token that serves as the primary currency within the Lay3rs ecosystem. The LAY token facilitates various transactions across the platform, including funding projects, purchasing licenses for exports, and participating in governance through voting mechanisms.

Role and Utility

Currency for Transactions

The LAY token is used to fund the development of a fine-tuned model, digital twins, acquire data, purchase digital exports and pay for their uses. It acts as the central medium of exchange, simplifying transactions across the platform.

Governance and Voting

Holders of LAY tokens can participate in decision-making processes, influencing the development and strategic directions of projects. This includes voting on project proposals and governance changes.

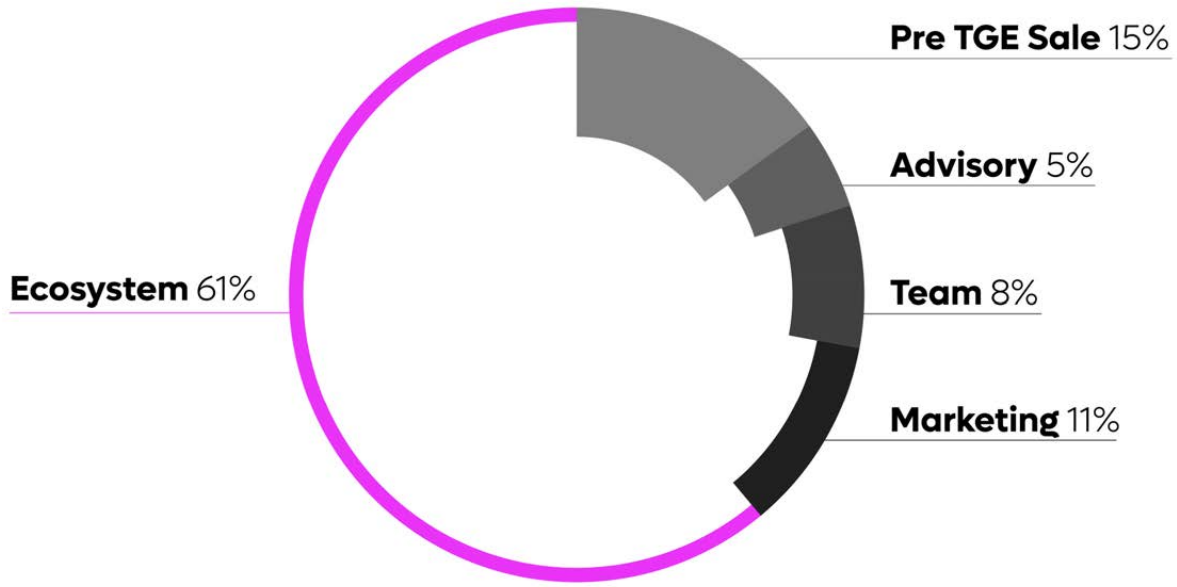
Incentivization

The token also serves as a means of incentivizing contributions from users, whether they are providing data, creating digital content, or helping to curate and validate new projects.

Tokenomics

- **Total supply:** 1,000,000,000 tokens
- **Decimals:** 18
- **Name:** Lay3rs
- **Symbol:** LAY
- **Burnable, Non-mintable**

Token allocation



Smart Contract 2: NFT AI materials (Data or code) (ERC-721)

This smart contract is a key component of the Lay3rs infrastructure, enabling efficient and secure management of AI materials contributions while supporting transparency and fairness for all platform users.

Functionality

This contract utilizes the ERC-721 standard, which is for non-fungible tokens (NFTs), to manage unique AI materials associated with fine-tuned model. Each NFT represents a specific dataset or brick of code, ensuring clear traceability and ownership of data or development contributions. AI materials can vary in type, size, and complexity, and each NFT is linked to a unique identifier and metadata securely stored on IPFS (InterPlanetary File System).

Role and Utility

Traceability and Ownership

NFTs ensure that the ownership of AI materials (datasets or bricks of code) is clearly defined and easily verifiable, crucial for copyright and compensation issues for data or code creators.

Rights Management

Each NFT can include information about usage rights, allowing users to purchase or negotiate licenses for using AI materials.

Integration and Use

NFTs facilitate the use of AI materials (datasets or bricks of code) in various projects and licenses, ensuring that each AI materials usage is recorded and that contributions are fairly compensated.

Smart Contract 3: Multi-token License (ERC-1155)

This smart contract is essential for managing the complex interplay of digital assets within the Lay3rs ecosystem, ensuring that both creators and users of licenses of digital exports can interact efficiently, with transparency and legal compliance in their transactions.

Functionality

This contract utilizes the ERC-1155 standard, which supports the management of multiple token types within a single contract. It's specifically used to issue and manage exploitation licenses for exports—digital assets that are optimized subsets of data from fine-tuned models for specific uses. This multi-token framework allows for the efficient handling of various digital assets and their licenses on a granular level.

Role and Utility

Issuing Exploitation Licenses

The contract enables the creation of licenses for using digital exports. These licenses define the terms of use, such as duration, geographic limitations, and exclusivity.

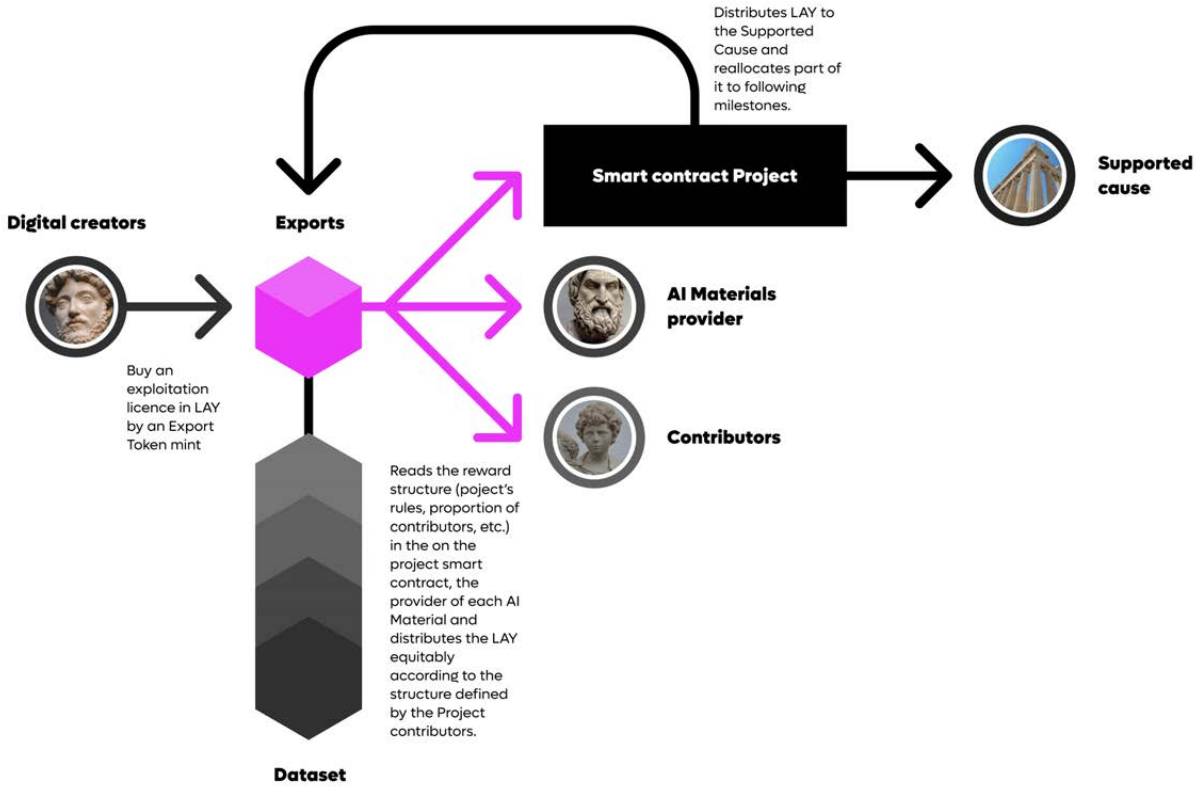
Flexibility and Efficiency

By supporting multiple tokens, the ERC-1155 standard allows the contract to handle a variety of digital exports and their respective licenses more efficiently than traditional single-token contracts. This efficiency is crucial for reducing transaction costs and complexity.

