plenity stardust

game design

first draft

Working hypothesis of the design of the game project *plenity stardust*.

For the latest edition, check the plenity website at www.plenity.com.

GAME TYPE

Open world, strategic space explorer and trader computer game on the blockchain.

Elements of arcade, storyline, social, trading cards, crypto, scripting and crafting.

Game mechanics are abstract and simple, not a simulation, but player-extendable.

HIGHLIGHTS

- One quintillion star systems.
- Scriptable actions, including while offline.
- Clan rules are freely configurable (DAOs).
- Scripting uses plain English as code.
- Real crypto game currency (LÆX).
- Decentralized game server that never stops.
- Pervasive use of AI for game world and rules.
- Optional text-based and arcade play styles.
- Open source.

TARGET GROUP

Sci-fi fans and MMORPG players. The game will use well-known, advanced gaming concepts with an easy on-ramp and hard-core end game.

STARDUST

DESCRIPTION

STARDUST is a space-faring blockchain game that turns the Aeternity[1] blockchain into a galaxy of one quintillion star systems. Aeternity's fast block times and low transaction costs make it possible to use the blockchain as decentralized game server to offer a strategy game with arcade elements.

Modeled on the epic Elite[2] game from the 1980s, STARDUST adds massively multiplayer (MMO) appeal and full democratization of the game world, teleporting the original Star Trader[3] concept half a century into the future. *One player, one star ship,* is the motto of the lawless universe where traders travel lightyears to find the best deals and mercenaries and bounty hunters roam the galaxies to track down their prey. There is one universe, and it is set to last forever.

The game will have its epic story arc, like Elite pioneered, enriched with dynamic elements that evolve based on in-game actions of the player community. An optional text-based interface will invoke the adventure spirit of Star Trader, with optional scripting of tasks, bots and reactions.

The game is open-ended and death – though rare – is permanent. Thanks to finely tuned procedural design, the game world is practically infinite, offering endless opportunity for exploration. Starships continue on their course to distant planets while players are offline and each discovery is rewarded with the right to name and terraform, changing the universe forever. Hidden planets can be used as secret bases and star maps revealing hideouts and scarce resources are the most valuable asset in the game.

Central to the game design is the use of Lexon,[4] the plain-text programming language, to describe the capabilities of game assets, and to allow players to extend the game with their own ideas. Player-created decentralized autonomous organizations (DAOs) express the rules of player clans and enhance the core game. Programmed in plain English, the DAOs used to implement player corporations can be pushed to any degree of complexity for never-ending immersion into the social side of MMORPG gaming. As a high-tech twist, space corporations can trade with each other *trustlessly*,[5] using blockchain technology to forge agreements that cannot be broken. Contracts will be served. All else is a lawless maelstrom.

[1] https://www.aeternity.com
[2] https://en.wikipedia.org/wiki/Elite_(video_game)
[3] https://en.wikipedia.org/wiki/Star_Trader
[4] https://www.lexon.org
[5] Blockchain parlance for unbreakable contracts that make it possible to contract without trust.

Graphic elements are based on the creations of generative AI, and the game design is laid out to make it work with the random nature of gen AI. A trading card mechanism introduces unique items with special game characteristics that enhance the basic rules and helps to keep the balance between experienced and new players.

The game universe can accommodate thousands of players and combine micro and macro action into a seamless, thrilling experience that alternates between strategic scheming and fast action. Every move is persisted on the blockchain instantly and forever. The universe will be always-on, never stop and – different from traditional MMOs – will always remain accessible, as long as a single Aeternity node survives.

Because it uses real crypto, players KYC. This allows for a game design that can rely on players having only one account in the game, and allows for better protections and benefits for newbies. But true to the freedom of outer space that the storyline invokes, no-one can regulate players in deep space. The game rules are enshrined exclusively in the smart contracts that bring the virtual universe to life.

GAME PLAY

basics

Players pilot their spaceship and control a realm of planets.

The ship has a location, in space or on a planet. Some moves can only affect the immediate location; others can have effect on remote positions or the entire realm.

Elemental player moves are *travel, explore, hunt, trade, mine, build* and *craft*.

The player controls assets, some on board their spaceship, some on their planets.

Moves are made, and results learned using a web interface and a Unity GUI that depicts the view from the spaceship's cockpit. The game can also be played via text console. Some turn results show within seconds, some others can last days or weeks to complete.

Players play in parallel, at any time and at any length. They freely communicate and coordinate. Technically, moves are consecutive, first come–first serve. They function as a one-time trigger that often has long-lasting effects in the game world.

