Intro

*Stars Uncounted* is a persistent-world multiplayer strategy game celebrating the vast complexity of the universe and the multitudes it contains.

Scale is meant to be huge here. A galaxy with enough systems that no one will ever be able to visit them all. Ships are not easy to make; they take a lot of work and need many different endeavors to be coordinated. Advanced technology requires multiple players cooperating to realize. It takes, at minimum, a full day IRL to cross most starsystems.

Notes are provided as to intended order of features: greater detail is given in the

Text-focused MMORTS

UI art, 2d sprites

Generative AI to produce models and 2d art

Inspirations

* Avorion in number of unique objects and map-based RTS design
* Eve in crafting complexity, MMO, and emergent player behavior
* Star Wars Galaxies in individuality of crafting results
* Stellaris in civ/species creation, RP potential, map-based RTS design
* Starship EVO, Avorion, Space Engineers, Galactic Civilizations III, and Starfield in ship building/customization
* Dyson sphere program, Factorio Space Exploration in the scale of projects you can tackle and how involved you are in their fulfillment
* Anno 1800 in the varied play styles and co-operative multiplayer options
* Democracy and Stellaris for civ management
* Dominion, Screeps, Desynced: Autonomous Colony Simulator for autonomous behavior of civs

# Problem Summary

1. How do online players interact with offline players?
   1. How is competition or combat handled when players aren’t online at the same time?
2. What happens to civs whose players quit the game?
3. Strong picks on the weak: how do you make sure the game stays fun for the weaker player?
   1. Established player attacks new player: how do you balance it so that it’s fair for the new player?
   2. Multiple players gang up on or bully another, or a smaller group: how do you protect the smaller?
   3. 4x games are typically characterized by an exponential growth in power. How do you make more powerful civs both fun to play and to play against?
4. How should updates, balance changes, nerfs, etc. be handled?
   1. If players can easily change their infrastructure, how do you make their choices to specialize meaningful? See also p5.1.
5. How do you keep players from optimizing the fun out of the game?
   1. How do you keep players from specializing so far that they only do one single thing?
6. How do you encourage positively social behavior?
   1. How do you encourage players to cooperate?
   2. How do you design so that peaceful play is also fun, not just combat?
7. In order to be worth making a persistent-world MMO, the game must offer things only possible in a persistent-world MMO
8. Amount of micromanagement should scale as square root function, not exponentially. Getting bogged down in later stages by too much micro isn’t fun.
9. Both tall and wide must be viable playstyles without a player being punished for doing one or the other
10. How do you keep gameplay fresh?

# Features Summary

These features are summarized to outline the game as well as to address the problems identified in Problem Summary. New potential problems produced by a proposed feature are not given new problem numbers, but are discussed under each feature.

1. **Latency system:** real-time unit control only possible in systems with established command infrastructure.

* Addresses p1 in conjunction with f2, f6 by reducing the chance of one player catching another offline.
* Addresses p3 in conjunction with f2 and f5 by making war harder the further from base it is, giving less established players a significant home territory advantage

1. **Galaxy scale:** the PvE game galaxy has billions of systems, and crossing just one of them takes at least a full day of real time. The galaxy in the PvP is smaller, with systems bearing advanced resources as per f3 being rare enough that players inevitably fight for them.

* Addresses p1.1 in conjunction with f1 by strongly de-valuing twitchy micro management.
* Addresses p6 in PvE by making violent competition unnecessary.

1. **Galaxy generation:** valid starting systems have only basic resources. Advanced weapons, fast FTL, megastructures, etc. can only be constructed using resources found in rarer systems.

* Addresses p3 by making new players’ territory worth very little strategical value to established players.
* Addresses p6.2 in conjunction with f9 by giving industry-specialized players a valuable role in accessing and processing these rarer resources. Aggressive players can win these systems, but they can’t use their resources to the fullest without allies who specialize outside of combat.

1. **Growth point (GP) system:** time spent in-game and acquiring traits accrues growth points (GP) which are attached to player accounts. GP can be either allocated or unallocated.
   1. **Archival:** players may spend GP to archive their civ and, unallocating their GP. They may then allocate remaining GP to a new civ, allowing them to accelerate its growth to a similar level as the one they started from. A player’s GP may be associated with only one active civ at a time. On archival, the civ disappears from the galaxy; any alterations to environments remain but units, buildings, populations, etc. disappear. If the civ is retrieved from archive, all GP is allocated to that civ and it spawns as per s3, most likely in a new location. Players receive a virtual inventory of the objects that were archived, and may place these objects after retrieval with no resource costs except worktime. If the civ is archived again with objects still in the virtual inventory, those remaining objects are permanently lost. Because GP is spent by archival, the player must choose traits to leave behind upon retrieval.

* Addresses p5.1 by allowing players to try other gameplay styles at will
* Archival cost discourages players from using it to defend themselves or resetting their infrastructure.
  + 1. **Cooldown:** if a civ is stored to archive, it may not be retrieved from archive for one week, and may not be stored again to archive for another three weeks.
* Discourages players from using archival to defend themselves
  1. **Cost growth:** GP cost to archive a civ exponentially increases as total owned GP increases.
* Enforces archival cost so that it doesn’t become cheaper as the game progresses (compare to IRL flat-rate fines representing different phenomena to people with different amounts of wealth). It is always a serious decision.
  1. **Expropriation:** players may instantly recycle game objects affected by updates and receive all resources that they spent to build or otherwise acquire them and also receive free GP that can be spent on the currently-active civ as a player would if they had archived their civ and started a new one. Update notes will include protos, techs, traits, buildings, units, etc. effected by the update. Patches and hotfixes will include any such objects missed in the original update.
* Addresses p4 by reimbursing players who are negatively affected by updates
  1. **Acceleration scaling:** spending GP accelerates the acquisition of new traits but does not make the acquisition instantaneous. The more powerful the traits, the less their acquisition is accelerated. For example, a +2% to resource efficiency when manufacturing steel plates will be acquired by GP much faster than a +25% unit HP. GP can only be spent on traits and research: it can’t be directly used to reduce the time needed to complete actions like crafting.
* Addresses p4.1 in conjunction with f4.3 by players to pivot to new strategies, but only when present strategies are made suboptimal by new updates.
  1. **GP types:** GP earned in PvE can't be spent in PvP
* This blocks players from farming GP in risk free play to gain an advantage over other players.

1. **Exponential spawn location system:** in PvP, when a new player enters the game, or a player retrieves their civ from archive as per f2, valid spawn locations are those whose distance is an exponential function of neighbors’ GP. For example, if two brand new players start the game, they might start right next to each other, but will both be far away from a player who’s been active for a little while, and very, *very* far away from a veteran.
   1. **Opt-in:** exponential distance function may be enabled or disabled, but is not optional for players retrieving civs from archives in PvP.
   2. **Friends:** players may request that they spawn near other civs marked as friends of that player. For this to happen, all nearby civs must unanimously agree to allow the spawn. If both parties agree, the newcomer will spawn closer to the friend than it otherwise would have, regardless of whether the newcomer enabled exponential spawn.

