

# The Access Economy in Web3

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**Abstract.** Elacity’s Access Economy Protocol (AEP) transforms digital rights and asset management in Web3. It addresses key challenges in Digital Rights Management (DRM), such as packaging, transparency, and secure playback, through the use of blockchain and peer-to-peer (P2P) technologies. By offering a decentralised, scalable networking solution, Elacity enables a digital asset marketplace which features robust IP protection and scarce, tradable access, ownership and distribution rights. Elacity delivers decentralised business models, instant royalties, and inclusive economics to owners in Web3, automating contractual challenges, optimising resource sharing, and enabling equitable control and monetisation of digital assets through a democratised online Access Economy.

## Contents

<b>1</b>	<b>Introduction</b>	<b>2</b>
<b>2</b>	<b>The Foundation for a Decentralised Access Economy in Web3</b>	<b>2</b>
2.1	Introduction to Web3	2
2.2	New Ownership Structures in Web3	3
<b>3</b>	<b>Digital Rights Management: Processes &amp; Limitations</b>	<b>3</b>
3.1	Operations of a DRM System	3
3.2	Processes in a Traditional DRM System	3
3.3	Limitations of Traditional DRM Systems & Scalability Challenges	4
3.4	Royalty Collection & Licensing: Contractual Complications	4
3.5	The Role & Benefits of MPEG-21 in DRM	4
<b>4</b>	<b>Elacity’s Solution: The Access Economy Protocol (AEP)</b>	<b>5</b>
4.1	Digital Capsules: Asset Packaging & Encryption	5
4.2	Digital Capsule Storage	5
4.3	Digital Capsule Ledger (ERC721)	5
4.4	Operative Contracts Group (ERC1155)	6
4.5	Authority Gateway Smart Contract	6
4.6	Licence Encryption: CapsuleConnect	7
4.7	Decentralised Runtime Player for Secure Playback	7
4.8	Decentralised Distribution: PC2 Hosting & Communication	8
4.9	Reputation System: Verifiable Credentials and Zero-Knowledge Proofs	8
4.10	Elacity’s ‘Video Capsules’ Minimum Viable Product	8
4.11	Overview of Elacity’s Access Economy Protocol (AEP)	9
<b>5</b>	<b>Elacity’s Business Model &amp; Partner Benefits</b>	<b>10</b>
5.1	Business Model Expansion Opportunities via Access Economy Protocol	10
5.2	Market Expansion Opportunities via Access Economy Protocol	11
5.3	Revenue Sharing, User Experience, & Regulatory Compliance	11
5.4	Elacity’s Revenue Generation Model	11
<b>6</b>	<b>Conclusion: The Access Economy in Web3 with Elacity</b>	<b>12</b>

# 1 Introduction

The Access Economy, the cornerstone of human evolution, originated from simple communication where individuals exchanged thoughts, ideas, and knowledge. This exchange evolved, manifesting physically in ancient markets where access to skills, shops, vehicles, and lodging was traded. To own something is not only to have unrestricted access but also to have the right to grant or restrict access to others. Therefore, by enabling access, we exercise ownership, and by seeking access, we recognise and respect the ownership of others. Access markets foster income, creativity, collaboration, community, resource sharing, and new economic standards. One of the most transformative platforms for monetising access in recent times has been the Internet.

In this paper, we discuss the transition from the traditional Web2 to Web3 models, focusing on the distribution, monetisation and management of digital assets within the evolving Access Economy. We highlight shortcomings in existing Digital Rights Management (DRM) systems and shed light on various challenges—technological, legal, and contractual—that affect small to large owners of intellectual property. We introduce Elacity’s Access Economy Protocol (AEP) as a disruptive solution. It serves as a catalyst for the formation of new markets and smart economies. AEP focuses on asset encryption into ‘Digital Capsules’ alongside scarce, tradable rights governed and validated on a blockchain. The protocol aims to promote a more secure, equitable, and empowering digital future for all.

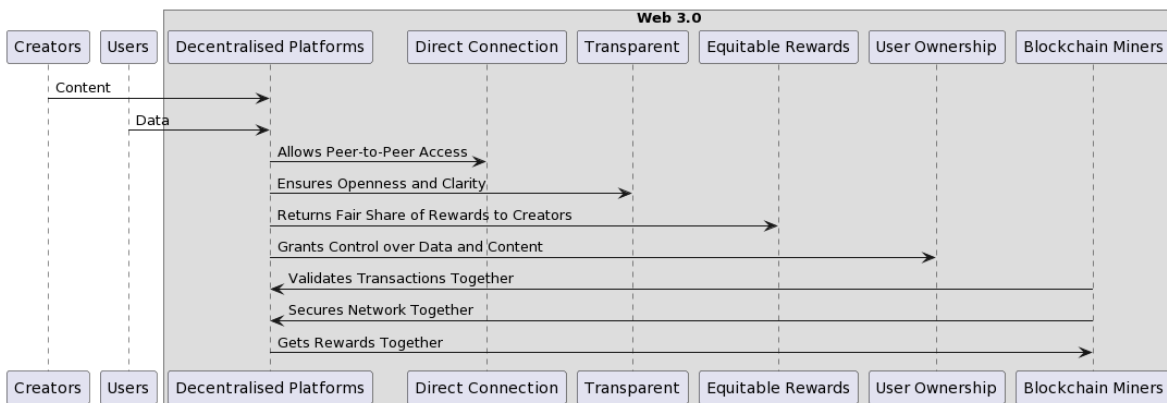
## 2 The Foundation for a Decentralised Access Economy in Web3

A digital asset is any content or data in digital form that can be owned and holds value. This includes but is not limited to, cryptocurrencies, documents, digital art, to audio (music, podcasts, audiobooks), and video (films, documentaries, educational) content. They include games, in-game items, digital avatars, metaverse assets, 3D printing designs, machine learning models, automated workflows, and software. These assets, used, distributed, or exchanged online, often require DRM protocols to regulate access and use for stakeholders, traditionally overseen by centralised gatekeepers.

