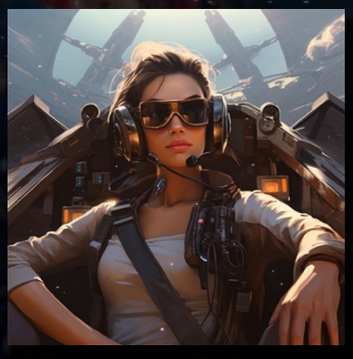
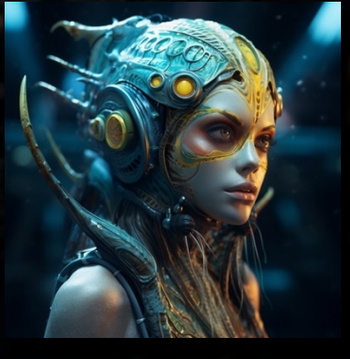
plenity

STARDUST

design 1.8-240731





STARDUST

STARDUST makes you a near-immortal android, a starship pilot, hunting energy forms between the stars, **trading, fighting, and bonding** with thousands of fellow players in a gigantic universe of trillions of stars. Players must cooperate to survive. A 3D real-time game client visualizes the journey through crypto space. The icing is the ultra-free clan mechanism that implements **guilds as DAOs**.

Based on **real blockchain** qualities, we use decentralization, democratization and participation to add features to MMOs that only crypto can bring. Players will truly **own their world**. Forever.

Based on **generative and symbolic AI** we are creating an elegant, simple, and doable design leveraging our team's decades of experience in blockchain and game programming.

We use cryptography to realize **hidden planets**, procedural gamer math for a vast, **fully open game world**. The game credits are **real tokens**, and game assets are NFTs that no-one but the player controls.

The **blockchain is the game server**, with no intermediate trustful layer in-between. No roll-ups, no caching. The full **game state resides on-chain**, including the hidden star bases. This is the native blockchain way, more robust and powerful than any over-engineered layout. It grants amazing options for truly trustless gameplay.

Players pay turn-for-turn with **microtransactions**, as was envisioned at the beginning of the blockchain era. Visionary decisions in the game design, a smart choice of tools, based on deep knowledge of the crypto ecosystem, make this simplicity possible.

Stardust is the brainchild of experienced web2 game developers and a veteran blockchain architect. It uses more than a decade of research and learnings. We roll for passion. We are looking for contributors and partners for acceleration.

www.plenity.com

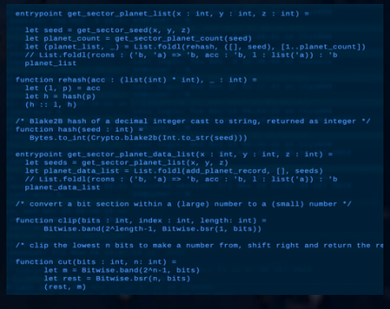
STARDUST

GAME DESIGN

STARDUST[1] is an open-world, strategic space explorer and trader game design for blockchain. It blends elements of **arcade, storyline, social, trading cards, crypto, scripting and crafting**. Game mechanics cater to blockchain strengths, & are player-extendable in a new, crypto way.

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.
- Decentralized game server that never stops.
- Pervasive use of AI for game world and rules.
- Optional text-based and arcade play styles.



```
entrypoint get_sector_planet_list(x : int, y : int, z : int) =

  let seed = get_sector_seed(x, y, z)
  let planet_count = get_sector_planet_count(seed)
  let (planet_list, _) = List.foldl(rehash, ([], seed), [1..planet_count])
  // List.foldl(rcons : ('b, 'a) => 'b, acc : 'b, l : list('a)) : 'b
  planet_list

function rehash(acc : (list(int) * int), _ : int) =
  let (l, p) = acc
  let h = hash(p)
  (h :: l, h)

/* Blake2B hash of a decimal integer cast to string, returned as integer */
function hash(seed : int) =
  Bytes.to_int(Crypto.blake2b(Int.to_str(seed)))

entrypoint get_sector_planet_data_list(x : int, y : int, z : int) =
  let seeds = get_sector_planet_list(x, y, z)
  let planet_data_list = List.foldl(add_planet_record, [], seeds)
  // List.foldl(rcons : ('b, 'a) => 'b, acc : 'b, l : list('a)) : 'b
  planet_data_list

/* convert a bit section within a (large) number to a (small) number */

function clip(bits : int, index : int, length: int) =
    Bitwise.band(2^length-1, Bitwise.bsr(1, bits))

/* clip the lowest n bits to make a number from, shift right and return the re

function cut(bits : int, n: int) =
    let m = Bitwise.band(2^n-1, bits)
    let rest = Bitwise.bsr(n, bits)
    (rest, m)
```

the galaxy spawn code, prototype

The game is for web2 and mobile gamers, crytpo buffs, Sci-fi fans and MMORPG players. It will feature an easy on-ramp, well-known, advanced gaming concepts and a hard-core endgame.