* Addresses p3.1, p3.2 in conjunction with f1, f2 by spawning less established players far from more established ones, i.e., war is harder to wage the further it is from base, giving less established players a significant home territory advantage

1. **Autonomous systems:** gameplay centers on management of otherwise autonomous systems. While real time control is more effective than automated behavior, it is only possible in defensive situations. Otherwise, latency limits how quickly new orders can be issued.

* Addresses p1 in conjunction with f1, f2 by devaluing real-time control and making it only possible in defensive situations.
* Addresses p3 by giving new players a home territory advantage.

1. **Player quit:** civ either becomes a ruin or a non-player civ (NPC) when if the player’s civ is deleted (by choice or if banned).
   1. **Ruin:** buildings and ships remain in damaged to ruined condition, but all people of the civ disappear.
   2. **NPC:** civ control is given to the AI.
2. **Paranoia:** aggressive actions, military buildups, xenophobic culture, researching dangerous technology, etc. would all make NPCs and the populations in other players' civs "paranoid". For attacks, paranoia scales exponentially with how much weaker the target civ is. Player civs with high paranoia will readily go to war against the aggressor even if they're not otherwise set up for war. NPCs become exponentially more likely to attack players as they become more paranoid. On aggregate, this means that if an established, strong player attacks a new, weak player, they'll be an easier target for other players, and they'll get NPCs attacking their home territory, with attack strength scaling with the power difference between the players.
   1. Paranoia scales much less strongly in PvE server.

* Addresses p3 in conjunction with f9 by encouraging players to fight comparably powerful players, and also to think carefully before committing to aggressive or warlike strategies.
* Addresses p3 by discouraging aggressors from committing large forces to attacks, since they'd need to defend against the NPCs.

1. **Civ culture:** players direct autonomous civs which can comprise multiple cultures. Those cultures influence how the civ behaves, interacts with other civs, their crafting ability, scouting ability, etc. etc. etc. As per f10, the game's economy is complex enough that players need to co-operate for advanced resources, components, and end products like ships. Taking aggressive actions without an aggressive culture disrupts the civ. Having an aggressive culture limits how effectively you can interact/cooperate with other players.

* Addresses p3.3 by checking how militarily powerful an aggressive civ can become without co-operation.
  1. **Centralization:** in order to remain militarily organized, aggressive cultures must also be hierarchically centralized. Central authority must be maintained at a single seat of government.
     1. **Latency:** the more hierarchical an aggressive the culture, the higher its latency because it takes longer for commands to travel from authority structures.
* Addresses p3 in conjunction with f5 by making war harder to fight the further away it is
  + 1. **Fractiousness:** the less hierarchical the culture, colonies become more likely to split or rebel the further they are from the civ’s homeworld.
* Addresses p3 by checking how powerful an aggressive civ can become.

1. **Economy abstraction layers:** players may operate at multiple levels of economy and resource management, with the more abstract being default, but the more detailed levels giving more bonuses.
   1. **Simple economy:** players may operate at a resource abstraction similar to Stellaris where the main resources are energy, organics, compounds, metallics, and alloys. This is easy to work with, but provides no bonuses.

* Allows new players to start off simply and ease into more complicated mechanics.
* Addresses p3 by limiting how powerful aggressive civs can become.
* Addresses p3.3 by allowing military-specialized civs to focus on empire rather than other aspects of the game.
  1. **Ecological disruption:** developing a lifebearing world’s economy without regard for the planet’s ecosystem will degrade that ecosystem, decreasing health, decreasing habitability, decreasing organic resource yields, increasing upkeep costs, and at the highest level rendering the world toxic to life.
  2. **Pyanodontic economy:** at the most complex level, players may operate at a level of detail similar to that of the Pyanodon Factorio mod, with minimal abstraction, and multiple outputs and byproducts needing consideration. For example, using iron for starship hulls rather than copper yields higher HP, and carefully managing industrial byproducts reduces or eliminates ecological disruption.
* Addresses p9 by providing a variety of play styles.
* Addresses p9 in conjunction with f15 by allowing tall, carefully managed playstyles to perform competitively against wide, loosely managed ones.
* Addresses p3.3 in conjunction with f15 by limiting how powerful civs can become without careful management, encouraging multiple players use co-op play on a single civ so that civ can become more powerful.

1. PvP and PvE:
   1. PvE PvP: players can still fight each other in PvE, but all involved parties must explicitly and unanimously agree to specific terms to fight. Terms include valid targets, fight length, victory conditions, victory condequences, whether violation of agreement is possible, and what penalties are applied if so. Aggression checks like f6 and f7 still apply if agreement occurs.
2. Events: the game periodically presents procedurally generated events to players. These may come in the form of interactions with other civs based on the players’ actions or the civs’ cultures, or an event from within the civ itself, or an environmental event. Events can usually be ignored without consequence, but grant bonuses or other benefits when interacted with.

* Addresses p10 by giving players input to respond to without requiring them to do so.

1. Traits:
   1. Pop: apply more to populations than overall civ. Civ-wide traits are generic enough to apply to multiple playstyles.
   2. Rate: higher when interacting
   3. Items: higher traits easier to get when more players involved in the item
2. **Contests:** classic RTS battles organized in small enough spaces that latency is not at play. Contests must be scheduled and agreed to ahead of time, ensuring players are online at the same time.

* Addresses p1.1 by allowing more directly managed, real time combat, in addition to the predominant asynchronous style.

1. **Co-operative civs:** multiple players may manage the same civ.

# Mechanics

## General Gameplay

PvE, PvP, co-op

### Contests

RTS style battles

## Map

Galaxy, systems, radii, bodies

### Environment

* Hot, cold
* Dry, wet
* Xenocosmic
  + Makes industrial tech type very expensive, reduces psionic tech type expense
* Viridescent (sapient ecosystem, all life cooperates)
* Gaia

Size

* Moon
* Dwarf
* Datum
* Giant

State

* Void
  + Interstellar
* Gaseous
  + Makes industrial tech type very expensive, biological tech type inexpensive.
  + Gas giant
  + Nebula
* Terrestrial
* Aquatic
  + Limnic
  + Marine
* Plasma
* Singularity