Gatekeepers are dominant, global firms with entrenched market positions, linking a large user base to various businesses. While they facilitate market access, such centralisation burdens systems, stifles innovation and poses privacy and security risks due to unfavourable terms and extensive data collection. As digital assets diversify, the need for secure, decentralised infrastructure grows, enabling individuals to become their own independent gatekeepers in an inclusive, globally interconnected marketplace.

### 2.1 Introduction to Web3

In Web3, the Internet’s third era, users gain control over identity, data and transactions via blockchain technology. This enables secure, transparent global value transfer on peer-to-peer networks, backed by public or private ledgers. Miners globally use computational power to validate transactions and earn fees, automating tasks for users without middlemen through smart contracts. This non-custodial approach challenges centralised corporate control over key infrastructures, reduces security vulnerabilities and transforms the internet into Web3, emphasising digital freedom, resilience, and trust.



## 2.2 New Ownership Structures in Web3

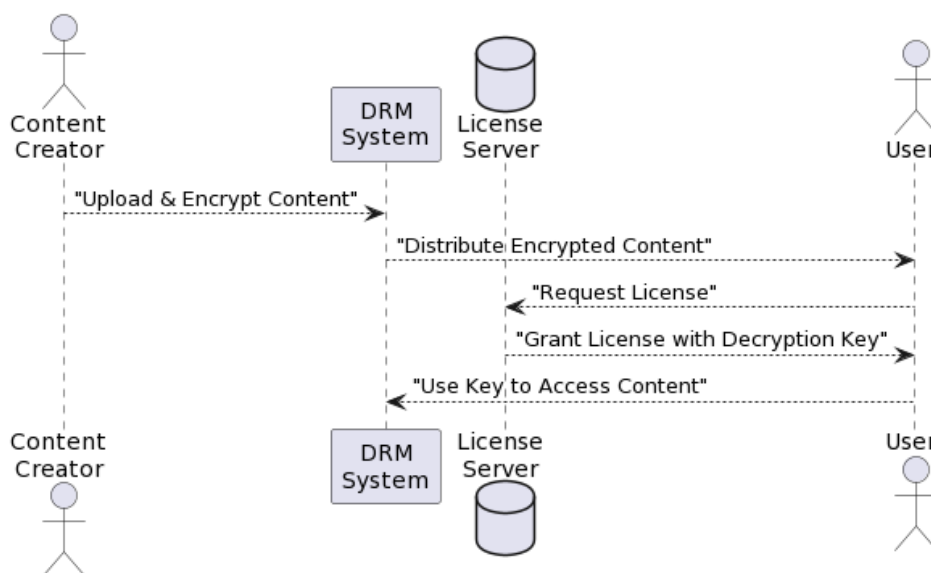
Web3 offers innovative ownership structures, providing users control over online identities, finance and rights, fostering a more inclusive, equitable digital environment. One transformation is the arrival of Non-Fungible Tokens (NFTs), unique blockchain tokens signifying ownership rights. While decentralised identities can own and trade NFTs globally, they don't inherently protect the digital assets they represent. To deliver the Access Economy and a global digital asset marketplace with business models in Web3, a secure, decentralised digital rights management protocol is essential; its primary role would be to regulate both access and use of encrypted digital assets using tradable NFTs.

## 3 Digital Rights Management: Processes & Limitations

Digital Rights Management (DRM) safeguards digital assets like software, media, and data from unauthorised use. Acting as a virtual guard, DRM controls rights from creation to consumption. Major players like Adobe, Apple, Google, and Microsoft rely on DRM, using encryption to protect and monetise digital assets effectively in the Web2 era.

### 3.1 Operations of a DRM System

DRM is a complex process that involves three key elements: encryption, distribution, and licence acquisition. First, the content is encrypted and then distributed. To access the content, consumers need to have access permissions and a decryption key. These are found in an encrypted licence that is obtained from a centralised server using a server/client model. With this licence, buyers can securely consume the content [1].



### 3.2 Processes in a Traditional DRM System

1. **Packaging:** Digital asset is encrypted and packaged, with decryption keys stored in separately distributed encrypted licences.
2. **Distribution:** Users receive the packaged file.
3. **Licence Server:** Content providers maintain a server to authenticate licence requests.
4. **Licence Acquisition:** Consumers obtain a licence with decryption keys and content rights.
5. **Playback:** Usage adheres to licence rules via a DRM-compatible player.

### 3.3 Limitations of Traditional DRM Systems & Scalability Challenges

Centralised licence servers, the weak point of DRM systems, act as a central point of failure, risking service disruption and costly maintenance, particularly burdensome for small providers. Managing an immense number of rights for each piece of content, especially when dealing with millions of users, traditional DRMs lack scalability, cost-effectiveness, and flexibility, necessitating compromises and adding complexity. Each content piece and user presents a vast array of potential rights to control, challenging even robust systems.