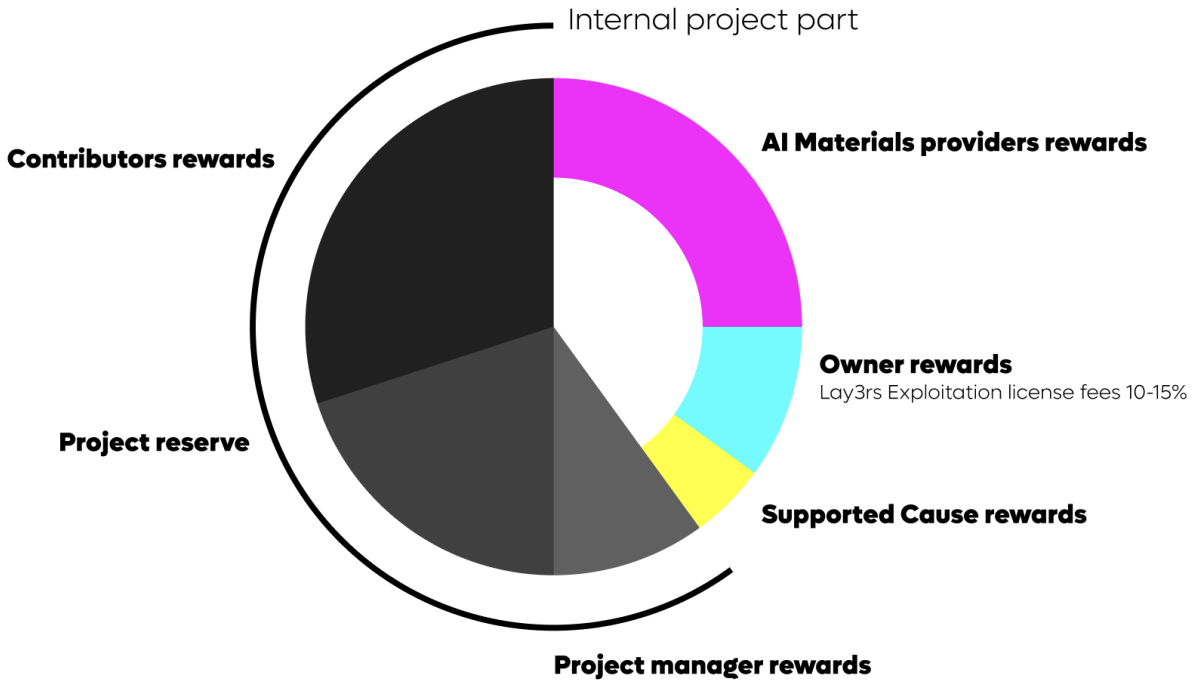
Dynamic Asset Management

The contract can manage different types of digital assets and their licenses simultaneously, offering great flexibility in how assets are bundled, issued, and transferred.

The Multi-token License role



Licenses rewards allocation



The purchase price of the license linked to the Export is calculated by multiplying the corresponding file's coefficient by the price per coefficient in LAY (information defined and updatable within the smart contract of the project it depends on).

$$Export\,\mathrm{Pr}\,ice\;=\;CoefficientSize\;\times\;Lay\,\mathrm{Pr}\,iceByCoefficient$$

Regarding data providers rewards, they will be distributed as follows:

1. **AIMaterial Operator Royalties LAY**:
   $\mathrm{AIMaterialOperatorRoyaltiesLAY} = \frac{(\mathrm{AIMaterialRoyaltiesLAY} \times \mathrm{AIMaterialScarcityPondered})}{\mathrm{AIMaterialTotalScarcityWeight}}$
2. **AIMaterialRoyaltiesLAY**:
   $\mathrm{Royalties\ allocated\ for\ all\ data\ providers\ related\ to\ a\ license\ purchase}$
3. **AIMaterialScarcityPondered**:
   $\mathrm{Share\ pondered\ of\ a\ dataset\ with\ its\ scarcity}$
4. **Formula for AIMaterialScarcityPondered**:
   $\mathrm{AIMaterialScarcityPondered} = \mathrm{AIMaterialScarcity} \times \mathrm{AIMaterialPercentageWeight}$
5. **Total Scarcity Weight of AIMaterial**:
   $\mathrm{AIMaterialTotalScarcityWeight} = \sum_{i=0}^{N} \mathrm{AIMaterialScarcityPondered}_i$

Smart Contract 4: Project

This smart contract is a crucial element for the structured development and management of projects within the Lay3rs ecosystem. It ensures that projects are executed in an organized manner, with clear funding stages, milestone achievements, and community-driven governance, enhancing transparency and accountability throughout project lifecycles.

Functionality

This contract specifically manages individual projects within the Lay3rs ecosystem. Each project may consist of a series of development milestones, data acquisition, creation of digital twins, and the generation of exports. This contract facilitates the

pooling of resources, oversees the achievement of project milestones, and handles the distribution of funds and rewards.

Role and Utility

Resource Pooling and Project Funding

The contract allows community members to contribute LAY tokens to fund specific projects. These contributions are pooled to reach funding goals set for various project milestones.

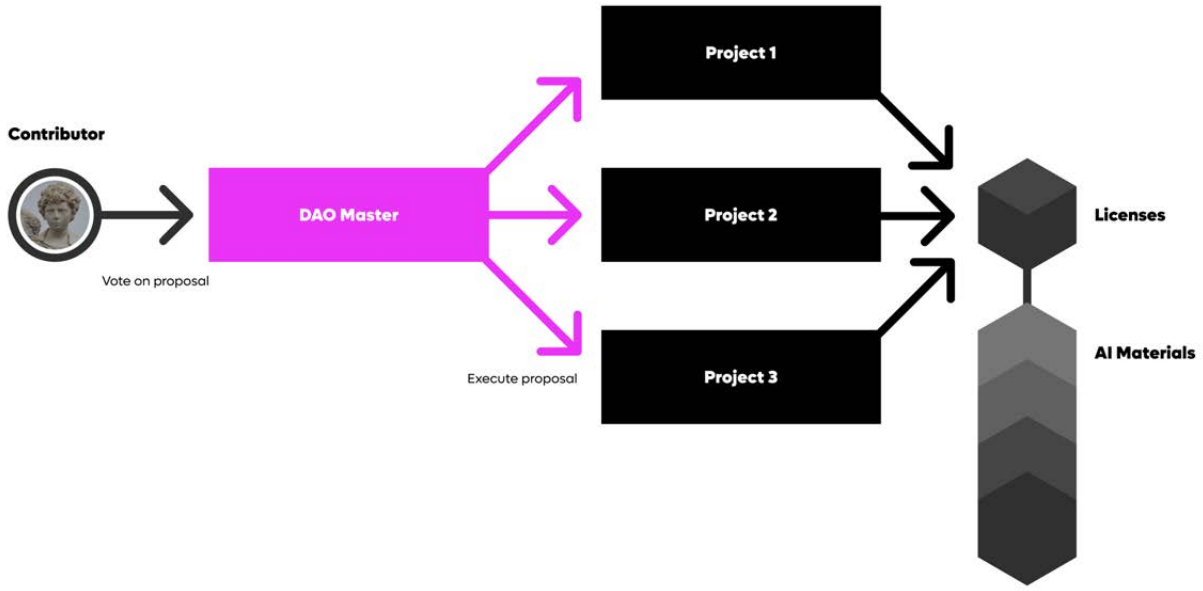
Milestone Management

It tracks the progress of each project through predefined milestones. Once a milestone is achieved, the contract facilitates the release of funds for project continuation or reward distribution.

Governance and Voting

This contract integrates governance functionalities, enabling token holders to vote on key project decisions, such as approving project initiation, milestone completion, and the distribution of funds.

The DAO Master Smart contract role



Smart Contract 5: DAO Master

This smart contract is essential for maintaining the integrity and forward movement of the Lay3rs ecosystem, ensuring that it remains a secure, effective, and community-driven platform. It acts as the backbone for governance, providing a structured approach to managing and evolving the platform's rules and operations.

Functionality

This contract acts as the overarching governance layer for the entire Lay3rs ecosystem. It manages the higher-level rules and functions that affect all other smart contracts within the platform. Its main role is to ensure that the ecosystem operates smoothly and cohesively, adhering to the governance standards set by the community.

Role and Utility

Global Governance

This contract is responsible for the overall governance of the ecosystem, handling key administrative functions such as setting and modifying global parameters that affect all projects and smart contracts.

Emergency Functions

It includes mechanisms to handle urgent situations that may require immediate attention, such as pausing operations in the event of a security breach or major flaw in the system.

Updates and Upgrades

The DAO Master contract facilitates updates and upgrades to the ecosystem's infrastructure, ensuring that Lay3rs stays current with technological advancements and community needs.

Project platform use case : Laygacy

What is Laygacy?

Innovative Platform for Digital Twins of Historical Real World Asset (RWA)

Laygacy is a platform dedicated to creating 3D digital twins of historical monuments worldwide. Our mission is to preserve cultural heritage using cutting-edge technologies.