The extensible endgame is unique. For spirit, we want to compete with Dark Forest.

STATUS

We are building the visual and technical proof of concept. See first (μ) server protocol specification [μ] Plenity Stardust GUI Server Protocol 1.0.1.

ROADMAP

Our playable demo will include:

- The near-infinite universe map
- The first-person graphical GUI
- All basic player moves

OPEN SOURCE

Program, game world, and game data will be open source.

[1] plenity.com

STARDUST

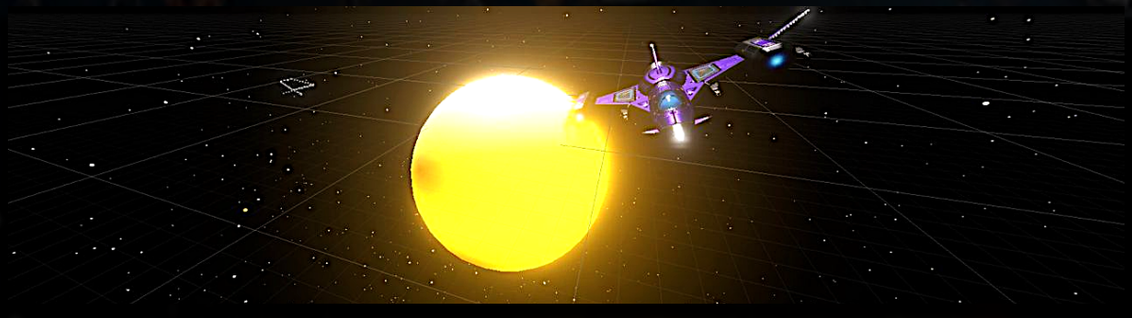
DESCRIPTION

STARDUST is a space-faring blockchain game that turns the blockchain into a galaxy of one quintillion star systems.

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 maxim 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 text adventure spirit of **Star Trader**, for optional scripting of tasks, bots and reactions.



in-game visuals (early GUI prototype in Unity)

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

[2] https://en.wikipedia.org/wiki/Elite_(video_game)
[3] https://en.wikipedia.org/wiki/Star_Trader
[4] https://www.lexon.org

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.

STARDUST has a strong artistic streak built into its DNA that envelopes its graphic design as well as storytelling, filmic elements and musical score.

The 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.

in-game visuals (actual HTML5 programming, not photoshopped)

The 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 blockchain 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.

Our chosen blockchain's very fast block times and very low transaction costs make it possible to use the blockchain itself as decentralized game server to offer a strategy game with arcade elements.

[5] Blockchain parlance for unbreakable contracts that make it possible to contract without trust.

STARDUST

GAME PLAY

BASICS

Players pilot their **spaceship** and control a **dominion 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 moves are ***travel***, ***explore***, ***hunt***, ***trade***, ***ambush***, ***mine***, ***build*** and ***craft***. Players move to complete quests they accepted or to achieve their own goals. There are major common milestones in every player's career. The final stage is acceptance into a **corporation** and organizing coordinated building, crafting and domination.

The players control **assets**, some on board their spaceships, some on their planets. The assets are represented as virtual collectible trading cards, or NFTs. Most moves use, consume, require or acquire assets.

Moves are made, and results learned using a web interface and a Unity GUI that depicts the view from the spaceship's cockpit. Some results show within seconds, other moves can last days or weeks to complete.

Players play in parallel, at any time and at any length. They freely communicate, coordinate and exchange. 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 to emerge.

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' dominion 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 be fully hidden as it needs to be connected to the energy grid.

STARDUST

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

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, trustful 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 a corporation is to get rid of a player's lifeforce countdown that is a constant hassle until hacked.

VIRTUAL CARDS

Each time players discover and explore a planet they receive virtual playing cards that each describe an **asset** like defense technology or a craft blueprint. This signifies a reward for extending the known universe by the discovery. It symbolizes treasures and knowledge found in remote worlds.

The cards are designed like **collectible trading cards** (see pages 6 and 9), 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**, and **technology** (see page 2).

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, an experience they can later use to **extend the game**.

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. While cards can be traded, the total score of cards a player can hold is limited.