1. **Centralisation Issues:** Authorisation managed by a single service and licence server enhances vulnerabilities and raises operational costs.
2. **App/OS Limitations:** Content Decryption Modules (CDMs) which allow playback are DRM-vendor specific, restricting scalability and content accessibility on apps and operating systems.
3. **Licence Complications:** Providers must acquire multiple DRM licences for cross-platform functionality, increasing both costs and complexity.
4. **Necessary Trade-offs:** To handle costs and complexity, current DRM solutions compromise on user count, content amount, rights per content, business models, and security levels.
5. **High Innovation Costs:** Tight controls by Gatekeepers make innovation within existing DRM structures expensive.

### 3.4 Royalty Collection & Licensing: Contractual Complications

The process of managing royalties and licensing for content is often complicated by a variety of legal, technological, and contractual issues. The global nature of these transactions introduces legal complexity, while outdated systems can lead to inaccurate royalty payments. Contractual complexity further exacerbates these challenges, as it can cause management and enforcement difficulties, disputes, and payment inaccuracies. Contracts require significant effort to ensure adherence, leading to more disputes. Even minor errors in tracking and reporting can result in payment inaccuracies, and “grey areas” in contracts can create uncertainties around fair use and copyright, which can affect payable royalties for specific content uses.

1. **Lack of Transparency:** Centralised systems and their contracts often lack clear, transparent mechanisms for royalty distribution, making it difficult for creators to understand how they are being compensated.
2. **Timing and Distribution Challenges:** The centralised model frequently suffers from delays in royalty calculations and distributions, impacting creators who rely on timely payments.
3. **“Pro-rata” Inequality:** The prevalent “pro-rata” distribution model disproportionately favours popular artists over less well-known creators, creating a skewed revenue distribution that does not necessarily align with consumer preferences.
4. **Exclusivity Clauses:** These contractual elements can restrict small or independent creators from diversifying their income streams, making them financially vulnerable.
5. **High Fees and Commissions:** Centralised systems often impose hefty fees or commissions, reducing net earnings for all creators, regardless of their popularity or scale.

### 3.5 The Role & Benefits of MPEG-21 in DRM

The Motion Picture Experts Group (MPEG), notably through its MPEG-21 standard, defines frameworks for extensive rights outlines. The Media Contract Ontology (MCO) standardises media contracts, focusing on licensing and royalties. It integrates with MPEG-21’s Intellectual Property Management and Protection (IPMP), which employs the Right Expression Language (REL) for machine-readable licensing terms and the Content Expression Language (CEL) for structuring multimedia [2]. These frameworks improve navigation and user experience in digital rights management and can be applied to evolving systems.

## 4 Elacity’s Solution: The Access Economy Protocol (AEP)

Elacity delivers the “Access Economy” to Web3, a model emphasising the value and monetisation of access. We introduce ‘Digital Capsules’—encrypted goods stored in decentralised networks with scarce, tradable access and ownership rights. This model enforces rights and royalties, empowering owners to monetise their digital assets directly through Elacity, a global, decentralised marketplace. We will now explore the components of the Access Economy Protocol.

### 4.1 Digital Capsules: Asset Packaging & Encryption

To ensure packaging security, Elacity imitates W3C’s ClearKey Content Protection with other DRM solutions to allow users to encrypt digital assets into ‘Digital Capsules’.

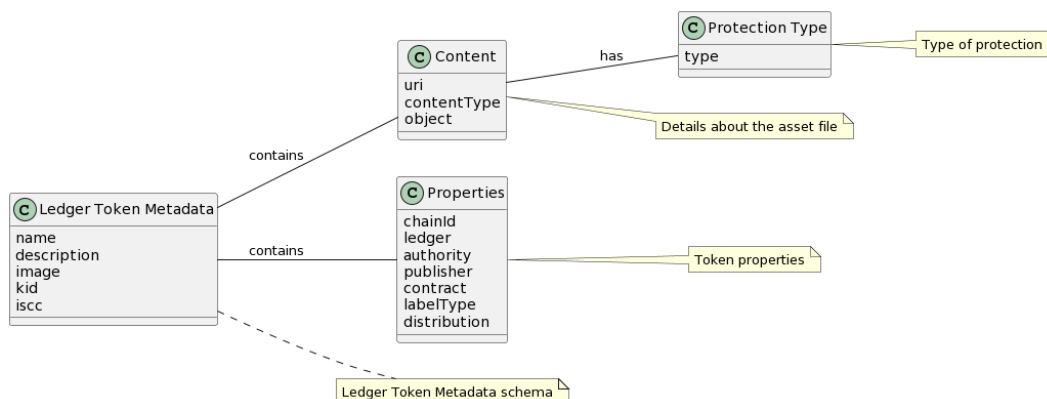
1. **Compliance and Encryption:** Fully compliant with the Common Encryption (CENC) standard and utilises the 128-bit Advanced Encryption Standard in Counter Mode. This dual approach ensures a secure and interoperable environment for digital assets, effectively safeguarding sensitive information while allowing for parallel processing.
2. **Key Management and Implementability:** The system is defined by the W3C’s Encrypted Media Extensions (EME) specification, providing a cohesive framework for secure decryption. This ensures compatibility and ease of implementation, minimising the complexity and risks associated with DRM deployment.
3. **Efficiency, Security and Interoperability:** Balances computational efficiency with robust security, making the system ideal for real-time applications. This optimised approach also ensures that the DRM system is interoperable with other CENC-compliant solutions, whilst delivering encrypted licences and secure playback decryption, creating a holistic security infrastructure.