Here's what Laygacy offers:

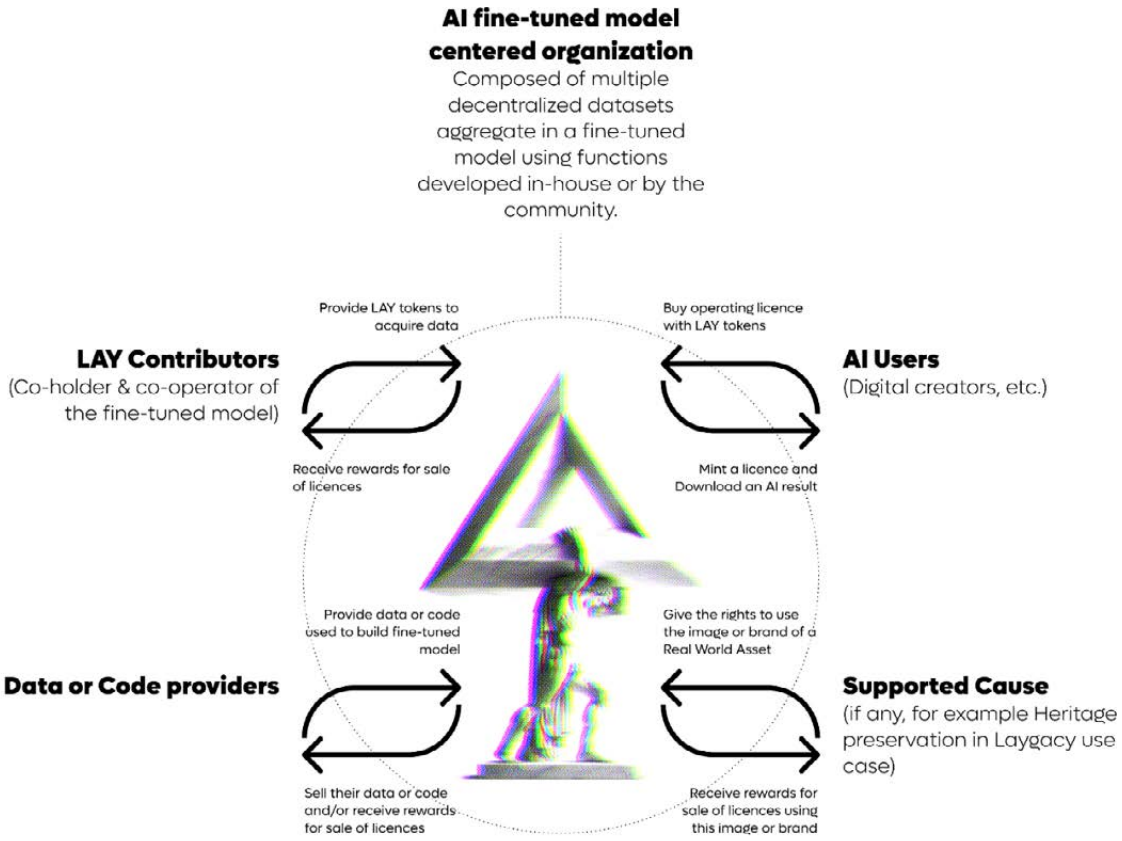
- **Token Pools**: Initiatives for project development around digital twins, including data collection and the creation of precise and detailed 3D models, up to their exportation.
- **Digital Twin:** The creation of a 3D fine-tuned model per monument (the digital twin) to serve as a 'master' for editing, segmentation, exportation, or further processing by other third-party AI.
- **Governance Tools:** Each contributor to a digital twin can actively participate in its development and dissemination, including voting on future project milestones and export usage conditions.
- **Data Exchange Service:** An aggregation platform for photographic and video data provided by the community, essential for constructing 3D models.
- **Marketplace:** Buying and selling of 3D exports of various elements (furniture, scenes, architectural modules, etc.) from these digital twins.

Laygacy benefits 4 main target groups:

- **Contributors:** Heritage enthusiasts, digital innovation enthusiasts, cultural institutions, or individuals looking to leverage their LAY tokens.
- **Data Providers:** Data funds, cultural institutions, professional or amateur photographers.
- **3D Consumers:** Video game creators, immersive experience creators, filmmakers, advertisers, metaverses, and cultural institutions.
- **Heritage preservation institutions**: since a share of the revenues from each digital twin project is donated to the institution in charge of preserving the real heritage.

The creation of Laygacy stems from a competition launched by the French Ministry of Culture, of which Lay3rs is the proud winner. This platform revolutionizes how we interact with our heritage, making it accessible to all while preserving it for future generations. The platform was launched as a Beta version in a test network in October 2023 under the name Build3rs powered by a PLAY token (LAY Prototype).

Project platform stakeholders map



Why apply our system to architectural heritage

Fragility of heritage and archives

By nature, both natural and human heritage, as well as the archives created from them, are constantly under threat from time, natural disasters including climate change, and the consequences of human activities, be it economic, urbanistic, or conflict-related such as wars. It is crucial to find effective and sustainable ways to preserve these precious elements for future generations.

Funding heritage preservation

Funding is a major challenge for heritage preservation, regardless of its forms, and the means to secure funds for preservation institutions are often limited. In France, for example, a historical monument can rely only on public assistance, ticket sales, and marginally on sponsorship and events. While this equation may still be relevant for major monuments, what about lesser-known architectural works that are more difficult to access or not suitable for public visits? With such crowd-appealing power, history and nature can create much more value.

Lack of value creation in traditional heritage preservation system.

Following the previous problem of funding, there is an emerging concern regarding the sustainability of current practices. Many efforts in historical preservation, while well-intentioned, often struggle to develop a robust economic model that ensures long-term viability. This challenge highlights the necessity for innovative approaches to value creation within the sector.

Anchoring and authenticity

Historical-style 3D models are flourishing in marketplaces. However, too often, they are merely a fantasy of what a historical or natural subject could have been from the perspective of a 21st-century creator. Much of the subject's richness is lost in this reinterpretation. To move towards increasingly immersive virtual environments, it is essential to anchor them in plausibility by incorporating elements that are ever more meaningful.

Digital twin mass creation

The European Union has understood the importance of preservation and, in a 2021 report[1], urged its member states to create 16 million digital twins[2] of their architectural historical heritage by 2030. However, after 2 years, only thousands of these creations have been made. It is therefore urgent to take action to make this ambition a reality while also considering not only the archival aspect but also the dimensions of economic models and the usage of these twins.

Sustainability

If we consider the risks of disappearing elements or places of our cultural or natural heritage, the question of their archival becomes crucial, whether for their preservation, transmission to future generations, or non-destructive digital exploitation. Blockchain technology, although still imperfect for storing heavy data, opens highly relevant possibilities, thanks to the principles of decentralization and redundancy, allowing this digital heritage to be stored permanently and independent of a public or private organization. Efforts are still needed to address the ecological impact and speed of data access.

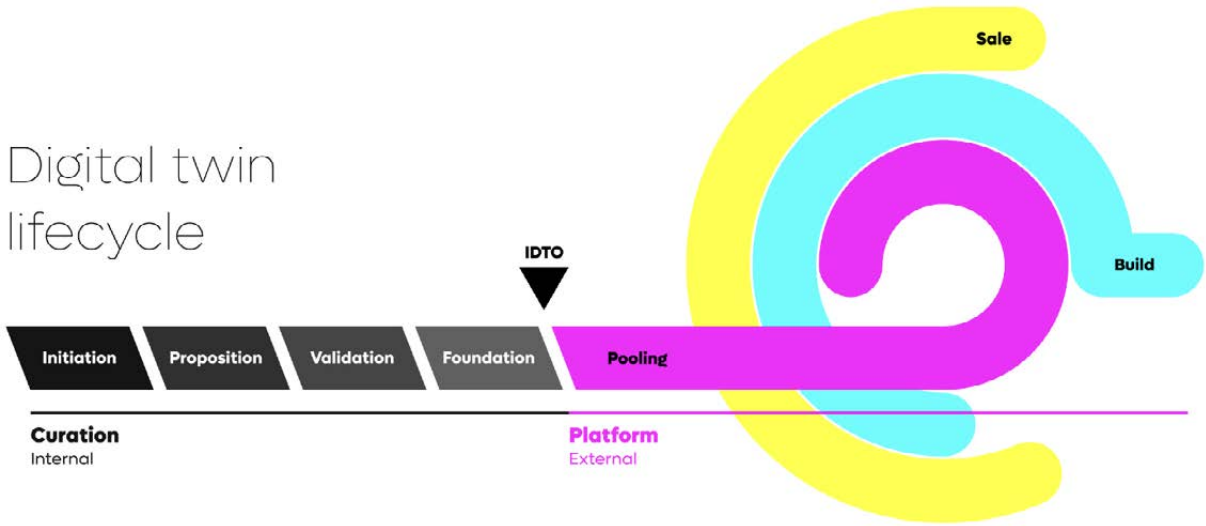
Accessibility and engagement

Over time, the understanding of accessibility in our society has changed. What was once purely a physical concept has now become cognitive and sensory. We must not only provide physically accessible buildings for everyone, regardless of their physical condition, but we can and should also build digital worlds that ensure access to culture (architecture, sculpture, painting, museum visits, etc.) regardless of the country we live in, our economic resources, or our physical condition. While access to cultural and natural heritage may seem like an inalienable human right, it is a privilege reserved for a few. Access to this heritage comes with economic, social, and ecological costs that inherently limit its accessibility.