Temperature

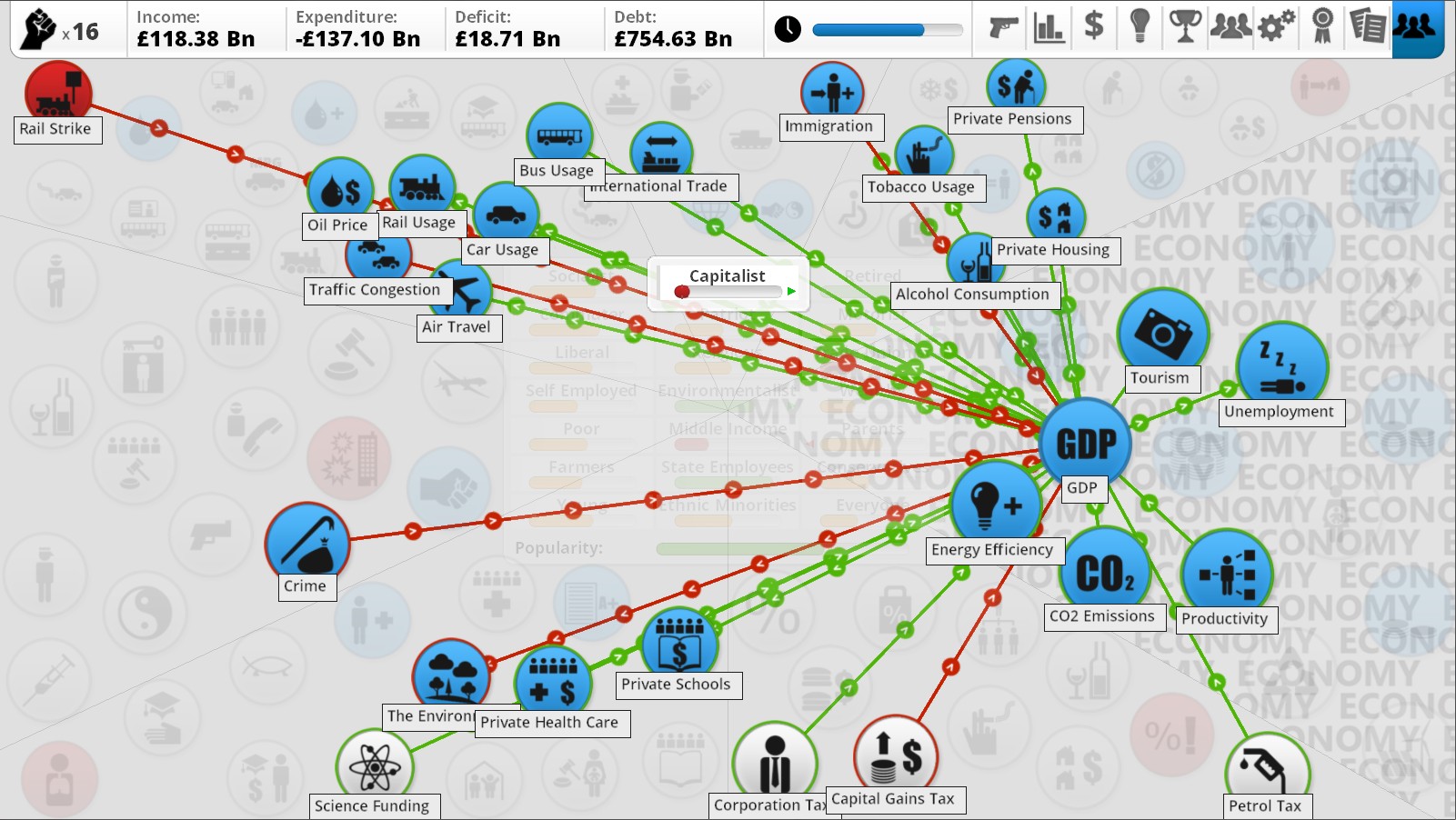
* Frozen
  + Makes biological tech type very expensive, industrial tech type inexpensive.
* Polar
* Tundra
* Temperate
* Tropical
* Desert
* Hothouse

Fertility: how welcoming the world is to the existence of life. Varies for each composition and biomolecular class.

* Toxic
* Tomb
* Barren
  + Makes biological tech type expensive, industrial tech type inexpensive.
* Harsh
* Lifebearing
* Cradle
* Gaia
* Viridescent (sapient ecosystem, all life cooperates)
* Xenocosmic
  + Makes industrial tech type very expensive, reduces psionic tech type expense

## Interface

Radnet (radial network):



## Civ

radnet, cultures and species each averaged to one but can be expanded

Species

Each has a radnet

Cultures

radnet each, species comprised by culture averaged for single display. May open it to show others.

Government

radnet

Tech

## Activities and Actions

* Warfare
  + Defense
  + Offense
  + Espionage
* Exploration
  + Scouting
  + Monitoring
* Science
  + Applied science
  + Formal science
  + Natural science
  + Social science
* Engineering
* Technology
* Diplomacy
* Communication
* Production
  + Manufacturing
    - Artisan
    - Shipwrights
    - Architects
    - Tech
    - Metallurgy
  + Construction
  + Agriculture
  + Mining
* Culture
  + Entertainment
  + Games
  + Media
  + Art
  + Music
  + Writing
  + Philosophy
  + Theology
  + Ritual
* Community
* Municipal
  + Waste
  + Amenities
  + Civil functions
* Training
* Transportation

Build

Diplomacy

## Stats and Traits

## 

### 

# Species and Civ

Start with 1000 points. These get allocated throughout civ and species creation. Some choices will make later choices cost more or fewer points.

## Stats

Civs, species, and cultures are described by a large number of continuous variables called stats. When the player first creates a species and civ, a variety of choices interact to determine starting stats, but they quickly begin to change as play progresses. There are two main types of stat, in stat and out stat. In stats are internal variables; the player's machine is responsible for keeping track of and calculating these values. Out stats are ones which influence interactions with external entities.

* Population count
* Population tension
* Population health
* Cultural stability: at moderate quantities equates to rate of social divergence. As it grows it reflects severity of upheaval, revolution, or rioting.
  + Mutation chance: probability of a new culture forming, or of an existing one understand significant change
* Happiness
  + Physiological needs
  + Safety
  + Community
  + Meaning
  + Vibrancy
  + Engagement
* Inspiration chance
* Discovery chance
  + Anomaly
  + Proto
  + Tech
* Breakthrough chance
* Research rate
* Production rate
  + Resources
  + Buildings
  + Components
  + Starships
* Production efficiency
* Ship travel rate
* Ship life support range
* Energy production rate
* Raw resource production rate
* Paranoia inspiration

<https://ourworldindata.org/12-key-metrics>

<https://www.irckc.org/international-metrics/>

<https://www.usnews.com/news/best-countries/articles/methodology>

## Species

### Number

How many species start out comprising the civ. 100 points per species. Each species has its own radnet.

### Origin

One way or another, the emergence of your race was predetermined by the precursors, but there are many paths to such emergence.

* Genesis: the precursors gave rise to your race directly
* Artifice: your race is a creation of a genesis race or is descended from such a race

### Context

* Unification
* Bubbling cauldron: your species managed to reach space without actually unifying. You remain a chaotic, diverse mix of discrete elements.
  + Cultural and species differences create 40% less tension
  + Citizen-initiated events happen 40% more frequently, breakthroughs happen 10% more frequently.
* Great tree
* Viridescent
* Xenocosmic
* Voidborne

### Composition

Carbonaceous: free

May choose any distribution of percentages across these categories. Adding percent to a new category costs 5 pts per % for the first, 10 for the second, 15 for the third and so on.