### 4.2 Digital Capsule Storage

The InterPlanetary File System (IPFS) is a peer-to-peer storage and content delivery network. It employs a decentralised architecture that mitigates server downtime and failure risks inherent in HTTPS. Built around content addressing, users can store, retrieve, and locate Digital Capsules via unique fingerprints called Content-IDs (CIDs). The network uses thousands of nodes, saving bandwidth and reducing latency. Buyers can additionally save CIDs to personal IPFS nodes, while the Arweave storage blockchain offers immutable CID backups via one-time payments. This supports Digital Capsule integrity and retrieval. AEP unifies these features, communicating globally with decentralised hosting, ownership, and backups nodes, and uses blockchain to register IP, govern rights, and enforce royalties.

### 4.3 Digital Capsule Ledger (ERC721)

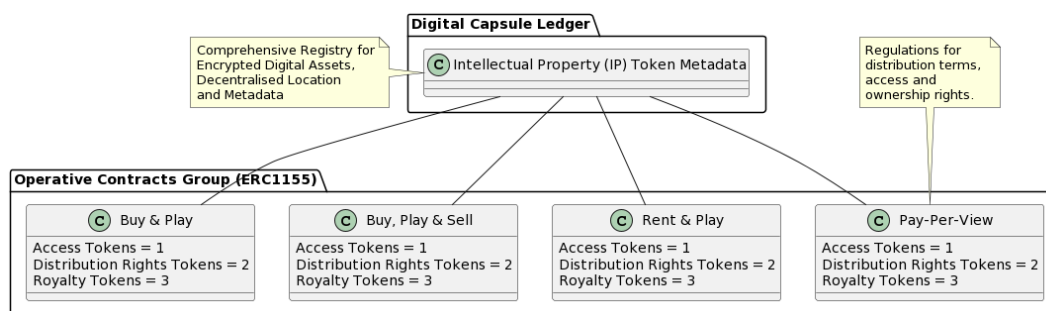
The Digital Capsule Ledger serves as a comprehensive Ethereum Virtual Machine (EVM) registry and ‘mint’ gateway for logging all encrypted digital assets, representing Intellectual Property (IP) as unique ERC721 tokens on a blockchain. Each IP token corresponds to a distinct Digital Capsule, its IPFS CID and an in-depth metadata schema which adheres to MPEG’s MCO, CEL and REL standards.



## 4.4 Operative Contracts Group (ERC1155)

Upon registering an asset to the Digital Capsule Ledger, an Operative Contract is generated that outlines access, distribution, and ownership rights as NFTs. These EVM Smart Contracts establish a clear business model for the Digital Capsule. While each Operative contract has unique regulations, all adhere to a unified language and guidelines. Tokens within an Operative Contract include:

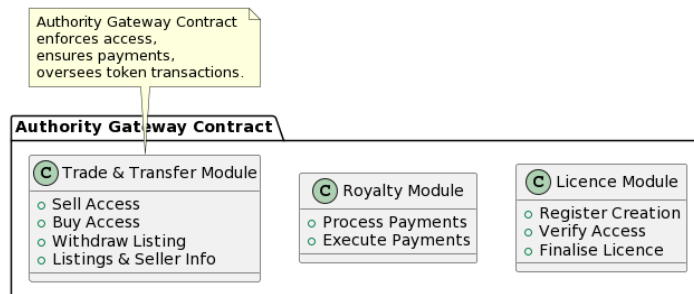
1. **Access Tokens:** Unique, tradable tokens with specific access rights embedded. Owners can issue any number, from one to billions, per contract. Scarcely defined Access Tokens introduce unique economic models, allowing for flexible, open-market trading globally between decentralised identities. Access Token holders have owner-specified rights to retrieve licences to decrypt capsules.
2. **Distribution Rights Tokens:** Owners set terms for Access Token sales and transfers, such as usage, transfer restrictions or resale percentage rights for buyers in secondary markets.
3. **Royalty Tokens:** Royalty Tokens represent ownership rights where holders receive instant profit-sharing to decentralised wallets from Access Token trades. The total supply is set to 1000 which is equivalent to 100 percent, making 1 Royalty Token 0.1 percent.



## 4.5 Authority Gateway Smart Contract

Acting as Elacity's primary marketplace, the Authority Gateway Smart Contract regulates content access, enforces payment processes, and supervises token trades and transfers. Its functions include:

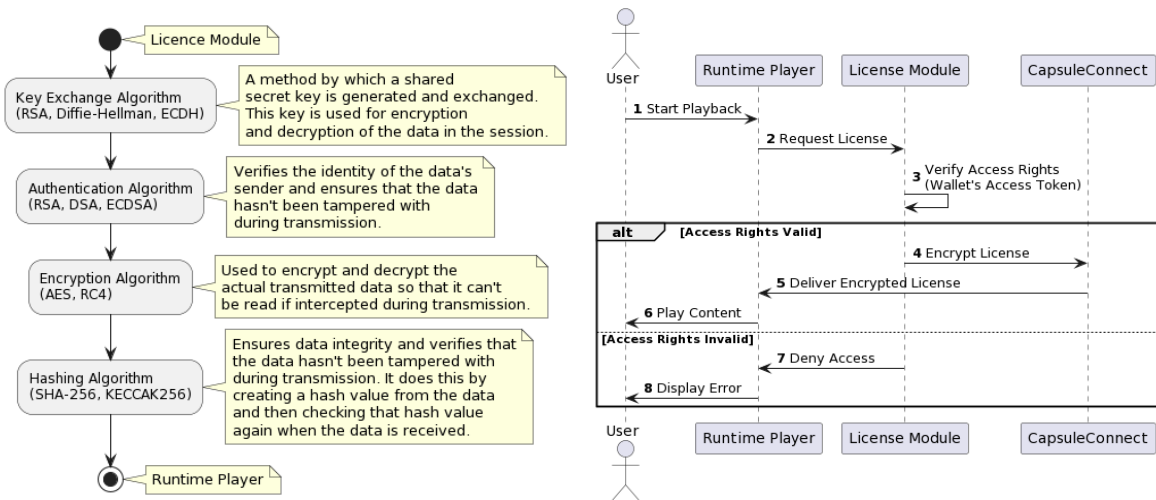
1. **Trade & Transfer Module:** Facilitates Digital Capsules Operative Contracts token listings, provides purchase and retraction options for buyers and sellers, and offers detailed insights into specific asset sales.
2. **Royalty Module:** Works in tandem with the Operative Contracts to guarantee accurate fund distribution during access token transactions to Royalty Token rights holders.
3. **Licence Module:** Streamlines licence management, issues licence keys to Access Token holders, and replaces traditional licence servers. The licence module verifies Access Token rights before issuing licences from a private function, ensuring on-demand, secure content decryption and correct playback for authorised users.



## 4.6 Licence Encryption: CapsuleConnect

To address the security concerns associated with ‘clear’ licence key interception and unauthorised Digital Capsule decryption, Elacity has developed CapsuleConnect, a WebAssembly-based (WASM) cryptographic protocol. This protocol securely encrypts licence keys for access token holders and facilitates communication between AEP’s Authority Gateway and the user’s device.

1. **WASM-Based Interoperability:** Utilises WebAssembly (WASM) for platform-agnostic and interoperable execution of binary code locally on various browsers and devices.
2. **Robust Security:** CapsuleConnect employs a Cipher Suite featuring ECDH-P256, AES, and SHA-256 for robust licence protection, without reliance on company-specific hardware or CDM software. The protocol is tailored for Ethereum’s Solidity using 256-bit Koblitz Curve encryption, achieving a balance between speed and security.



## 4.7 Decentralised Runtime Player for Secure Playback

In traditional DRM, Content Decryption Modules (CDMs) are embedded software in users’ browsers or apps, functioning as ‘black boxes,’ receiving encrypted licence keys from servers to decrypt DRM content for playback. CDMs are tied and specific to different centralised DRM systems, creating fragmentation and limiting playback interoperability. To address these challenges of security and universal playback, we have built a decentralised WASM runtime player.

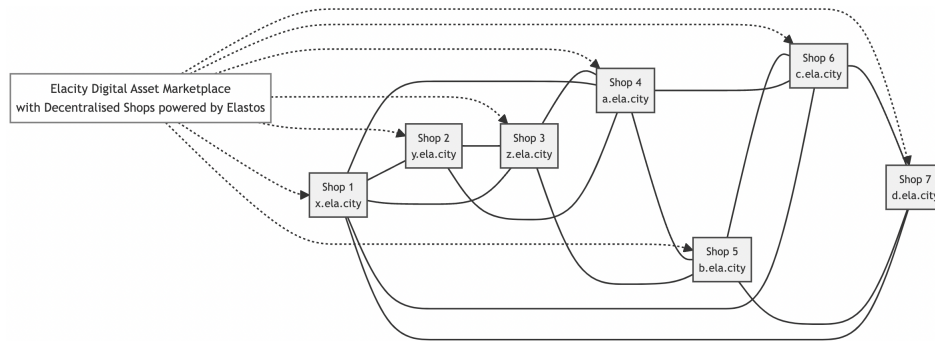
1. **Decentralised Web3 Playback:** Built on WebAssembly (WASM), runtime serves as a device-local, sandboxed execution environment to conventional CDMs, allowing interoperable playback solutions to run in a decentralised manner via both web browsers and apps.
2. **Direct Key Retrieval & Decryption:** Utilising CapsuleConnect, the runtime interfaces with AEP’s Authority Gateway for secure licence key encryption and retrieval, enabling direct decryption and playback for authorised token holders without any intermediary steps.
3. **Robust Media Support & Streaming:** Built with C and compiled in Emscripten, runtime currently supports video and audio, utilising MSE’s API, FFmpeg, OpenSSL, Libxml2, x264, and AV1. It provides adaptive, buffer-free streaming through MPEG-DASH, optimised for browsers.



## 4.8 Decentralised Distribution: PC2 Hosting & Communication

Decentralisation through edge computing empowers users with greater control over their own data, increases network resilience and further reduces dependency on centralised platforms.

1. **Personal Clouds and Edge Computing:** ElastOS, an Internet OS, exemplifies edge computing for local data processing by offering Web3-powered ‘Personal Cloud Computes’ (PC2s). These are software-defined Web3 computers [3] which encapsulate storage, communication, and CPU capabilities like physical computers yet run on-demand via browsers or 24/7 on personal servers, on home Wi-Fi or rented Linux servers.
2. **Decentralised Marketplaces and Hubs:** When managed using Decentralised Identifiers (DIDs) for log-in and user autonomy, PC2s boot identities and operate as independent ‘clouds’. By installing Elacity, owners convert personal clouds into public shops or distribution hubs. These hubs are discoverable on a decentralised, global peer-to-peer network via unique domain names, such as ‘sash.ela.city’. Ela.city serves as a trusted playback environment, an aggregated marketplace, and a comprehensive global PC2 directory, directing users to decentralised shops.