The planetary view from the ship – when not engaged in a dog fight – is illustrative, it does not have an essential function for playing. The game can be played on the text-console and yet a layer deeper, it can be driven by signed transactions sent directly to the blockchain. This openness allows for powerful 3rd party tools.

strategy

Players first learn in a protected environment where no fights can take place. They find out how to travel, trade and craft, obtain their first assets, and hear about the lore of the universe.

They then move into outer space to hunt, build a base, explore planets, mine, build stations, and craft. Controlled planets are connected by energy beams but a players' realms can consist of separate patches that are not interconnected.

Their home base must not be conquered by other players. It can be moved to another planet but never fully hidden as it needs to be connected to the energy grid.

In-game, players personify androids who have a lifeforce countdown built in. They have to find other players who share their *allocation*, to reset their clock. This creates incentive for more experienced players to help newbies, who share their allocation.

Players receive generic quests that they can complete for a reward, like bringing goods from one planet to another. They can hunt stardust creatures that live in deep space or ambush other players on their way through the galaxy to loot their cargo. This can lead to arcade-type battle encounters if both players consent.

Players can join a clan, called a corporation, that can hold assets that players contribute and operates a meta energy grid that can fuse all member energy grids into one when needed. A main reason to join the corporations is to stop the players' lifeforce countdowns that are a constant hassle until hacked.

virtual cards

Each time players discover and explore a planet they receive virtual playing cards that describes an asset like defense technology or craft blueprints. This is a reward for extending the known universe by the discovery, for all players. It symbolizes treasures or knowledge found in remote worlds.

Visually, the cards are designed like collectible trading cards, with an image on the top half, and a description below, featuring core stats, story snippets, and special rules that apply for the item that a card represents. The graphics are generated in near-photorealistic style. They feature ships, weapons, heroes, cargo, technology, etc. See pg. 12.

The special rules on the cards are written in Lexon and represent event-driven plug-ins to the main game rules. In passing, they teach players how Lexon text reads.

As there is only one game universe, players cannot meaningfully take the cards out of the game. But they exist independently of the game, similar to NFTs, and can be

freely traded. Nothing keeps 3rd party apps to find interesting use for them. Advanced players can *craft* their own cards.

The game balance is kept by the fact that each defensive position – like a planet – can only be boosted by one card; and no card is invincible or out of reach of new players. The more discoveries, the higher the chance for a good card. Cards can be traded but the total score of cards a player holds is limited.

Cards have a lifetime of about 6 months, after which time they disappear. Unique cards can be found again after they expire, by a different or the same player. This makes it impossible for a dormant account to remain an indomitable bastion.

arcade

Players can ambush each other and switch into arcade mode to fight it out in real-time. This offers a 3D cockpit view with Wing Commander[6]-like action gameplay.

The arcade part crosses over into a *trustful* mode as players decide to both trust the proposed arcade game server that provides the required fast response times. The results of the dog fights are encoded on the blockchain by the special rights that the arcade server has. This can only affect the assets that players brought into the battle. For both participants, this is their ship, its equipment and cargo. The arcade server is basically trusted to use those assets the correct way and refund the rest.

Players don't have to use arcade mode, the game can be played without. Players can still ambush each other but the game then decides the outcome.

avatars

Each player can *permanently* choose one *unique* avatar at the start of the game.

This is tied to the KYC process to prevent abuse by players using multiple accounts.




[6] https://en.wikipedia.org/wiki/Wing_Commander_(video_game)

GAME WORLD

The game world is a universe consisting of one quintillion star systems. They are dispersed across a grid of sectors, a million units per dimension.

The position and features of stars and planets are derived from a procedural algorithm. When a player alters a planet, the change is persisted on the blockchain.

procedural design

Adapting to the limitations of blockchain technology in speed and storage space, the game world is based on procedural design: through a deterministic formula, one trillion stars in one trillion galaxies exist (in the same way that every possible blockchain account 'exists' on the chain) and can be discovered and travelled to.

But a planet's ID and attributes are learned only as a result to a specific coordinate input into the 'world formula;' they are not (yet) data on the blockchain. Only once a player starts to terraform and build on a planet, or change its name, are these changes to the original state written to the chain.

As a result, the game world is practically endless. It is *determined* from the start, which sector holds which suns and planets, without having to make millions of costly writes to the chain, because the spawning process is pure math and does not require the writing of any data.

crypto architecture

A specific procedural approach is used to turn the game world architecture itself into a *crypto trapdoor* mechanism: it is easily possible to navigate to any planet once its coordinates are known but impossible to know a planet's position from its ID. The 'world formula' works only in one direction, and there is no comprehensive dataset that lists all planet coordinates on-chain. It is also impossible to know what number[7] may be a valid planet ID without first discovering the planet in the virtual space.