* Mammalian: warm-blooded, able to control inner body temperature, give live birth.
  + Traits
    - Photosynthesis and chemosynthesis 10% more expensive.
    - Emergence 50% more expensive.
  + Environments
    - Gas giant 1000% more expensive.
    - Iceworld and hothouse 100% more expensive.
    - Polar and desert 25% less expensive.
  + Culture
    - Social unit:
      * Individualism 50% less expensive
      * Collectivism 25% more expensive
    - Social binding:
      * Duty
      * Freedom
    - Social structure:
      * Egalitarianism
      * Hierarchy
    - Social fluidity:
      * Uniformity
      * Diversity
      * Deviancy
    - Acquisitiveness:
      * Avarice
      * Asceticism
    - Engagement
      * Apathy
      * Serenity
      * Excitement
      * Mania
    - Animacy
      * Spirituality
      * Materiality
    - Tribality
      * Xenophobe
      * Xenophile
    - Attitude
      * Militarism
      * Pacifism
    - Focus:
      * Rounded
      * Mastery
* Reptilian: cold-blooded; scales reduce moisture loss, lay eggs.
  + Emergence 50% more expensive. Photosynthesis and chemosynthesis 8% more expensive. Gas giant 100% more expensive. Tundra, polar, and frozen 10, 20, and 30% more expensive, respectively. Tropical and desert free. Hothouse 0% less expensive.
  + Traits
  + Environments
    - Emergence 50% more expensive.
    - Gas giant 1000% more expensive.
    - Iceworld and hothouse 100% more expensive.
    - Polar and desert 25% less expensive.
  + Culture
    - Social unit:
      * Individualism 50% less expensive
      * Collectivism 25% more expensive
    - Social binding:
      * Duty
      * Freedom
    - Social structure:
      * Egalitarianism
      * Hierarchy
    - Social fluidity:
      * Uniformity
      * Diversity
      * Deviancy
    - Acquisitiveness:
      * Avarice
      * Asceticism
    - Engagement
      * Apathy
      * Serenity
      * Excitement
      * Mania
    - Animacy
      * Spirituality
      * Materiality
    - Tribality
      * Xenophobe
      * Xenophile
    - Attitude
      * Militarism
      * Pacifism
    - Focus:
      * Rounded
      * Mastery
* Avian
* Molluscoid
* Arthropoid
* Fungoid
* Plantoid
* Ichthyoid
* Echinoid
* Ctenaphoid
  + Comb jelly
* Unicellular: an unusual case of sapience arising from the simplest-possible beginnings or emerging from the interactions of billions of single, cooperating cells. May choose any temperature preference for free. 30% increase in efficiency. Gaseous and aquatic phases 30% more expensive. 25% increase in production time.

Silicaceous: tougher, slight paranoia, 75 pts

May choose any distribution of percentages across these categories. Adding percent to a new category costs 5 pts per % for the first, 10 for the second, 15 for the third and so on.

* Crystalline
* Stratified
* Glass
* Ceramic
* Latticed: delicate, slow, flexible)
* Amorphous

Synthetic: significant paranoia, can easily learn to build to almost any environment, 125 pts

Cybernetic: if selected, may choose a sliding mix of synthetic and silicaceous or carbonaceous. 100 pts.

Exotic:

* Convection cell
* Lithoid
* Starborne
* Star
* Horizon dwellers
* Dark matter
* Void cloud

Spliced: if selected, may choose a sliding mix of any of the above. 200 pts.

* The more widely distributed the selection, the greater the chance of disease, insanity, or variation.
* May select multiple biomolecular classes for free. The more widely distributed between carbonaceous, silicaceous, and synthetic, the more classes that may be chosen.

Biomolecular class: what family of biomolecules your species is built from. Exposure to sufficiently different classes will cause allergic reactions.

### Traits

* Virtuality
  + embodied people
  + people with bodies
* Emergence (“gestaltality”)
  + One person, one body; an indivisible individual
  + single hivemind
* Metabolic rate
  + Glacial
  + Hyper
* Size
  + Nanoscale
  + Titanic
* Ancestral niche
  + Rushdown predator
  + Stalker predator
  + Ambush predator
  + Persistence predator
  + Generalist
  + Forager
  + Scavenger
  + Grazer
  + Detrivore
  + Decomposer
  + Parasite
  + Disease
  + Producer
  + Symbiote
  + Domesticator (*Stevland* of *Semiosis*)
* Photosynthesis
* Chemosynthesis
* Heterotroph
* Abstraction
* Memory formation: ability to absorb information
* Memory retention: how long information is retained
* Memory recall
* Correlation
* Social intelligence; understanding the thoughts, behaviors, wants, and needs of others
* Metacognition
* Planning, extrapolation, prediction
* Inference, data synthesis
* Spatial intelligence and reasoning
* Intuition
* Acuity
* Discipline: how well the mind can control itself
* Speed
* Trains of thought

## Environment

Preferred environment (temperature range, terrain, etc.)

## Culture

* Different populations have different values and traits which can change over time. Exchanges between populations can cause these to change
* If populations migrate, they bring their own values and traits.
* On a gradient: values and traits range in how strongly they are held
* Radically different traits can spark tension or even violence

Each civ has a discrete number of “cultures”. A civ is made up of its cultures; a small or highly homogenous civ may have only one culture, while others might contain hundreds. Depending on how the player chooses civ-wide specific values, the civ will start with a varying number of cultures. The relevant values are social binding, social structure, social fluidity, engagement, and tribality.

Each culture is described by its values (continuous axes) and ideals (discrete properties). Every culture is stored as a child object under a given civ. Within the game code, a culture has the following properties:

* Name: procedurally generated name
* Values: variables describing culture’s position in the value space
* Ideals: any held ideals
* Locations: which planets the culture is found on
  + Population: how many people of the culture reside at each location
* Relations: links to other cultures. At civ start, will be some random collection of other cultures within the civ. As the game progresses, cultures may gain relations to other cultures, including ones from other civs.
  + Closeness: how closely this culture interacts with the other. Chance of interaction events increase the greater this value is.
* Applied policies
  + Standard of living
* Stats: any culture-relevant in- and out-stats

Each rotation, the following events may occur:

* Drift: random values may change by random amounts.
* Spark: an ideal might appear or disappear.
* Relation change: the culture might gain or lose a relation.

Players may take the following action to a culture:

* Set policy
* Encourage value shift
* Encourage ideal shift
* Encourage relation
* Move
  + Encouraɡe
  + Force
  + Ban

### Values

Each is a bell curve between extremes.

Optionally, players may spend extra points to sculpt custom distributions with multiple peaks.

Select median. Can spend points to narrow distributions.

* Social unit: how important are individuals or groups?
  + Individualism
  + Collectivism
* Social binding: what do we owe each other?
  + Duty
  + Freedom
* Social structure: how should we value each other?
  + Egalitarianism
  + Hierarchy
* Social fluidity: how should the nature of our interrelation change?
  + Uniformity
  + Diversity
  + Deviancy
* Acquisitiveness: how much should a person accumulate?
  + Avarice
  + Asceticism
* Engagement: how energetically should life be lived?
  + Apathy
  + Serenity
  + Excitement
  + Mania
* Animacy
  + Spirituality
  + Materiality
* Tribality
  + Xenophobe
  + Xenophile
* Pragmatism
  + Dreamers
  + Doers
* Attitude
  + Militarism
  + Pacifism
* Focus: how far should people and peoples specialize?
  + Rounded:

new developments equally likely to be related to old ones as they are to be totally new.

* + Mastery:

### Ideals

Player selects any number of ideals and rank them on ten tiers. These will grant bonuses; which bonuses depends on how the ideals interact with the civ’s values. Highest-tier ideals produce the greatest bonuses, lowest tier the least. Percentage of each tier gets divided by the ideals in that tier; the more ideals per tier, the more total bonuses but the more thinly spread the percent of each bonus will be.