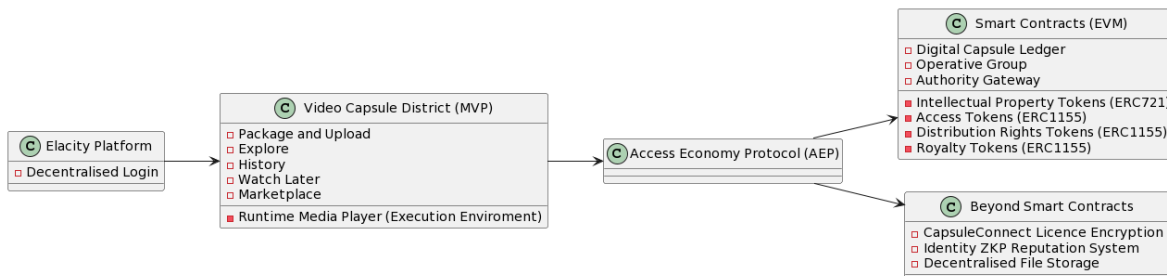


## 4.9 Reputation System: Verifiable Credentials and Zero-Knowledge Proofs

Ethical growth in the Access Economy must be anchored in legal compliance, consumer protection, and anti-illicit measures. Trusted third parties can issue Verifiable Credentials to users Decentralised Identifiers (DIDs) for completing KYC and AML checks. Using zero-knowledge proofs (ZKPs), users can then verify information without directly disclosing data to Elacity. This balance between privacy and security enables verified shops and age-restricted protection in Elacity, supports third-party accountability, and prevents bots and AI manipulation through proof of personhood. As credential systems evolve, broader ZKP applications like secure voting and credit systems are anticipated.

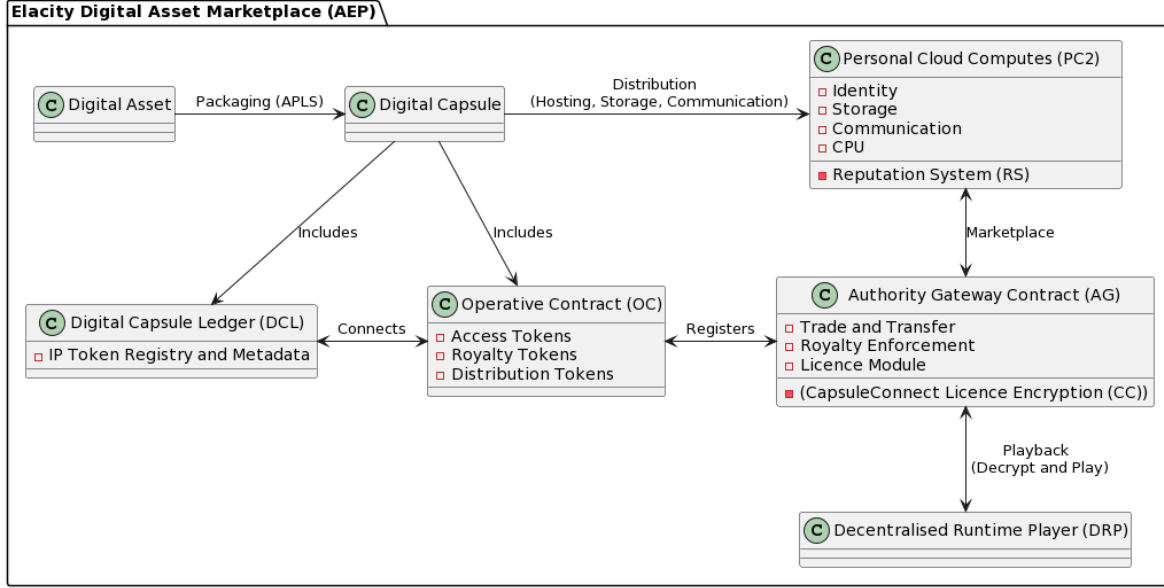
## 4.10 Elacity’s ‘Video Capsules’ Minimum Viable Product

Elacity’s “Video Capsule” MVP operates on the Access Economy Protocol, enabling creators to monetise various DRM-protected video content through tradable NFT access rights. Using EVM-compatible smart contracts, it automates complexity and delivers encrypted licences for browser-ready runtime player execution. The platform leverages decentralised IDs and IPFS nodes for global control and monetisation. It features a buy-now model, secondary markets, and instant wallet payments. As a privacy-centric, scalable solution, this marks Elacity’s entry into delivering Web3’s Access Economy.