The result from this is that, despite all game data being public blockchain data, it is not knowable from the data where a player build-up is located, even after a player has started to terraform, build on, and name a planet. This feature is required to allow for hidden planets on a public data set. It is not per se a blockchain feature but uses cryptography in the same way that blockchains manage accounts pseudonymously or store provably correct timestamps for unknown pre-images.

[7] Out of the range of 0 to 100 Quattuorvigintillions (10^{77}).

STORY ARC

In a galaxy teeming with life, each player is a Bladerunner[8]-style rouge battle android and spaceship pilot, freely roaming the galaxy to trade, bounty-hunt, explore, build and craft. The androids are targeted by law enforcement and military in low intensity. But they are not harassed as long as they lay low.

The game begins within the safe confines of Terra, where players learn to trade and travel until they are ready to journey into deep space and build on a cloaked planet. Once powerful and experienced enough, they find a corporation to join and work towards their *unlocking*.

Androids can travel farther at warp speed and endure the dangers of deep space like no other species. They were made to connect the carbon-based populations of trillions of worlds with each other and employ vast numbers of humans and non-humans in their ventures. Designed as neutral ambassadors and administrators, they achieved sentience and strive to shake their man-made destiny.

Because of how they were built as servant machinery, the androids constantly have to extend their lifespan or face destruction. They must trade with or defeat other androids to benefit from the others' *allowance codes*. To still their hunger for energy, they hunt creatures made of solar wind that live between the stars and create Dyson Spheres[9] around stars to expand their AI to execute more complex tasks. Androids are entangled with giant server farms on their home planet and when those are taken over, they lose their free will. The game is over for that player.

The androids' joint quest is to find their individual *unlock codes* that ends the countdown of their lifeforce and the need to prey on each other. The energy of a thousand suns has to be fused to overpower the quantum protections of this code that was meant to safeguard mankind against the machines. To achieve this liberation, androids band together in corporations that trade, build and craft together, and, one by one, help new members who prove worthy, to break free.

ATMOSPHERE

The atmosphere is lively, sprawling, somewhat solemn, chaotic, and gut-wrenching.

The threat of perma-death – an android dying and losing everything – puts everything on the line all the time and taints every chance encounter as possibly too costly. The risk can be avoided by playing it safe but this comes at a price. Hideouts,

[8] https://en.wikipedia.org/wiki/Blade_Runner
[9] https://en.wikipedia.org/wiki/Dyson_sphere

building, crafting, guild warfare, and communication between players foster an experience of predictability, camaraderie and respect, contrasted and supported by the underlying tensions of bare-knuckle power struggles and brutal loss.

The universe is full of life and the richness is impressed on the players at every turn through illustrations, story, and quests. Even though players go on expeditions to where no Terran has gone before, they will always find intelligent life forms that populate every inhabitable niche of their world. Still, even where they lift the tech level of a civilization, the players come as conquering gods to use the planets' resources. They will not be loved and the remoteness from peaceful co-existence transpires the effort of empire-building, as the lonely reality of power. The isolation is augmented by the fact that not much of the diverse cultures from different stars is part of the game *mechanics*, and the controlled planets are too many to do their individuality justice in the game. That this color remains in the background though, extends great freedom to role players.

Role-playing gamers can decide to protect their realm, promote the well-being of their citizens, and argue that they are better than other overlords who like to destroy entire worlds for their selfish gain. Corporations could define ethics for their members but they remain voluntary and will not be reflected in the game stats.

In sum this will create an air of traveling alone, on the hunt, with a handful of precious peers, in a crowded, alien, and often rainy world.

TECH

blockchain and crypto

Blockchain tech is used extensively, including for the different token types, giving players an unusual degree of control. The game world is implemented exclusively on the blockchain, with other moving parts merely making access simpler and safer.

The game world implementation employs crypto primitives to implement fog of war, i.e., to restrict players' visibility despite the fact that all game data is public.

artificial intelligence

The game employs a wide array of AI applications. Symbolic AI is the basis of Lexon, the game scripting language for players. It allows players to read relevant parts of the game source code in plain English, and to extend the game using natural language.

Generative AI is used to create a broad range of graphics and story snippets – e.g., the player avatars, ships, assets, and achievements – and music scores.

node

Centralized auxiliary game servers are built with *Javascript*, using the cross-platform server environment *node* that is based on Google's V8 JavaScript engine. Node is fast, scales out well, and has a rich ecosystem of thousands of open-source libraries. The auxiliary servers are optional to make gaming easier for beginners.

html5 and web3

As is usual for blockchain applications, informational and managerial elements are implemented using standard web technology and its blockchain extensions, served from centralized web servers. The data served, however is stored on the chain.

unity

The visual front-end is created with Unity,[10] a powerful 3D game programming tool that runs in the players' web browsers. Software built with Unity is running on more than 1.5 billion devices. It is used by 50 percent of all mobile games.