1. 20%
2. 15%
3. 10%
4. 5%
5. 2.5%
6. … etc. to tier 10

* Freedom of choice
* Freedom of expression
* Social order
* Truth above all
* Faith
* Harmony
* Relaxation
* Discovery: hunger to uncover the unknown and explore the mysteries of the universe.
* Handarra
* Dutiful
* Compassionate
* Competitive
* Social Darwinists
* Cruel
* Loyal
* Engaged: more likely to request changes and higher inspiration rate
* Apathetic
* Serene
* Explorers: infrastructure and labor more expensive, but bonus to sensor range, movement speed, range, and discovery chance
* Wanderers: infrastructure and labor significantly more expensive, large big bonus to sensor range, movement speed, range, and discovery chance
* Sedentary: infrastructure and labor less expensive, but lower sensor range, movement speed, and range
* Rooted: infrastructure and labor much less expensive, but much lower sensor range, movement speed, and range
* Curious: higher inspiration rate and research speed but may seek dangerous or unethical techs
* Indifferent: lower inspiration rate and research speed. Low chance of seeking dangerous or unethical techs.
* Hard workers: lower labor cost, lower happiness
* Lazy: higher labor cost, greater happiness
* Deviants
* Conformists
* Tinkerers: incremental improvements happen more quickly
* Environmentalists:

## Civs

### Tech types

#### 

Three axes

* Industrial
  + Industrial: molds, production lines, specialized facilities for each part. Very fast, very cheap, but not efficient and you need factories for each specific part.
* Psionic
  + Expensive. Significantly debuffs construction and production. Buffs other projects like art, research, soldier combat, etc.
* Biological
  + Expensive
* (if select mix of biological and industrial) Biomimicry: 3D printing and AI-controlled manufacturing. Most manufacturing centers can build most components for less cost in materials and energy, but much more slowly

Sublight

* Ion
* Micropile
* Chemical

FTL

* Warp
* Jump
* Gates
* Churten

## 

### People

No discrete units

Cultures and distribution

Cultural mixing, drift

#### Policies

Ethos

#### Economic structure

* Capitalistic
  + you do not have to directly control any construction, but rather allow companies within your empire to build in places you alot.
  + companies may request subsidies
  + companies may protest if you build things or enter into markets in competition with them
* Unrestrained capitalism
  + more productive but far more destructive to the environment, potential for severe unhappiness and poverty
* State-controlled
* Communism
* Socialism

### Governmental structure

* Dictatorial
* Monarchy
* Parliamentary
* Autocracy
* Technocracy
* Democracy
* Anarchy

Radnet:

* Mobility
* Law and enforcement
* Public good
  + Services
  + Welfare
  + Culture
* Taxes
* Foreign policy

### Activities

A given civ might specialize in some activities, and will inevitably conduct some of its activities differently from other civs.

More competitive and aggressive actions are compatible only with more xenophobic, competitive, and aggressive cultures. If a player takes such actions without such a culture, they will incur happiness and stability penalties. Such cultures have a harder time interacting peacefully with other civs, which makes it harder to acquire complex resources or goods. However, NPC and pirate threats will occasionally arise that require aggressive response, and which provide unique resource opportunities, giving aggressive civs a needed role to play in any group.

Similarly, peaceful and cooperative actions are compatible only with xenophilic, cooperative cultures. Again, if a player takes actions at odds with the culture, they will incur happiness and stability penalties. However, the tangled nature of interstellar trade and value chains require cooperation in order to produce complex or technologically advanced goods, giving peaceful civs a needed role to play in any group.

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# Game Objects

Nonenvironmental and non-civ entities.

Each object is a unique entity and may develop its own traits. For example, a shipyard may develop a specialization in a particular type of ship, or it might be more likely to innovate ship protos, or it may become more efficient over time.

## Protos

Short for ‘prototypes’. Players can create/design their own objects, and their designs determine whether the object is a planet-side building, starbase, alloy, starship, circuit board, etc. They can design appearances, though premade and procedurally generated ones are also available. Protos can be traded. Once a new proto is made, a project becomes available that allows it to be built.

Players may design the look of protos. They have access to the following:[[1]](#footnote-1)

* Voxel: create a block with a specified texture
* Sculptor: sculpt a block to a desired shape
  + CAD-like additive/subtractive functions based off of 2d schematic
    - Rotating schematics
    - Repeating a design feature along a route, such as along a circle
* Symmetry: create planes of symmetry when building
* Create part: select a series of adjacent voxels to make a new part, then place connection points that determine where
* Rotate: rotate voxels or parts along three axes.
* Scale: scale a part up or down.
* Offset: offset the part or voxel from its parent connection point.
* Market: parts, protos, or groups of either make can be shared or traded.

Protos are automatically generated to enable basic play, but a player will usually be able to design more efficient protos if they so choose. The game will procedurally generate new protos in a system similar to how cultures can acquire new traits over time.

Each proto has four main elements: its class (material, structure, unit), activities (what activities it facilitates and how), environment (where it’s designed to exist), and its traits. These elements are in roughly deterministic order: its class determines what activities it can facilitate, which determine where they can be facilitated, all of which determine the overall traits of the proto.

The four classes of protos are described below.

* Material: raw or refined resource, a continuous or semi-continuous material
* Component: a combination of different materials, which may be used in other protos, be consumed, or traded.
* Building: a static structure, usually comprisinɡ many materials and components
* Unit: a proto that can move; units can fulfill the same roles as buildinɡs, and the only consistent difference between a buildinɡ and a unit is that the unit can move.

Each proto has four sub elements below its class. These are the inputs, processes, outputs, and ethea.

* Inputs: resources required to produce the object, e.g. minerals (usually destroyed by production), workers (usually not)
  + Relevant traits:
* Processes: methods by which the object is produced, e.g. artisan handwork, froth distillation, assembly line, or metalysis; each with different characteristics and tradeoffs
* Outputs: final product(s)0 that the proto creates
* Ethos: attitudes associated with the proto: they may influence final traits, ffect the people who might use the proto, or even change how people relate to the final object.; examples include favoring quality or quantity, religious reverence around a procedure, industrial farming, or the prioritization of using experienced workers over untrained workers.

For a full list of inputs, processes, outputs, and ethea, see Zerostate Protos.

Protos are blueprints for objects or spaces that facilitate the activities of a civ. To that end, when designing a proto, the player must specify *which* activity it facilitates.

One proto may facilitate multiple activities. Each additional activity increases the cost to build the proto, as well as the mass and volume that it occupies.

Environments

Traits

* Mass
* Volume
* Components
  + Thrusters: can control thrust output. Higher output means higher resource cost. The player chooses where the trade-off is.
  + Armor plate: control thickness and shape.
* Equipment
  + Can design equipment especially for constructing components. Builds them faster and uses less resources than prototyping components one by one. Technology can improve the performance of equipment.
  + Reactors
    - Magnetic confinement
    - Inertial confinement
    - Magneto-inertial (helion)
* Starships
  + Can give uniform armor thickness and bull reinforcement: mass will be added as a function of armor material density.
* Starbases

## Structures

Structures

## Units

Like any other object, each unit is unique.

Ships must have crew and any other required materials like fuel, ammo, cargo, supplies, etc. before they can launch. If these are available onworld, they’ll automatically be routed to the ship.

Keeping the same crew with a ship improves their performance over time. They’ll also do better with similar ships.