Similarly, the opportunities for individuals to engage in the preservation of this heritage are limited. In this context, it is necessary to empower the public (both existing and new audiences) in their actions of discovery, learning, conservation, and preservation.

[1] https://drive.google.com/file/d/166pdEIktbOtDvTuMRnQWCGB1ez9aruXU/view?usp=drive_link
[2] https://drive.google.com/file/d/1I1qCMvmciqhcAi2_cS8f4Un_EeBuRDML/view?usp=sharing

Lifecycle of a Digital Twin



The cycle of life of one monument is divided in two stages divided by a precise stage named Initial Digital Twin Offering (IDTO)

Curation Phase

The aim of this phase is to select the future Digital Twins to be created and to define the needs and opportunities for creating IDTO, as well as defining the Supported Cause. This phase also enables the legal aspects of the twin and its use to be defined with the institutions.

This phase consists of 4 stages: Initiation, Proposition, Validation & Foundation. The precise and definitive process for this phase will be detailed after the listing, according to the Community decision-making process.

Platform Phases

The aim of this phase is to create, develop and distribute Digital Twins and their derived products. This cyclical phase is structured in 3 stages, which are carried out in parallel.

Stage 0 / IDTO: Initiation of Digital Twin projects

One IDTO initiates one Digital Twin project on the platform, offering publicly the contribution with LAY token on the Digital Twin project, and opens the Pooling stage for the first Milestone. It concludes the following steps:

1. A dedicated project smart contract is deployed
2. An IDTO framework document is published on the platform

By the initiation of each IDTO, a framework document is presented by Lay3rs curation team to LAY token holders on the platform, detailing: historical, business and technical research conducted by the team, and requirements, costs and timeline that is necessitated to produce this Digital Twin. The document consists of:

- Identification and estimation of pre-existing AI materials.
- Components of a first Milestone enabling the creation of a first version of the Digital Twin. This Milestone is therefore made up of tasks, each valued in LAY. The sum of the value of each of these tasks constitutes the Hard Cap of the Pooling phase. This Milestone consists of:
    1. Data acquisition batches (to be created or pre-existing)
    2. For each batch, data acquisition rules (external acquisition, external creation or by the community, purchase or sharing of rights), allocated amount and scarcity of the future AI material token.
    3. Creation of first Licenses of exports that can generate value.
    4. The deadline for the first Milestone.
- Identification and contractualization with the institution supported by the Digital Twin and with any beneficiaries.
- Identification of potential first use cases for the Licenses, enabling their creation to be prioritized.

Stage 1 / Pooling: Pool resources and data to create or develop the Digital Twin.

In the case of a first Milestone, the Pooling stage starts in the conditions announced by the IDTO, with the following steps:

1. The IDTO is opened for LAY contribution
2. IDTO project in Pending Status: the community data acquisition tasks that make up one Milestone are published, yet not open for acquisition.

In the case of a subsequent Milestone, part of LAY contributed to precedent Milestone can be directly self-financed by the project contract at the time of the Milestone vote.

The Pooling stage is terminated by:

1. **Reaching Hard Cap with LAY before reaching the Deadline.**

- In the case of a first Milestone: Reaching a Hard Cap gives contributors the right to engage and benefit from the Digital Twin project's governance.
- IDTO project on Contribution Status: data providers contribute first data according to the community data acquisition task published.
- All LAY contributed are transferred to Project smart contract, then allocated to the various tasks and the share reserved for the Supported Cause and platform fees.
- In the case of a subsequent cycle, the first step is irrelevant, but the process remains unchanged.

2. **Reaching the Deadline before the hard cap is reached.**

For both first and subsequent cycles:

- Funds collected are returned 1:1 to contributors.
- IDTO Project in Abort Status: all data acquisition tasks linked to the IDTO is aborted.

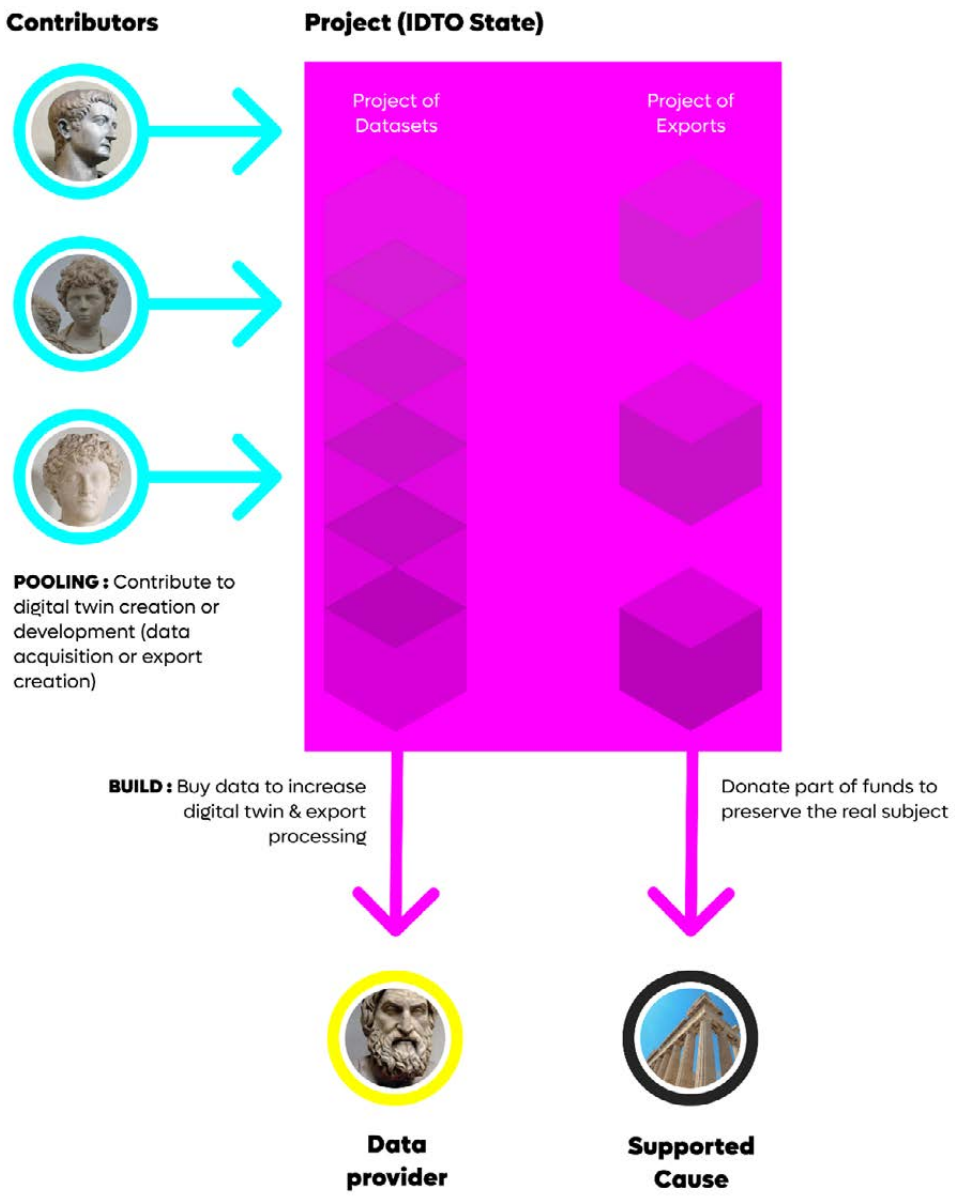
Once a first Milestone has been successfully completed, contributors can vote for a new Milestone to initiate a new Pooling cycle.

Stage 2 / Build: Aggregate data into a Digital Twin and create Licenses for distribution.

The Build stage consists of achieving the Milestone goals. It is structured as follows:

1. Receipt of data sourced externally or acquired from the community.
2. Validation of data for aggregation of the Digital Twin.
3. Mint of a AI material token for each batch of incoming data.
4. Production of a global scene integrating all data.
5. Production of Milestone Licenses.

Pooling & Build Process



Stage 3 / Distribution & Sale: Generating value from the Digital Twin.