Many cards have a **lifetime** of between 1 and 6 months, after which time they disappear. 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.

STARDUST

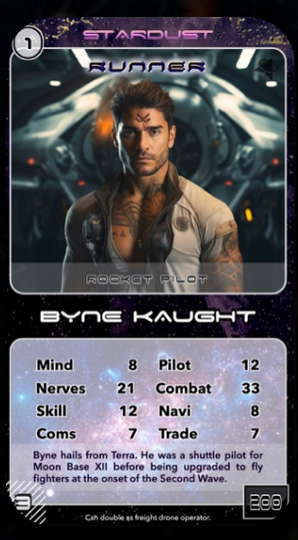
ARCADE

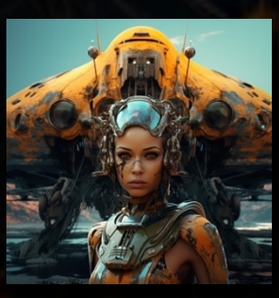
Players can ambush each other and switch into arcade mode to fight it out in real-time. This offers a 3D cockpit view with Wing Commander[6]-like action gameplay.

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 trusted to employ those assets the correct way and correctly distribute the spoils.

Players don't have to use arcade mode, the game can be played without. Players can still ambush each other. The game serving smart contracts then decide the outcome.

AVATARS





Each player can **permanently** choose one **unique** avatar at the start of the game. This selection is tied to the KYC process to prevent abuse by players using multiple accounts. Avatars are depicted as virtual cards and bestow abilities. AI is used to create the imagery for unbeatable individuality.

FUTURE UPGRADES

Upgrades to the game can be frequent and branch out in three directions:

MEDIA INTEGRATION

Film elements will be spliced into the story arc to deepen immersion for players.

RARE COLLECTIBLES

Collectors will find rare items that can be held and collected like other NFTs.

SPECIAL EVENTS

A staple of web2 games, based on temporary mini games embedded in the main.

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

STARDUST

EXPERIENCE

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. This universe is created using pseudo randomness, but it then **never changes**:

Positions 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. Every exploration and every terra forming move will remain relevant forever. Players thus have true and lasting impact. Bots and hardware are allowed to aid in the mapping.

This will create an air of real discovery and invite pioneering spirits to leave a lasting mark early. At the same time, **players need each other** to succeed and survive as per the game mechanics, which prevents the vastness from producing a solo experience.

STORY ARC

In a galaxy teeming with life, each player is a Bladerunner[7]-style rouge battle android and spaceship pilot, freely roaming the galaxy to trade, bounty-hunt, conquer, explore, build, and craft.

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. In the **Pacified Sector of Earth**, the players are targeted by law enforcement and military in low intensity. But they are not severely harassed as long as they lay low and don't use violence.

Once powerful and experienced enough, players find a **corporation** to join and work towards their **unlocking**, to become immortal.

The players personify androids who can travel farther 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 to employ vast numbers of humans and non-humans in their ventures. Designed as neutral ambassadors and administrators, they achieved sentience and now 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 by their built-in countdown. They must trade with or defeat other androids to benefit from the others' **allowance codes**.

[7] https://en.wikipedia.org/wiki/Blade_Runner

STARDUST

To still their hunger for energy, they hunt creatures consisting of solar wind that live between the stars, the **stardust**. They create Dyson Spheres[8] around suns to generate energy to expand their AI capacity, to be able to execute more complex tasks. And they are entangled with giant AI server farms on their home planet. If those are taken over by others, they lose their free will. The game is over for that player then.

The androids' joint quest is to find their individual **unlock codes** that end the countdown of their lifeforce and the need to prey on each other. The energy of a thousand suns must be **fused** to overpower the quantum protections their human creators layered onto 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 help new members who prove worthy, to break free.

ATMOSPHERE

Lively, sprawling, 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. This risk can be avoided by playing it safe, but this comes at a price. Shared hideouts, building, crafting, guild warfare, and communication between players foster an experience of predictability, camaraderie, and respect. This is contrasted—and the sweeter for it—by the underlying tension of bare-knuckle struggles and brutal loss.

The universe is full of life and its richness is impressed on the players at every turn through illustrations, story, and quests. Even when 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 respective world. Still, even where they lift the tech level of an alien civilization, androids come as conquering gods to use a planets' resources. They will not be loved and the remoteness from peaceful co-existence permeates the effort of empire-building, as the lonely reality of power. This emotional isolation and aloofness is mirrored in the fact that not much of the diverse cultures from far-away stars is reflected in the game *mechanics*; and the number of planets in a player's dominion are too many to do their individuality justice in the game. That this color space remains in the background 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 can define ethics for their members. But this will remain optional behavior, not reflected in the game stats.