### Moving

A voideborne unit can’t necessarily enter atmosphere. Bringing resources from interstellar trade routes down a planet’s gravity well (and vice versa) requires an amphibious freighter, a shuttle, or a lift.

Route planning

Can plan to travel nonlinearly to destination or make multiple stops. This takes longer and costs more fuel, but makes it harder to intercept.

Intercepting

Higher espionage improves chance of detecting route plan.

## Deterioration

Repair types

More advanced objects or more miniaturized require more advanced, specialized equipment to repair. Developing planets or frontiers are unlikely to have the kind of infrastructure needed to maintain high-end, fancy tech.

# Events

Game time

Tick

Period

Cycle

Rotation

## Research

## Buildings

## Business

## Inspiration

## Diplomacy

## Traits

Any civ, population, or object can randomly gain traits over time. Some traits can increase the rate of this happening to themselves or others. Base probability is 70% chance an existing trait will be modified, 30% chance of a new one.

For example, a repair crew stationed on a megastructure may be able to achieve the same upkeep for less resources generation by generation. A shipyard may get faster and more efficient at upgrading ships.

# 

# Resources and Goods

# 

# Actions

* Research
* Construction
* Expedition
* Encourage trait
* Transfer trait
* Members of the public may come to you, wanting to start a project of some sort.
  + May have their own resources, but you might not get the benefits
  + May want your resources, but you will get more of the benefits

Undergoing a project will expend a certain amount of resources and also temporarily use another amount. For example, you must spend concrete and steel to erect a building but also temporarily allocate workers, tools, and scaffolding. After the building is done being built, you will not get the concrete and steel back but the workers, tools, and scaffolding can be put to other uses.

Any given project has a chance to consume some of its temporary resources. For example, a dangerous construction or exploration project may cost a few lives. Tools may break, unforeseen complications may occur.

Workers become more experienced at certain projects the more they perform them.

The result of each project is a unique object with varying quality and traits. Projects performed by skilled and/or more experienced workers will yield better results.

## Research

Radial tech gardens. Not linear trees.

* Members of public may have an idea that they ask to pursue, but you can also set priorities
* Most research doesn't have immediately practical effects
  + some lines of inquiry are dead ends
  + Usually need to discover a new idea, develop prototypes, develop ways to scale it, develop ways to adopt it, and train people to use the new tech
  + Resource discovery/use: some material with no prior known use may have an application. If successful, can mine that resource. Algorithmically generated, so each civilization will discover its own resources. Each resource will have its own traits.
  + Material: possible new material which might have applications for different components or structures
  + Component: component that might make things like advancements in civil engineering or new weapon protos possible
    - May also improve performance of existing components, or make them smaller, or require fewer parts to build
  + Production: figuring out how to actually build that new component, possibly a new way to build something more efficiently.
    - May also discover a new way to produce a component.
    - May discover incremental improvements to processes: may have higher yield, may be faster, may become more efficient.
  + Building: architects and engineers may propose variations of existing buildings that will be slight improvements on old ones, though they often may come with drawbacks.
* Can get unexpected benefits
* Breakthroughs usually finish a tech early, but may also skip ahead to a more advanced tech suddenly
* Each player will have a unique set of technologies, granting them access to unique materials, components, etc.
* Players can trade their technologies. For example, if player A knows how to build one type of power generator, and player B knows how to build a mass accelerator, they can swap techs. However, the process requires a project where citizens train each other.
* Players retain rights to their techs, and can outsource manufacturing or collect royalties on the use of their tech
* Engineers can continuously make incremental improvements to existing tech, slowly improving performance or efficiency or miniaturization a percent at a time
* Discover novel resource either in raw form or a new way to use an existing raw resource
  + Raw ore
  + Mine tailings
  + Recycling and scrap
  + Waste extraction
  + Fusion
  + Chemical synthesis
* Discover new applications for a resource or material
  + Building, ship hulls, catalysts, components, etc.
* Discover new ways to refine those resources
  + Froth refinement
  + Oil cracking
* Discover new ways to work with those resources

### 

Construction

Can build protos for other civs. Can lease protos from other civs. Will need to train workers on a new proto; the more alien it is, the longer/more expensive the training will be.

Diplomacy

* Cultural exchange
* Request permission to build
* Information exchange
* Joint research
* Alliance
* Defensive pact
* Nonaggression pact
* Migration treaty
* Open/close borders
* Offer project: share resources and work on a project together. Builds trust. Exchanges culture.
  + Research
  + Economy
  + Construction
  + Military exercises

## Espionage

## Paranoia

* Extremely different cultures will be paranoid of each other
* Aggressive acts within your own borders or outside will make neighbors paranoid
* Certain technologies, especially superweapon tech, will make neighbors paranoid
  + Researching things spiritual neighbors deem blasphemous will raise paranoia
* Military buildups
* High enough paranoia will trigger war
* warlike cultures have lower paranoia thresholds to trigger war
* Previous levels of Paranoia multiply any increases in Paranoia.
* Construction of nuclear reactors which could breed weaponizable isotopes
* Research of technologies with overtly militaristic applications, especially superweapons research
* Large-scale militarization
* Aggressive or oppressive social policies
* Extremely different ideologies
* Violence near borders: different types of violence cause different responses (riots vs. wars)

## Trading

* Resources
* Blueprints and techs
* protos
* Components
* Ships
* Stations
* Planets
* Territory
* Contracts
* Mining rights/contracts

### Routes

Value of route influenced by, in order:

* Number of resources and/or goods available at one end of the route not available at another
* Route distance
* Production capacity of either end
* Distance from other trade route termini
* Population at either end
* Population near either end

Player machine calculates value of its route once per rotation

#### Networks

If either network terminus overlaps with the terminus of any other route, a network is created. The player(s) owning the two sides of the new route get a bonus

* Total distance of network
* Average value of other routes in network

All routes in the network gain a value boost proportional to that added by the new route. The value produced by the new route is calculated after this boost.

### Contracts

* Citizens from your civ can be contracted to work on another civ's project
  + Nomadic ship pilots

### Markets

Set taxes for the flow of goods in or out.

allow/encourage mixing

discourage/ban mixing (some will still occur, and may spark tension)

Publicize what your civ can make and what they know (other civs may still learn)

Select exports or imports (citizens will also do their own)

Ban certain exports or imports

You can restrict a good, and determine whether or not it is illegal to sell it. Depending on your society, some people may resist this, you may need a vote, and/or some people will still try to illicitly sell or purchase.

You and other players or NPC civs can still try to sell goods to a market that has banned that particular good, but if the civ finds out, there will be a diplomatic penalties.

## Tourism

## Mixing

Any contact between two or more cultures will change them all. The more points of contact, the greater the change. There are a variety of consequences to this. Points of contact that cause mixing include:

* Espionage (very low chance)
* Shared comm networks
* Open borders
* Trade agreements
* Trade routes
* External contracts
* Associations
* Migration treaties
* Tourism

Cultural mixing happens more slowly the more different two cultures or species are

Tension

Inspiration

Production

# Map

Galaxy

Sectors

Systems

Stars

* 1-2 per system
* Dwarf, main sequence, giant, neutron

Belts 0-4 per system

Outcloud. 0-1 per. Generalized oort cloud.