The Sale Stage represents the commercial life of all the Licenses/uses of the Digital Twin on the market. When we "sell' an Export that means that we sell an exploitation license of this Export defined by the 4 criteria that may change the price independently of the one chosen by the Pool DAO:

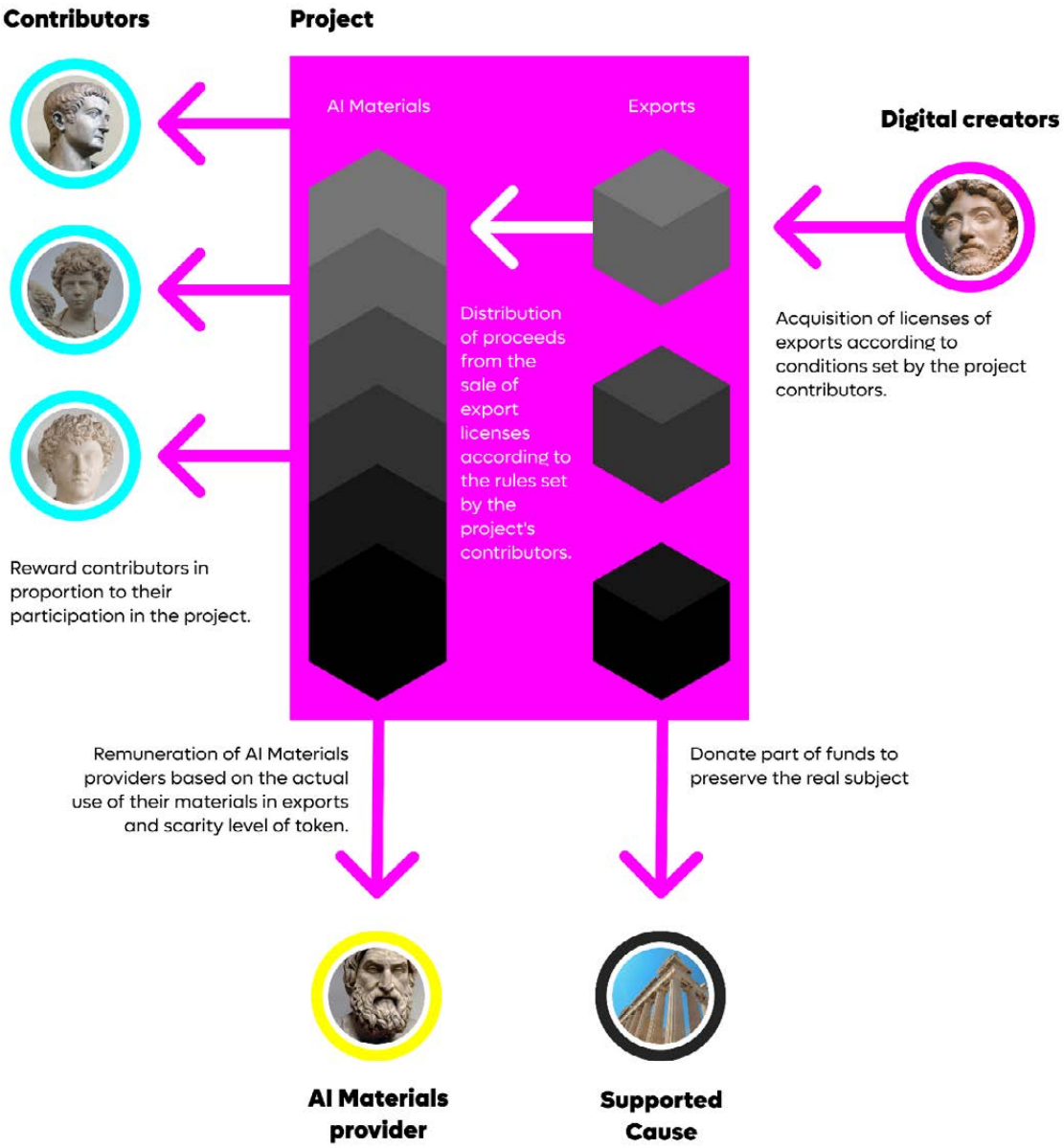
- Geographic area
- Duration
- Support of exploitations
- Exclusivity or not

The acquisition of an operating license corresponds to the mint of a smart contract Licenses token following EIP-1155 standard.

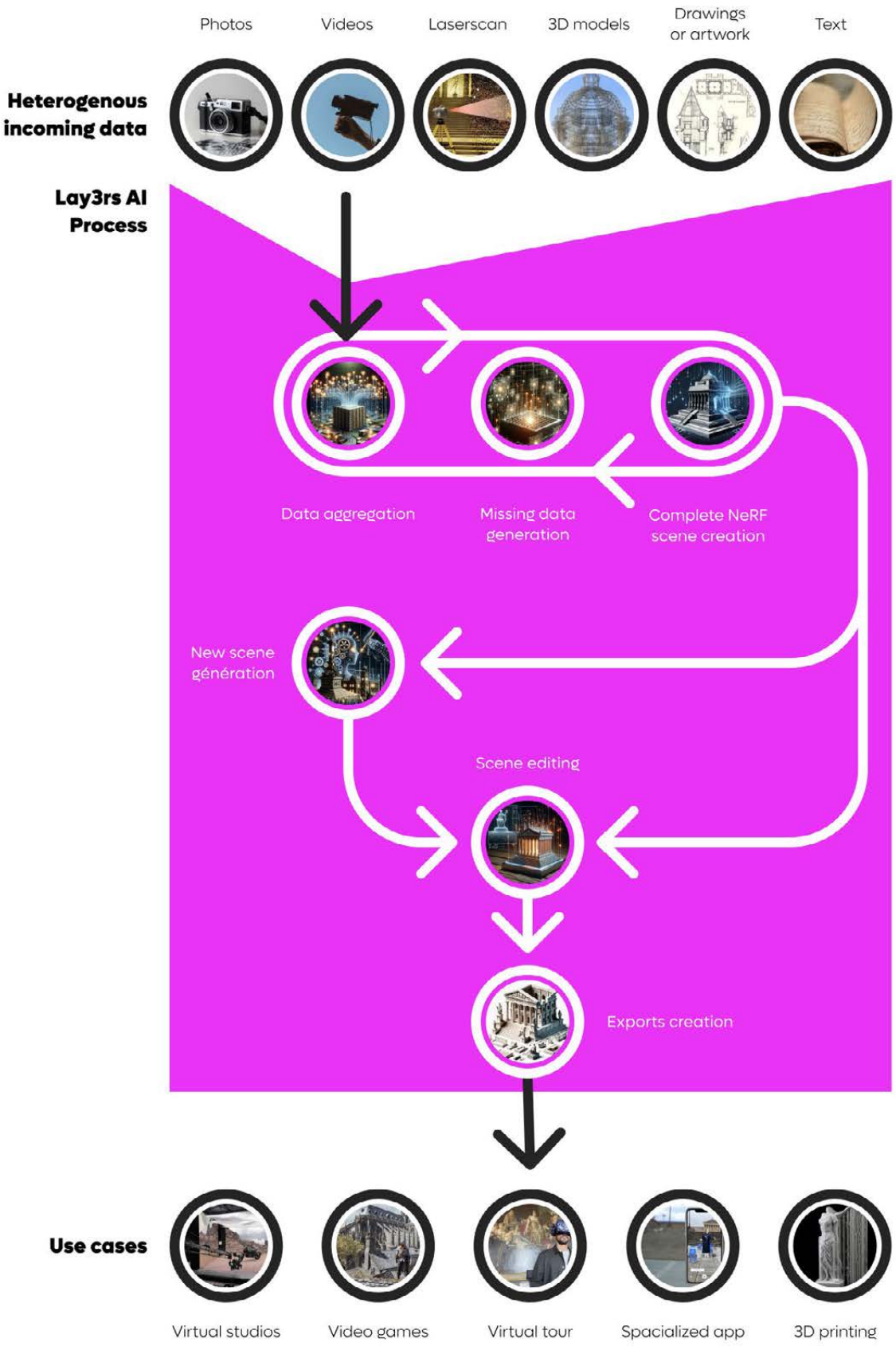
Any income generated by the sale of those license will automatically be shared as a key of partition defined by the smart contract Project between:

- Contributors according to their participation in the project
- Data or Code Providers according to the proportion of their contribution used in the License and its scarcity
- Supported Cause
- Project manager
- Platform fees

Sale process



Digital twins production process (3D fine-tuned model)



Main partners portraits

Caisse des Dépôts et Consignations

The Caisse des Dépôts et Consignations (CDC) is a French public financial institution established in 1816. Its main mission is to safeguard the savings of French citizens. However, over time, its functions have diversified to include areas such as housing, insurance, transportation, and pensions. With 22 subsidiaries and a total balance sheet of 1.2 trillion euros, the CDC is now the world's largest public financial group. It constantly works in the public interest with the ambition to "contribute to the growth of France." It is currently Lay3rs' primary financial partner.

CEA List

Since 2021, we have been collaborating with the Ambient Intelligence and Intelligent Systems department of CEA (French Alternative Energies and Atomic Energy Commission), which is the main applied research center in France. We work daily with different laboratories to provide LAY3RS with access to a range of expertise that is both specific and rare. This already fruitful partnership will continue to develop in the coming years, enabling LAY3RS to achieve its most ambitious and innovative technological goals.

Centre des Monuments Nationaux (CMN)

The Centre des Monuments Nationaux (CMN) is a French institution that manages over 100 monuments throughout the country. These monuments include historical sites, castles, gardens, arches, and towers. The CMN organizes various events and activities to promote these monuments and raise public awareness of their significance. The CMN is also active in the field of innovation and actively supports Lay3rs by providing access to monuments for experimentation and aims to initiate work on opening the management of Digital Twins through a DAO model.