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

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

STARDUST

TECH

PROCEDURAL DESIGN

Embracing the limitations of blockchain tech, its speed and storage space, the game world is based on advanced crypto and gamer math.

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. A planet's ID and attributes can be learned by exploring a specific coordinate, that is,

by feeding it into the world formula. The attributes are not initially data on the blockchain.

Only once a player starts to terraform or build on a planet, or change its name, are such changes to the original state written to the chain.

As a result, the game world is practically endless. Both in dimension and time. It is *determined* from the start, which sector holds which suns and planets – but without making millions of writes to the chain. Because the spawning process is pure math that does not require the writing of data. It is still as fix as the speed of light.

CRYPTO ARCHITECTURE

The crypto trapdoor design of the universe allows for hidden planets.

Hidden planets and bases are places that a player discovered and can build on that have not been publicly registered. Other players can therefore not find them.

The trapdoor is realized by the fact that 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. Because the universe consists of trillions of systems, it can never be fully mapped out. It is also impossible to know what

random number[9] may constitutes a valid planet ID without first discovering the planet in the virtual space, i.e., it is unfeasible to find it by chance or through intelligence.

As a result, 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 allows for hidden planets on a public data set. It is not per se a blockchain feature but uses cryptography in the exact same way that blockchains manage accounts pseudonymously or store provably correct timestamps for unknown pre-images.

Technically, the planet position is identified by a hash in the blockchain data, the pre-image of which is the planet's position. To be certain that they are not accidentally building in a 'parallel dimension,' players are by default routed through an auxiliary *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.

TOKENS

Blockchain tech is used comprehensively, 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 only ever making *access* simpler and safer. Because of how data access and manipulation on a blockchain works, this gives **full control** to the players.

Many elements of the game, like assets and avatars, are using blockchain staples like **NFTs**, while the game currency comes in the form of a **real blockchain token** that is fully owned by the players and not depending on the game world for its existence.

STARCOIN

The Starcoin token is a real token that is both found in the game, as reward for moves, and is the currency to trade in and pay for moves.

The game uses the Starcoin 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.

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

STARDUST

NFTS

Virtual cards – avatars, planets, awards, story elements and special game assets – are represented by non-fungible tokens (NFTs) that are part of the Starcoin token functionalities. Most such virtual cards can be traded among players for Starcoin, using the typical NFT mechanisms. But many 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. Other cards, like **planets**, can be traded and named and renamed. **Awards** and **story elements** are the closest to classic NFTs. They are found in the game but do not influence game mechanics.

GAME PERSISTENCE

The game world is safeguarded by full blockchain guarantees.

Because of its 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. The nodes **never stall** and will operate even in isolation. All it needs is one node, which is easily maintained.

ARTIFICIAL INTELLIGENCE

The game employs the full breadth of cutting-edge 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 as rules 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 controls the use of **music**.

STACK

The technical toolset is sophisticated and straight-forward:

LEXON

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

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

STARDUST

NODE

Auxiliary game services are built with **Javascript**, using the cross-platform server environment **node** that is based on Google's V8 JavaScript engine. Node is fast, scalable, and has a rich ecosystem of thousands of open-source libraries.

HTML5 AND WEB3

As is usual for blockchain applications, informational and managerial elements are implemented using standard **HTML5** web technology, plus web3 extensions.

UNITY

The visual front-end is created with Unity, a powerful **3D game programming** tool and de facto standard that runs in the players' 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 individual transactions, not by a firewalled game server. The game design fiercely respects the limited pace and capacity of blockchains and utilizes to its advantage blockchain **sequencing**, **consensus** and **micro-billing** mechanisms. The choice of the right chain powers the innovation presented. Blockchain requirements also protect the game world against spam and fake accounts. This allows for an unusually open architecture where extensions can be created that reach deep into the **fabric of the game** and players and 3rd-party apps 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 open, 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 (p. 12) that enable hidden planets as safe player 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 keys and upgrades themselves to do it the crypto way.

THE CHAIN

Exploiting the diversity of chains available is a decisive enabler. We picked a blockchain that is the perfect game server environment. It has a very strong technological basis, building on a tried and tested **high-availability** environment; has a transaction time of mere seconds; and a cost per transaction well **below 1 cent**. This is excellent for moderately fast-paced strategic and tactical games. It allows for a straight-forward design that is not possible on chains with higher transaction costs.

PLENTY

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