Horizon: hill sphere, outermost reach where the primary's gravity dominates satellite orbits, edge of outcloud

Bodies

* Procedurally generated
  + Rocky worlds near primary most likely
  + Gas giants near outcloud most likely
  + Dwarf stars or significantly lower mass stars can also appear in orbit at random positions
* 1-12+ per system. Middle distribution most likely, but random.
* Realistic scale
* Base amount of buildable area
  + Tech can expand this horizontally or vertically
* Altering too much of the surface will degrade the planet's biosphere if it has one
  + Research into development design, biosphere integration, etc. can mitigate or remove this issue
* Biospheres randomly generate a variety of species and products
  + Some may be useful for trade as medicines, catalysts, food, luxuries, or other materials
* Other materials like minerals and ores also randomly spawn. Each planet has a chance of containing a unique material with unique properties.

Anomalies

Pocket dimensions

Wormholes

Warped space

Regions of space that are bigger (or sometimes smaller) on the inside

# Zerostate Protos

Protos that exist from the beginning of any server and exist separately from what a civ might discover or develop.

Classes

Material

* Inputs
* Process
* Outputs
* Ethea
  + Reverence: religious worship centers around this procedure

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Activities | Inputs | Processes | Outputs | Ethos |
| Warfare | Defense |  |  | * Armor * Signal blocker * Shroud |  |
| Offense |  |  | * Explosives * Fissile bomb material * Fusion bomb material * Neutron bomb material * Poison |  |
| Espionage |  |  | * Truth serum |  |
| Scouting |  |  |  |  |
| Exploration | Scanning |  |  | * Tachyon parent material |  |
| Monitoring |  |  |  |  |
| Science | Applied science |  |  |  |  |
| Formal science |  |  |  |  |
| Natural science |  |  | * Exotic matter |  |
| Social science |  |  |  |  |
|  | Engineering |  |  |  |  |
|  | Technology |  |  | * Quantum dots * Silicon crystal |  |
|  | Diplomacy |  |  |  |  |
|  | Communication |  |  | * Isolated philotes * Entangled quanta |  |
| Production | Manufacturing |  |  | * Catalysts |  |
| Construction |  |  | * Cement |  |
| Agriculture |  |  | * Fertilizers |  |
| Mining |  |  | * Drill material |  |
| Culture | Entertainment |  |  |  |  |
| Games |  |  |  |  |
| Media |  |  |  |  |
| Art |  |  |  |  |
| Music |  |  |  |  |
| Writing |  |  |  |  |
| Philosophy |  |  |  |  |
| Theology |  |  | * Entheogens |  |
| Ritual |  |  |  |  |
|  | Community |  |  |  |  |
| Municipal | Waste |  |  | * Civilian waste * Organic waste * Mining waste * Manufacturing waste * Material waste * Effluent * Byproducts |  |
| Amenities |  |  |  |  |
| Civil functions |  |  |  |  |
|  | Transportation |  |  | * Fuel |  |

* Component
  + Inputs
  + Process
  + Auxiliaries
  + Outputs
  + Ethos

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Activities | Inputs | Processes | Outputs | Ethos |
| Warfare | Defense |  |  | * Armor plate * Shield module * Adaptive armor * Ray shield * Deflector shield |  |
| Offense |  |  | * Explosives * Fissile bomb material * Fusion bomb material * Neutron bomb material * Poison |  |
| Espionage |  |  | * Spy camera |  |
| Scouting |  |  |  |  |
| Exploration | Scanning |  |  | * Scanner |  |
| Monitoring |  |  |  |  |
| Science | Applied science |  |  |  |  |
| Formal science |  |  |  |  |
| Natural science |  |  | * Survey equipment |  |
| Social science |  |  |  |  |
|  | Engineering |  |  | * Design adjutant |  |
|  | Technology |  |  | * CPU * Memory unit * Power supply |  |
|  | Diplomacy |  |  | * Dosier |  |
|  | Communication |  |  | * Ansible |  |
| Production | Manufacturing |  |  | * Smelter * Assembler |  |
| Construction |  |  | * Construction equipment |  |
| Agriculture |  |  | * Agricultural equipment |  |
| Mining |  |  | * Mining drills |  |
| Culture | Entertainment |  |  |  |  |
| Games |  |  |  |  |
| Media |  |  |  |  |
| Art |  |  | * Artwork |  |
| Music |  |  | * Musical recording * Musical manuscript |  |
| Writing |  |  | * Written work |  |
| Philosophy |  |  |  |  |
| Theology |  |  | * Scripture |  |
| Ritual |  |  |  |  |
|  | Community |  |  |  |  |
| Municipal | Waste |  |  |  |  |
| Amenities |  |  |  |  |
| Civil functions |  |  |  |  |
|  | Transportation |  |  | * Fuel * Life support module * Thruster * FTL drive |  |

* Structure

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Activities | Inputs | Processes | Outputs | Ethos |
| Warfare | Defense |  |  | * A * a |  |
| Offense |  |  |  |  |
| Espionage |  |  |  |  |
| Scouting |  |  |  |  |
| Exploration | Scanning |  |  |  |  |
| Monitoring |  |  |  |  |
| Science | Applied science |  |  |  |  |
| Formal science |  |  |  |  |
| Natural science |  |  |  |  |
| Social science |  |  |  |  |
|  | Engineering |  |  |  |  |
|  | Technology |  |  |  |  |
|  | Diplomacy |  |  |  |  |
|  | Communication |  |  |  |  |
| Production | Manufacturing |  |  |  |  |
| Construction |  |  |  |  |
| Agriculture |  |  |  |  |
| Mining |  |  |  |  |
| Culture | Entertainment |  |  |  |  |
| Games |  |  |  |  |
| Media |  |  |  |  |
| Art |  |  |  |  |
| Music |  |  |  |  |
| Writing |  |  |  |  |
| Philosophy |  |  |  |  |
| Theology |  |  |  |  |
| Ritual |  |  |  |  |
|  | Community |  |  |  |  |
| Municipal | Waste |  |  |  |  |
| Amenities |  |  |  |  |
| Civil functions |  |  |  |  |
|  | Transportation |  |  |  |  |

* Unit

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Activities | Inputs | Processes | Outputs | Ethos |
| Warfare | Defense |  |  | * A * a |  |
| Offense |  |  |  |  |
| Espionage |  |  |  |  |
| Scouting |  |  |  |  |
| Exploration | Scanning |  |  |  |  |
| Monitoring |  |  |  |  |
| Science | Applied science |  |  |  |  |
| Formal science |  |  |  |  |
| Natural science |  |  |  |  |
| Social science |  |  |  |  |
|  | Engineering |  |  |  |  |
|  | Technology |  |  |  |  |
|  | Diplomacy |  |  |  |  |
|  | Communication |  |  |  |  |
| Production | Manufacturing |  |  |  |  |
| Construction |  |  |  |  |
| Agriculture |  |  |  |  |
| Mining |  |  |  |  |
| Culture | Entertainment |  |  |  |  |
| Games |  |  |  |  |
| Media |  |  |  |  |
| Art |  |  |  |  |
| Music |  |  |  |  |
| Writing |  |  |  |  |
| Philosophy |  |  |  |  |
| Theology |  |  |  |  |
| Ritual |  |  |  |  |
|  | Community |  |  |  |  |
| Municipal | Waste |  |  |  |  |
| Amenities |  |  |  |  |
| Civil functions |  |  |  |  |
|  | Transportation |  |  |  |  |

Energy types

For anything to happen, energy must be harvested, moved, manipulated, and lost. There are three zerostate ways to move and make use of energy. A civ might rarely discover another method. Each type can have an arbitrary number of variants, which civs can easily develop to suit their own needs. Any component that uses energy will use at least one of these types and at least one of their variants.