Matrice

Matrice is a French institute for technological and social innovation founded in 2016. It operates entrepreneurship and digital training programs, startup incubation programs, as well as research and technology transfer programs. Matrice distinguishes itself by bringing together students, entrepreneurs, researchers, and artists within a single community, transcending disciplinary boundaries. In addition to its teaching and incubation activities, Matrice is also a research center and a place for artistic creation. Matrice was the first partner to believe in the project by supporting the company's structuring and securing initial funding.

Ministry of Culture (France)

As the organizer of the "France 2030" call for projects on the theme of "digitization of architecture and heritage," the French Ministry of Culture has supported the project, which was awarded laureate status in recognition of its relevance to the addressed issue and the means put in place to address it.

Univers network

Since we realized the potential of Web3 for our project in early 2022, Univers has been working with Lay3rs on the development of services that effectively address the specific challenges of Web3 and new creative environments (VR, AR, Metaverse, etc.). As a hub between different metaverses, Univers has incubated the project, placing interoperability and decentralization at the core of its approach and services.

Technology & Infrastructure

Blockchain choices

In selecting a blockchain platform for our needs, we've opted for the Polygon network, drawn by its numerous advantages that align with our objectives. Polygon serves as a scalable solution for Ethereum, greatly enhancing transaction speed and capacity, which allows us to process a higher volume of transactions per second efficiently. This scalability comes with the added benefit of reduced transaction fees, making it economically feasible for decentralized applications that typically engage in frequent transactions.

One of the standout features of Polygon is its ability to expedite transaction confirmation times. This is achieved through the generation of blocks at a faster rate than on the Ethereum network, thus providing our users with swift transaction experiences and minimizing any delays. Additionally, the network's compatibility with Ethereum virtual machine (EVM) means that we can utilize Solidity smart contract language, enabling us to tap into the robust developer community and existing infrastructure without any compatibility issues.

Interoperability is another key feature that Polygon brings to the table, offering bridges to other blockchains which allows for a fluid transfer of assets and information across different platforms. This interoperability paves the way for enhanced collaborative opportunities and resource exchanges.

Polygon's growing ecosystem, characterized by a wide array of projects, dApps, and a broad user base, presents us with an array of development tools and a well-supported environment. It equips developers with essential resources, documentation, and libraries, fostering an environment that is conducive to innovation and development.

In terms of security, Polygon leverages the established and proven security of the Ethereum blockchain, giving users confidence in the integrity of their transactions and the safety of their digital assets. This, coupled with its scaling advantages, makes it an attractive proposition.

Moreover, Polygon's infrastructure is designed to be developer-friendly, providing tools and frameworks that streamline the development process. The portability of applications and smart contracts on Polygon ensures that developers have the flexibility to transition between Layer 2 solutions or revert to the Ethereum Mainet as required.

Lastly, Polygon's decentralized governance model ensures that its community has a voice in the network's future, allowing for a democratic approach to its evolution and

governance policies. This aspect of decentralization is critical in maintaining a blockchain network that is truly by the people and for the people.

3D Fine-tuned AI technological choices

Why develop an AI-based 3D model?

The present 3D reconstruction process

The production of 3D models currently relies on photographic and/or laser capture and the use of 3D graphics software. Although advanced technological devices and software are used, the methods remain relatively artisanal, and the workflow is not highly automated.

- For photogrammetry workflows, the capture process requires expertise in image overlap, multiple angles of view, lighting, focal length, exposure time, and more. This is because 3D reconstruction software such as Reality Capture and Metashape demand precision in these aspects for successful reconstruction.
- Drone image capture is regulated, requiring pilots to obtain accreditations and undergo specific training. Drone operators are experts in piloting drones for capturing images of monuments to perform photogrammetry.
- Laser scanning capture is less demanding than traditional photography, but it requires expertise in cleaning and assembling point clouds.

Graphics software is primarily designed for use by 3D artists, and although it is possible to develop code to automate tasks, this is rarely done outside of major entertainment companies that have the resources to augment their 3D artist teams with technical artists capable of developing code to automate the software pipeline. It should be noted that finding training programs to enhance technical artists' coding skills on these software platforms is also challenging.

- Modeling software like ZBrush has gained popularity by allowing artists to utilize traditional techniques in a digital environment. However, tasks still rely on manual work, and the complexity of the software necessitates specialization to achieve quick results.
- Asset production management tools like Shotgrid are primarily designed for collaborative work and rapid validation, rather than industrial-scale interaction with large databases of 3D models hosted on cloud services.

The current ecosystem is mainly composed of small companies that handle the capture process and provide 3D models as services, or larger players that can internalize the entire workflow. To our knowledge, demand solely for the capture

process is atypical. However, such a service offers greater freedom and better control over the quality of the 3D models. Methods and tools for quality control of the 3D models provided by these service providers are a recurring topic of consideration for studios.

The fragmentation of the 3D model production workflow, along with the resulting specialization of roles, leads to complexity and significant costs. To simplify the workflow and significantly reduce production costs, we believe in utilizing AI-based tools. The objective is not to replace 3D artists but rather to provide them with new tools that enable them to reduce the time spent on repetitive and/or low-value tasks, allowing them to focus more on tasks where human intelligence is uniquely valuable.

How can AI be used to automate tasks?

To illustrate this, here's a concrete example that applies machine learning tools to a real issue in computer graphics. When reconstructing a large-scale scene (e.g., a 1000 m^2 monument), photogrammetry software only yields usable results when provided with tens of thousands of photos. They are much less effective for reconstructing individual 3D assets. Furthermore, aligning georeferenced laser point clouds with the photogrammetric point cloud must be done on the complete scene. The workflow of reconstructing individual 3D assets and then assembling them is counterproductive.

However, studio organization relies on task separation because a complete scene is typically not usable with standard computation resources, and 3D artists work on unique 3D assets. Therefore, we need to provide the studio with both the 3D assets and the elements required to easily reassemble them into a scene. Thus, starting from the complete scene, a Lay3rs 3D artist must segment the 3D scene into individual 3D assets, which significantly increases production time. To reduce this time, we are developing AI-based tools that can automatically search and segment the relevant 3D assets within the complete scene.

This example fits into the current workflow of 3D artists by providing assistance in a specific area. However, we have a much more ambitious vision. Our goal is to provide a universal solution to a 3D artist, as well as an entire team of artists, encompassing multiple machine learning and deep learning tools that enable them to achieve things currently unimaginable with available solutions.

The new AI-based 3D representation methods

In order to really create a new, highly automatable pipeline, we rely on new methods in Visual Computing called Neural Fields and 3D Gaussian splatting.

Neural Radiance Fields (NeRF)

The applications of Neural Fields to 3D reconstruction and rendering are collectively referred to as NeRF (Neural Radiance Fields). In this specific case, the radiance field is encoded within a neural network (Multi-Layer Perceptron or MLP). Radiance provides information on how light emitted from a surface is perceived by the eye, indicating whether an object in a scene appears bright or not. Based on a sparse capture of the scene, the neural network outputs the optical density and the color at each point of the scene. In other words, it can produce any viewpoint within the scene.

3D Gaussian Splatting

The 3DGS method does not rely on an MLP to encode the scene. It uses a set of 3D Gaussians to serve as a differentiable volumetric representation. Each Gaussian has the following parameters: 3D position, opacity, anisotropic covariance, and spherical harmonic coefficients. They are first initialized from the sparse point cloud produced by the SfM software. Then, these parameters are optimized by rendering images with a rasterization process and backpropagating the gradients from the measured errors. In addition, Gaussians can be added or removed iteratively depending on the local volume being under or over-rebuilt. After training, very fast rendering can be done via the CUDA-based Gaussian rasterization process.

One of the great strengths of these approaches compared to previous solutions lies in memory usage. Traditional 3D sampling-based solutions encounter a memory wall. While it is possible to produce individual 3D assets with sufficient resolution using these previous methods, reconstructing a large-scale 3D scene, such as monuments in our case, becomes prohibitively memory intensive. In other words, the major problem with 3D sampling is the scalability of memory when the required resolution increases. In contrast, these novel methods are inherently continuous and adaptive.

A new paradigm

Furthermore, by combining NeRF/3DGS and generative models, it is possible to leverage the advancements of generative models for generating 2D images, 3D geometry, textures, lightings and modify with user instructions.