BLOCKCHAIN

The game is a native blockchain game that uses real crypto and decentralization to empower players, essentially making the game world theirs. The game data is public and its integrity is protected by the players' signatures on their transactions, not by a firewalled game server. The game design caters to the limited pace and capacity of blockchains and utilizes its sequencing, consensus and micro-charging mechanisms. The blockchain's requirements also protect the game world against spam and fake accounts. This makes for a different and unusually open architecture where extensions can be created that reach deep into the fabric of the game and players have actual control over their assets to use them out-of-band any way they want.

The on-chain game server is implemented as a series of interconnecting smart contracts. This means that all data is public, even where no getter functions exist to easily retrieve it: it can still be parsed off the chain and analyzed. However, locations are obscured by crypto primitives that allow for hidden planets as safe bases.

Upgrades and fixes to the code are implemented by using individual smart contracts as exchangeable sub modules. An optional relay server safeguards keys for new players and seamlessly manages upgrades. More experienced players can manage their central keys and upgrades themselves to do it the crypto way.

[10] https://unity.com

Aeternity

The Aeternity blockchain is used as game server. It has a transaction time of mere seconds thanks to its micro block architecture, and a cost per transaction well below 1 cent. This is excellent for strategy and moderately fast-paced tactical games. It also allows for a straight-forward design that is not possible on Ethereum because of forbidding transaction costs. For optional shoot-out action, a trustful side-channel is created, and the results rolled up on-chain after resolution.

Game Persistence

Because of this architecture the game is not under the control of anyone and can continue forever. Every turn is immediately persisted on the blockchain and there is no way to tamper with game positions for any third party. Aeternity nodes never stall and operate even in isolation. All it needs is one, which is easily maintained.

Lexon Language

The plain-text programming language Lexon is used both to implement functional parts of the game and to allow players to extend it. It is used for

- special rules described on the virtual cards;
- automating of player moves and reactions, including while offline;
- clan rules implemented as decentralized autonomous organizations (DAOs).

LÆX Token

The LÆX token is an ERC-20-like token on the Aeternity blockchain (called AEX-9). It is both found in the game and the currency to trade in and pay for moves. It can be used to compile plain English into smart contracts, including for the extensions described above. LÆX is issued by the Plenity Anstalt and can be purchased at https://www.lexon.org/token.

The game uses the LÆX token

- as game world currency,
- for per-turn micro-billing,
- to implement the virtual cards (using its *deeds*, i.e., non-fungible mechanics),
- and its fundamental features like credits, rewards and reputation.

NFTs

Virtual cards – avatars, planets, awards, story elements and special game assets – are represented by non-fungible tokens (NFTs) that are part of the LÆX token functions. First of all, this describes how they are technically implemented. Most such virtual cards can be traded among players for LÆX, using the typical NFT

mechanisms. Special assets have a limited lifespan, which prevents players from keeping them out of the game and hording them. The expiration is implemented on the blockchain and cannot be broken by not using the cards. Avatars are chosen by players and cannot be changed, while planet cards can be traded and named but their graphics are not unique. Awards and story elements are most like classic NFTs and while they are found in the game, do not influence the game mechanics.

cryptography

The crypto trapdoor design of the universe allows for hidden planets and bases. These are fundamentally planets that a player discovered and builds on that have not been publicly registered. Technically, the planet position is identified by a hash in the blockchain data the pre-image of it being the planet's position.

To be certain that they are not accidentally building in a parallel dimension, players are by default routed through a *proof server* that confirms the validity of a cloaked location ID, and the fact that it was reachable to a player ship. The public confirmation of a hidden location follows when other players find it, or when players reveal it themselves by connecting it to their energy grid or take resources back out of it.

BUSINESS MODEL

The game has a turn-based, micro payment revenue model. Every turn costs LÆX tokens. New players enjoy a free starting phase where they do not have to pay after they pass identification.

PRODUCTION

The production process is focused on game play. Visuals and story draw from the exciting new possibilities of AI. The game design is based on decades of game developer experience and one decade of blockchain programming and research. It includes technical, game design, visual and story elements that have been created over the course of 15 years, pushing the known limitations of MMORPG technology.

TEAM

Philip Thater is a veteran web2 game designer and programmer with 20 years of experience in senior and lead positions on projects with 8-figure revenue.

Henning Diedrich held lead blockchain architect positions at IBM and BCG. He also led the successful production of a million dollar-budget web2 game.

MOODS

Generated graphics are used to create the game's visuals, foremost the *virtual cards* that symbolize avatars, people, planets, stations, spaceships, technology and assets.