## 4.11 Overview of Elacity's Access Economy Protocol (AEP)



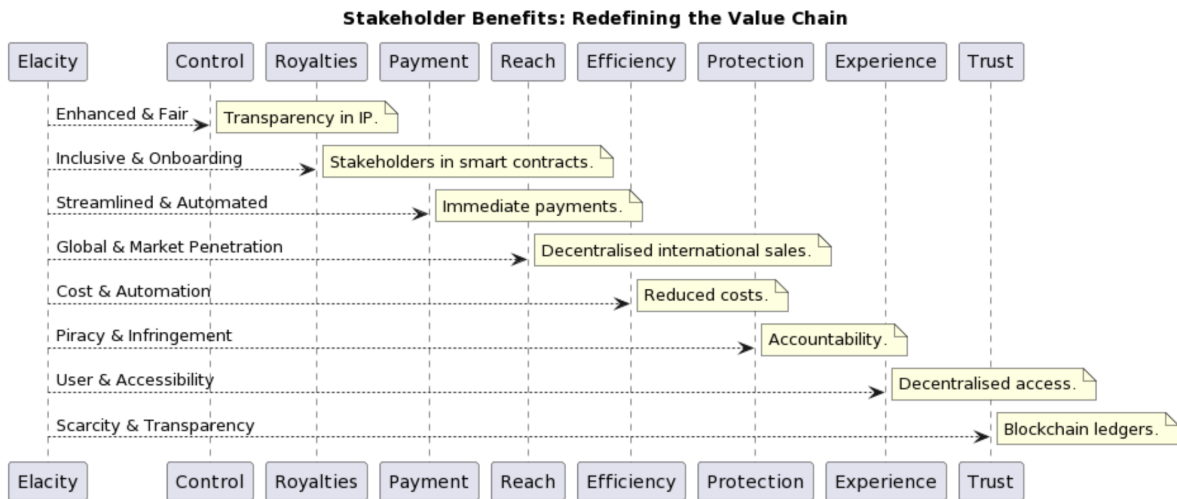
$$AEP = \left( \bigcup_{i=1}^N \{SmartContracts_i, OffChain_i\} \right)$$

$$AEP = \left( \bigcup_{i=1}^N \{\{DCL_i, OC_i, AG_i\}, \{APLS_i, CC_i, DRP_i, PC2_i, RS_i\}\} \right)$$

- **Packaging:** Owner/s encrypt digital asset into a Digital Capsule, incorporating the Asset Packaging and Licence Security ( $APLS_i$ ) and Digital Capsule Ledger ( $DCL_i$ ). Additionally, the Operative Contract ( $OC_i$ ) encodes the business model through the tokenisation of scarcely defined access, distribution, and ownership rights. This process encrypts a digital asset and registers the intellectual property and it's rights on the blockchain.
- **Distribution:** Capsules are hosted on Personal Cloud Computes ( $PC2_i$ ), serving as independent distribution hubs for hosting, storage, and communication. Utilising IPFS, these capsules are managed by decentralised identities and found on Elacity, featuring explore, trading ( $AG_i$ ) and playback tools ( $DRP_i$ ).
- **Licence Server:** Licence keys are managed by the Authority Gateway ( $AG_i$ ), a smart contract enforced by blockchain miners. This contract is responsible for executing permissions, trading, and overall governance, supplying encrypted licences for verified access token rights holders, simplifying content access and replacing traditional licence servers.
- **Licence Acquisition:** CapsuleConnect ( $CC_i$ ), a cryptographic protocol for secure licence key delivery, securely delivers encrypted licence keys directly to authorised token holders' Decentralised Runtime Player ( $DRP_i$ ) on their devices, effectively eliminating the need for middlemen.
- **Content Playback:** The Decentralised Runtime Player ( $DRP_i$ ) runs on a users device and decrypts the digital capsule, providing secure playback and direct communication with the smart contracts through CapsuleConnect and Personal Cloud Computes ( $PC2_i$ ) decentralised IPFS or Arweave storage.

**Note:** This system also integrates a Reputation System ( $RS_i$ ), which incorporates Verifiable Credentials and Zero-Knowledge Proofs for legal compliance and consumer protection.

## 5 Elacity's Business Model & Partner Benefits



Elacity's Access Economy delivers business models to Web3. Our business model is designed to empower a broad spectrum of stakeholders, from independent creators to large organisations, across diverse domains like entertainment, publishing, and software development. Through Elacity, stakeholders can monetise their digital assets while maintaining full control over access and distribution.

- **Asset Control:** Stakeholders create markets and set the terms of engagement by encrypting their digital assets and defining tradable rights. Users unlock these Digital Capsules through tradable Access Tokens, giving owners the control and immediate revenue streams they seek via holding and being able to trade Royalty Tokens on a globally decentralised network.
- **Decentralised Ownership:** We replace traditional, centralised licensing and royalty systems, eliminating middlemen costs. This opens the door for stakeholders to fully capitalise on emerging markets.
- **Transactional Transparency:** All transactions are direct, verifiable, and governed on the blockchain, adding a layer of trust and traceability that benefits all parties.
- **Automated Compliance and Inclusivity:** Our platform simplifies global distribution with smart contracts and peer-to-peer technology, while also enabling secondary markets through pre-defined percentages.

### 5.1 Business Model Expansion Opportunities via Access Economy Protocol

- **Buy Now:** One-time payment for indefinite Capsule access.
- **Rental:** Access content for a specified duration.
- **Pay-Per-View (PPV):** Charge per individual Capsule viewing.
- **Subscription (SVOD):** Recurring fee for a Capsule library.
- **Freemium:** Basic content for free; premium at a cost.
- **Ad-Supported (AVOD):** Free Capsule access with advertisements.
- **Capsule Bundling:** Package of multiple content pieces at a discount.
- **Early Access:** Charge for pre-release Capsule access.
- **Affiliate Sales:** Earn commissions promoting third-party products/services.
- **Derived Content:** Charge for Capsule that is based on, or derived from, original works (e.g., remixes, adaptations, or other transformative works).