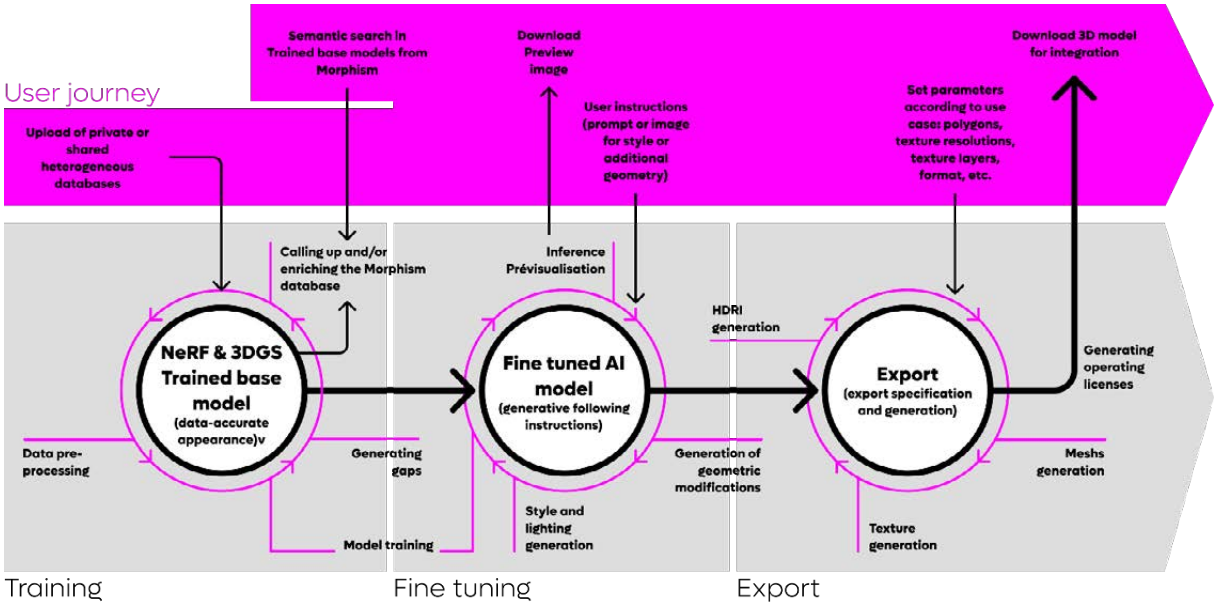
More generally, NeRF/3DGS based model is a new paradigm for seriously considering the development of a generative model for 3D. Pre-trained generative models are the well-known models now for language (1D) and images (2D). Large Language Models and Diffusion Models require a huge training database. In the case of 3D, the application of such an approach has led to a dead end because training on databases

of 3D models has several disadvantages: there are no 3D databases as large as for text or images, meshes are heavy objects in terms of memory size, generated 3D models are limited to simple shapes and the resulting renderings are far too smoothed and therefore unusable. NeRF/3DGS model is another way to tackle the problem for which a small model (a few MB) must be trained for each 3D scene. Once the NeRF/3DGS model has been trained on a 3D scene, it is possible to work directly in the 3D scene by using instruction as text, image and clicks to e.g. fill in the gaps during the creation of the 3D scene, identify objects directly in the 3D scene, modify the geometry and the texture of the objects and the lighting of the scene.

We developed a NeRF/3DGS robust pipeline during 1 year and we will continue to develope it until the end of 2025, with the aim to develop a generative model for 3D.

How does it work?

The exclusive Lay3rs 3D AI fine-tuned model production process



Our solution intervenes in the creation of 3D assets and texturing by using data from the user to generate the style desired. Our solution automates tasks and provides great flexibility in these production steps.

Our pipeline is broken down into 3 steps:

- Training (NeRF/3DGS): it allows the production of 3D models whose appearance is faithful to the input data with maximum accuracy and quality. They feed a database of generic 3D asset stores.

- Fine-tuning by generative AI: it allows user to modify the geometry of the generic 3D model, modify the textures and lighting in a consistent way in 3D in order to apply the wishful styles in a homogeneous context.
- Creation of licenses: this step allows the user to fine-tune and scale the exports exactly as needed.

In the following, an asset means indifferently an object, an environment or a setting.

Training (NeRF/3DGS)

The input data are, in general, already existing images and videos. This data can come from smartphones, websites, audiovisual videos, film footage, etc. They are provided following the different ways described in the part "Types of data or code provider". The data undergoes various pre-processing, including alignment, in order to obtain the camera poses, which are also input data. The training consists of several phases, mainly: the production of a geometrically accurate generic 3D model which involves the completion of the missing parts if these parts of the asset are missing in the initial AI material, the production of generic textures with lack completion, delighting. At the end of the training, the 3D models are faithful to the input data. They feed into a database of generic 3D models that are customizable by fine-tuning.

Fine-tuning by generative AI

In this part, the user wants to generate the assets needed. The input data are the generic 3D models of the database and the user data (images, videos). These user data is a strong prior to constrain the fine-tuned model and thus obtain homogeneity on all the assets created. From this 2D data provided by the user, our pipeline make it possible to generate geometry, textures and lighting in a coherent way in 3D based on the generic models, according to the user's specific instructions.

To obtain the 3D geometry of the desired asset, the fine-tuned model uses provided image and/or text instructions and a nearby generic 3D model. For example, from the 3D geometry of a generic statue in the database and an image of the desired statue, our pipeline produces the right 3D geometry of the desired statue. Our experience is that it is much more robust to use geometry that is close to the model than to use only an instruction in the form of an image or text. The important thing is to have an accurate generic 3D object that is then easily modified through generative AI as shown

in figure below. In this figure, the generic model is a scene with character, chair, and environment, and the instruction is textual ("make it sonic").

Modifying 3D geometry also involves deletions and additions. For example, in the case of a background, the user will often start by removing all unnecessary objects from the background. In this case, the fine-tuned model removes the objects and consistently generates in 3D the missing parts that were hidden by the deleted objects. This can be done by text instruction or by clicking depending on the case as shown in the following figure 2.

The pipeline allows the user to create textures in accordance with the desired style (photorealistic or not). In this case, the change in appearance applies to the style. Style transfer is widely used in 2D generation. We take this method and apply it to 3D generation. Based on one or a few images provided by the user, the generative model applies the user's desired style to the object by modifying the textures. Fine-grained control is achieved by clicking (selecting a part of an object) or by textual instruction as shown on the figure with Sonic style.

The change in appearance also applies to the lighting. Our generative model makes it possible to modify the lighting according to the needs of the users. In this case, the input data are user instructions in the form of images, text or clicks in the scene to position light sources. Several methods are used depending on the case. In simple cases such as darker/brighter or candlelighted/neon, the pipeline is light and the text

instruction is sufficient. In complex cases where the light sources are multiple and heterogeneous, the pipeline is richer and involves several neural networks, including a specific one for lighting that is fine-tuned during this phase. Examples can be seen on the following links, the modification of the lighting is done by text instruction:
Original lighting: https://www.youtube.com/watch?v=_XhD8KuXFYY
Candlelight: https://www.youtube.com/watch?v=lYrjkgwb5EI
In this example, it is clear that the fine-tuned model is able to identify what a candle is and that it has a spatial representation of the position of each candle in the room.

Creation of exports

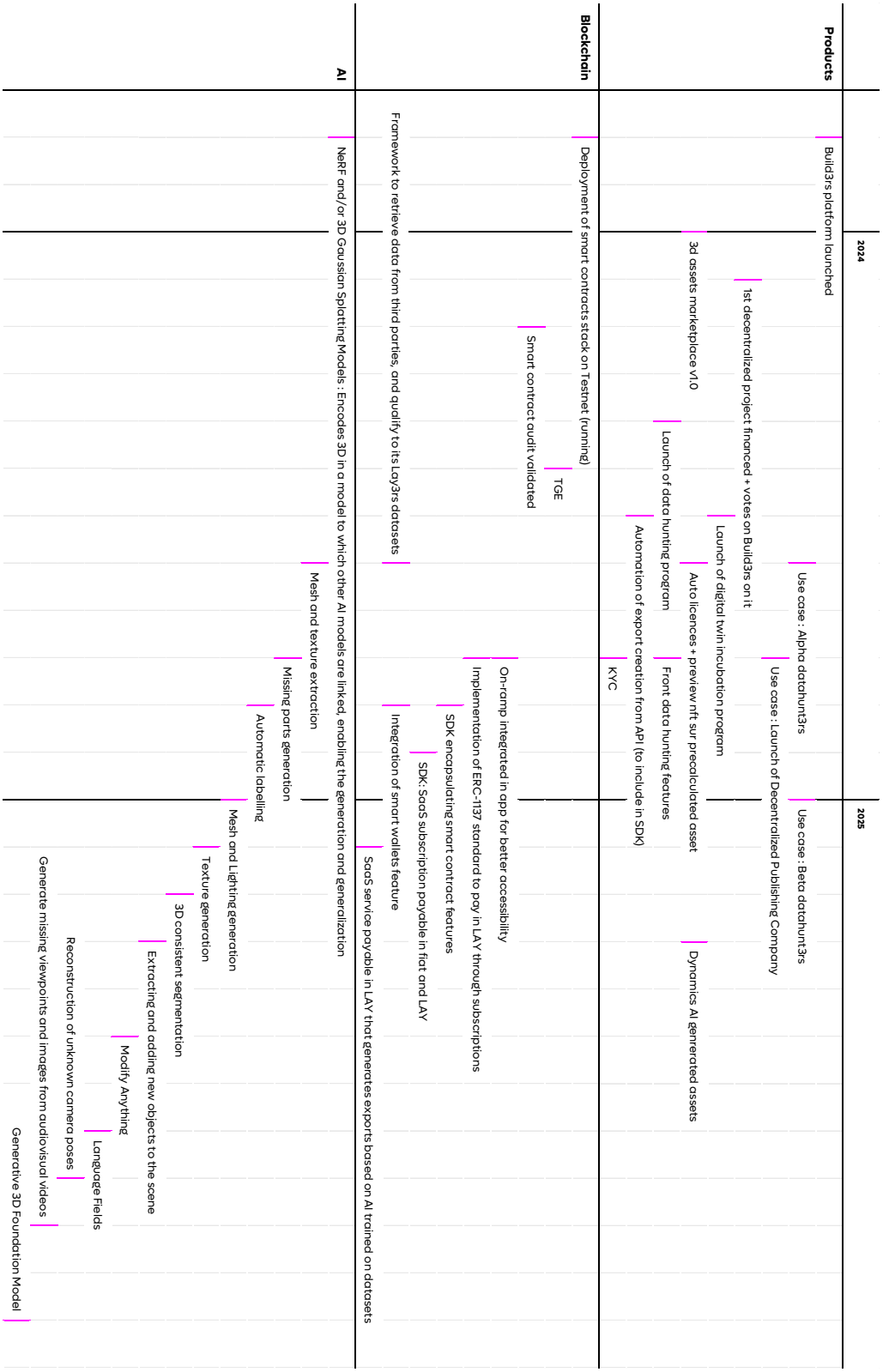
To export an asset (3D model, environment, HDRi), user have the freedom to choose a certain number of parameters according to its constraints. The user can choose:

- The number of polygons for each object
- For different levels of detail (LOD) of an object, the number of polygons in each 3D model of the object from high poly to low-poly
- The format of 3D models: obj, fbx, usd
- Texture maps: diffuse RGB, metallic, roughness etc
- Texture resolution: 1K, 2K, 4K, ...

In this way, the user can export each object according to his needs. During the integration stage, which allows a certain number of parameters to be more precisely defined, the user can again adapt these parameters more finely by making new exports. This solution is also very useful, especially for being able to develop games on several different platforms with marked differences in terms of computing power. (e.g. Switching a video game to VR).

Roadmap

Global roadmap



Team & partners

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Emmanuel Ea Development Advisor

Adrien Basdevant Web3 Legal Advisor

Clara Benyamin IP Legal Advisor

Maven Capital

Vaiot

Partners

Awards and distinctions

- Winner of France 2030 on the theme of "digitalization of heritage and architecture," which identifies and funds the most promising startups to address priority issues for innovation in France.
- French Young Innovative Company (JEI) labelization.
- Ongoing Deep Tech labelization by BPI France.

Lexicon

ReFi

Regenerative Finance (ReFi) is a concept that relies on blockchain technology to create decentralized financial systems designed for their positive externalities, whether financial or nonfinancial.

It aims to democratize access to financial services, make the financial system more transparent and equitable, and provides opportunities to fund preservation initiatives. It leverages the possibilities offered by blockchain technology to apply them to use cases that have an impact beyond their own model and community.

This mechanism is not simply a business model, but a deep commitment to the interweaving of the digital and physical realms in a symbiotic relationship. In championing this approach, Lay3rs is not only a pioneer in the digital sphere, but also firmly anchors its responsibilities in the original establishments.

Real World Asset (RWA)

"Real World Assets" (RWA) refer to physical or tangible assets that exist in the real world, as opposed to digital or financial assets. These include real estate, commodities (such as gold or oil), infrastructure, and even artwork. In the context of decentralized finance (DeFi), there is growing interest in the tokenization of RWA, enabling their use on blockchain platforms. This tokenization allows for fractional ownership of assets, making investment more accessible and liquid. Particularly, regenerative finance (ReFi) focuses on utilizing RWA for sustainable and impact-driven projects, combining the stability of physical assets with technological innovation to promote more responsible and ecological financial practices. By integrating RWA into the digital ecosystem, the aim is to create economic models that support environmental and social sustainability while offering innovative investment opportunities.

Supported Cause

In the digital twin model proposed by LAY3RS, "Supported Cause" refers to an organization or initiative that stands to benefit directly from the revenues generated

by fine-tuned model. If it's present in a project, each time the fine-tuned is used and monetized; a predetermined portion of its total revenues is systematically redirected to its corresponding preservation organization(s).

These organizations exist exclusively to preserve, protect and revitalize an original real world asset.

Fine-tuned model

A fine-tuned AI model is an artificial intelligence system adapted from a pre-trained model to perform specific tasks with greater accuracy. This process involves taking a general-purpose model, often trained on a large and diverse AI materials, and further training it on a smaller, task-specific AI material. Fine-tuning adjusts the model's parameters to optimize performance for particular applications, such as sentiment analysis, image recognition, or language translation. The advantage of fine-tuning lies in its efficiency, requiring less computational resources and data compared to training a model from scratch. This approach leverages the pre-trained model's broad knowledge while tailoring it to meet specific needs, enhancing both its accuracy and relevance for targeted tasks.

Fine-tuned models open a new horizon of development for AI, enabling the creation of ecosystems where a general model interacts with a set of fine-tuned models rather than requiring ever-larger AI materials. This synergy between a general-purpose model and specialized models maximizes the efficiency and flexibility of AI by combining the broad contextual understanding of the general model with the precision and expertise of the fine-tuned models. This approach not only reduces the costs and resources needed for developing new AI applications but also allows for rapid and precise adaptation to the evolving needs of users and industries.

Digital Twin

The digital twins created by Lay3rs consist of raw data and generated data, derived from various types of captures (geolocated point clouds, photogrammetry, videos, acoustic maps, etc.) or archives. These data allow us to aggregate an increasingly large and precise set of data over time about a monument to be preserved. These data are then assembled into a 3D fine-tuned model. It is then semantically segmented to isolate all parts (architectural elements, objects, textures, etc.) to be edited and exported.

Thanks to blockchain technology, the aggregated data will create the largest and richest library of resources on monuments worldwide, serving as a permanent archive beyond the natural or human risks that threaten cultural heritage every day.

XR

Extended Reality (XR) is a broad term that encompasses Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR).

- Augmented Reality (AR) is a technology that overlays digital information, such as images or data, onto our view of the real world. For example, an AR application could display information about a monument when you look at it through your smartphone screen.
- Virtual Reality (VR) is an immersive experience that places you in a completely digital environment. With a VR headset, you can look around and interact with a virtual world.
- Mixed Reality (MR) is a combination of the previous two. It allows you to interact with virtual objects placed in the real world as if those objects were present.

XR technology aims to combine or reflect the physical world with a digital twin capable of interacting with it. The fields of virtual reality and augmented reality are rapidly growing and are applied in a wide range of industries, including entertainment, marketing, real estate, training, and remote work.

Fungible Token

A Fungible Token is a type of cryptographic token that is interchangeable with other tokens of the same type. This means that each unit of this token type is identical to every other unit. Fungible tokens are often used as currency because their interchangeable nature makes them useful for transactions. Examples of Fungible Tokens are USDT (Tether), UNI (Uniswap) or MANA (Decentraland). Each USDT is, for instance, identical to every other USDT; they all have the same value and can be freely exchanged with one another.

Non-Fungible Token

A Non-Fungible Token (NFT) is a type of cryptographic token that is unique and non-interchangeable with other tokens. Each NFT has information or attributes that make it different from other tokens, which can give it a different value. NFTs are often used

to represent ownership of unique digital assets such as digital artwork, digital collectibles, and even virtual land parcels. An example of an NFT is CryptoKitties, where each cat is an NFT with unique attributes.

DAO

A decentralized autonomous organization (DAO) is a form of organization that is managed by rules coded as smart contracts on the blockchain. A DAO is collectively owned and controlled by its members, rather than by a single entity or a small group of individuals. In a DAO, all decisions are made through consensus or voting, with each member having a proportional vote based on their ownership stake in the organization. The governance rules of the DAO are encoded on the blockchain, which means they are transparent and immutable.

DAOs can be used for a wide range of purposes, from managing digital assets to organizing collaborative workgroups. They are designed to be fully transparent, thereby avoiding issues of corruption and conflicts of interest that may arise in traditional organizations.

Milestone

A Milestone is a stage in the development of a project. It is structured into several batches of data to be acquired or code to be developed, enabling the project to be developed according to the directions given by its community. It is from these batches that data or code acquisition missions are created.

This may be financed directly by the smart contract project, or may give rise to a new call for external contributions in LAY. In the latter case, a call for contributions will be launched directly via the tools offered on the Lay3rs platforms.

Pooling

Pooling is the name given to the mechanism for collecting resources of all kinds (money, opportunity, data, code, etc.).

This system enables the development of a dynamic and virtuous ecosystem, with each contributor getting his or her fair share of the fine-tuned model's creation and development.

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