## 5.2 Market Expansion Opportunities via Access Economy Protocol

### Established Markets

- **Documents:** Access e-books and research papers.
- **Imagery:** Access photos and art.
- **Audio:** Access music and podcasts.
- **Video:** Access films, documentaries, and video content.
- **Software & Applications:** Access decentralised apps (dApps) and plugins.

### Emerging Markets

- **Gaming:** Access games and in-game items.
- **3D Assets:** Access digital models and 3D designs.
- **VR/AR Experiences:** Access simulations, interactive content and Metaverses.

### Frontier Markets

- **Generative AI:** Access models.
- **Robotics:** Access robotics-as-a-service.
- **Real-World IoT Devices:** Access smart locks and smart city services.
- **Royalty Exchange:** Access ownership rights and digital asset income.

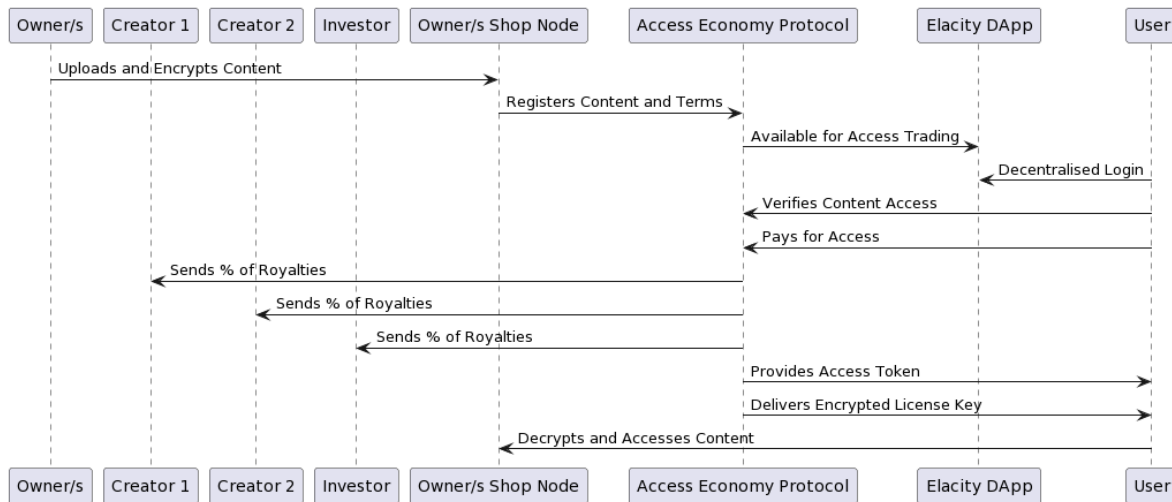
## 5.3 Revenue Sharing, User Experience, & Regulatory Compliance

Elacity offers global market access with transparency and fair revenue sharing while reducing administrative costs through blockchain automation. The platform ensures a high-quality user experience with seamless playback across devices. It builds trust via direct payment verification and offers valuable insights for content creation and pricing, streamlining operations and enhancing user trust. Security is paramount for Elacity, ensuring immutable proof of ownership while meeting ethical and regulatory standards like privacy and parental controls. We offer diverse storage solutions, from temporary to permanent, placing data control in owners hands. Our platform equips creators with the tools for effective digital asset management and monetisation, balancing availability with secure, compliant access.

## 5.4 Elacity's Revenue Generation Model

- A 5% publishing fee on the Access Economy Protocol (AEP) fuels technological innovation and market expansion. Of this 5% fee, 3% can be claimed by stakeholders globally through an optional affiliate link for asset onboarding support. 95% of a Digital Asset's revenue on Elacity is freely allocated and tradable among stakeholders. Revenue streams directly to individual decentralised wallets with each transaction. APIs are additionally available for custom platform development. Developers can integrate assets into the AEP and set their own fees.
- Elacity 'postcode' domain service (eg sash.ela.city) for decentralised networking and Personal Cloud Computes (PC2s).
- Contracts, grants and Elacity licencing agreements for bespoke Web3 Access Economy solutions.

## 6 Conclusion: The Access Economy in Web3 with Elacity



Owners have the right to control the distribution and access of their intellectual property. On the current internet, data can be easily duplicated, making it abundant and often devaluing it. In contrast, physical goods cannot be effortlessly duplicated, giving them inherent value due to their scarcity. Efforts to protect and commercialise digital assets scarcity is driven by Digital Rights Management and content distribution systems, which are filled with challenges stemming from centralised control, poor transparency, and high fees.

Owning a digital asset or ‘Digital Capsule’ in Elacity’s Access Economy would be akin to owning a copy of encrypted code. Blockchain, a decentralised and transparent ledger, is used to validate rights and authenticity to decrypt these digital capsules. It ensures that a digital asset’s ownership is transparent and verifiable, where decryption rights are scarce and held by decentralised identities, represented as scarce globally tradable units or NFTs.

This is a paradigm that combines the principles of digital ownership with blockchain validation. It implies an internet where assets are smart (i.e., they have inherent logic, validation, and can interact with other systems) and where the value of these assets is protected and verifiable. Elacity is building its vision of a secure, equitable digital asset marketplace, using data ownership toolsets. By revolutionising the digital asset landscape through decentralising digital rights management alongside peer-to-peer technologies, we redefine and introduce the Access Economy to Web3.

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