Electricity

Bioenergy

Psi

Energy

Metallics

Organics

Nonmetallic inorganics

Compounds

Alloys

Others

* Ore
* Organic
  + Acid
  + Gas
  + Petrochemical
    - Inert
    - Active
    - Polymer
    - Oil
    - Lubricant
  + Solvent
  + Fat
  + Protein
  + Oil
* Inorganic
  + Acid
  + Solvent
  + Metal
    - Copper
    - Iron
    - Aluminum
  + Mineral
  + Ceramics
  + Gas
    - Reactive
    - Inert
    - Combustible
  + Polymer
  + Lubricant
  + Gems
  + Water
  + Fissile
    - Thorium
    - Uranium
* Intermediates
  + Alloys
  + Electrical conductors
  + Electrical insulators
  + Thermal conductors
  + Thermal insulators
  + Plutonium
  + Smart matter
  + Catalysts
* Cosmic
  + Xenocosmic gas
  + Dark matter
  + Dark energy

Refer to global trade summary for inspiration for zero-state goods

<https://wits.worldbank.org/trade/country-byhs6product.aspx?lang=en>

* Animals, live
* Meat
* Fish and crustaceans, molluscs and other aquatic invertebrates
* Dairy produce; birds' eggs; natural honey
* Animal originated products
* Trees and other plants, live; bulbs, roots and the like; cut flowers and ornamental foliage
* Vegetables and certain roots and tubers; edible
* Fruit and nuts, edible; peel of citrus fruit or melons
* Coffee, tea, mate and spices
* Cereals
* Products of the milling industry; malt, starches, inulin, wheat gluten
* Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit, industrial or medicinal plants; straw and fodder
* Lac; gums, resins and other vegetable saps and extracts
* Vegetable plaiting materials; vegetable products not elsewhere specified or included
* Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable waxes
* Meat, fish or crustaceans, molluscs or other aquatic invertebrates; preparations thereof
* Sugars and sugar confectionery
* Cocoa and cocoa preparations
* Preparations of cereals, flour, starch or milk; pastrycooks' products
* Preparations of vegetables, fruit, nuts or other parts of plants
* Miscellaneous edible preparations
* Beverages, spirits and vinegar
* Food industries, residues and wastes thereof; prepared animal fodder
* Tobacco and manufactured tobacco substitutes
* Salt; sulphur; earths, stone; plastering materials, lime and cement
* Ores, slag and ash
* Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes
* Inorganic chemicals; organic and inorganic compounds of precious metals; of rare earth metals, of radio-active elements and of isotopes
* Organic chemicals
* Pharmaceutical products
* Fertilizers
* Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints, varnishes; putty, other mastics; inks
* Essential oils and resinoids; perfumery, cosmetic or toilet preparations
* Soap, organic surface-active agents; washing, lubricating, polishing or scouring preparations; artificial or prepared waxes, candles and similar articles, modelling pastes, dental waxes and dental preparations with a basis of plaster
* Albuminoidal substances; modified starches; glues; enzymes
* Explosives; pyrotechnic products; matches; pyrophoric alloys; certain combustible preparations
* Photographic or cinematographic goods
* Chemical products
* Plastics and articles thereof
* Rubber and articles thereof
* Raw hides and skins (other than furskins) and leather
* Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut)
* Furskins and artificial fur; manufactures thereof
* Wood and articles of wood; wood charcoal
* Cork and articles of cork
* Manufactures of straw, esparto or other plaiting materials; basketware and wickerwork
* Pulp of wood or other fibrous cellulosic material; waste and scrap of paper or paperboard
* Paper and paperboard; articles of paper pulp, of paper or paperboard
* Printed books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans
* Silk
* Wool, fine or coarse animal hair; horsehair yarn and woven fabric
* Cotton
* Vegetable textile fibres; paper yarn and woven fabrics of paper yarn
* Man-made filaments
* Man-made staple fibres
* Wadding, felt and nonwovens, special yarns; twine, cordage, ropes and cables and articles thereof
* Carpets and other textile floor coverings
* Fabrics; special woven fabrics, tufted textile fabrics, lace, tapestries, trimmings, embroidery
* Textile fabrics; impregnated, coated, covered or laminated; textile articles of a kind suitable for industrial use
* Fabrics; knitted or crocheted
* Apparel and clothing accessories; knitted or crocheted
* Apparel and clothing accessories; not knitted or crocheted
* Textiles, made up articles; sets; worn clothing and worn textile articles; rags
* Footwear; gaiters and the like; parts of such articles
* Headgear and parts thereof
* Umbrellas, sun umbrellas, walking-sticks, seat sticks, whips, riding crops; and parts thereof
* Feathers and down, prepared; and articles made of feather or of down; artificial flowers; articles of human hair
* Stone, plaster, cement, asbestos, mica or similar materials; articles thereof
* Ceramic products
* Glass and glassware
* Natural, cultured pearls; precious, semi-precious stones; precious metals, metals clad with precious metal, and articles thereof; imitation jewellery; coin
* Iron and steel
* Iron or steel articles
* Copper and articles thereof
* Nickel and articles thereof
* Aluminium and articles thereof
* Lead and articles thereof
* Zinc and articles thereof
* Tin; articles thereof
* Metals; n.e.s., cermets and articles thereof
* Tools, implements, cutlery, spoons and forks, of base metal; parts thereof, of base metal
* Metal; miscellaneous products of base meta
* Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof
* Electrical machinery and equipment and parts thereof; sound recorders and reproducers; television image and sound recorders and reproducers, parts and accessories of such articles
* Railway, tramway locomotives, rolling-stock and parts thereof; railway or tramway track fixtures and fittings and parts thereof; mechanical (including electro-mechanical) traffic signalling equipment of all kinds
* Vehicles; other than railway or tramway rolling stock, and parts and accessories thereof
* Aircraft, spacecraft and parts thereof
* Ships, boats and floating structures
* Optical, photographic, cinematographic, measuring, checking, medical or surgical instruments and apparatus; parts and accessories
* Clocks and watches and parts thereof
* Musical instruments; parts and accessories of such articles
* Arms and ammunition; parts and accessories thereof
* Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, n.e.s.; illuminated signs, illuminated name-plates and the like; prefabricated buildings
* Toys, games and sports requisites; parts and accessories thereof
* Miscellaneous manufactured articles
* Works of art; collectors' pieces and antiques

OECD BILATERAL TRADE DATABASE BY INDUSTRY AND END-USE CATEGORY

<https://drive.google.com/file/d/1JCW3DLLPr5uD_dhRSQ8b0i1tzFKLAM1o/view?usp=sharing>

Thrusters

Drives

Most early drives require leaving a system's horizon.

Reactors

Chemical

Photovoltaic

Electrostatic

Bioharvest

Sediment battery

Ion

Fission

Microfission

Nanofission

Slow fission

Throttleable fission

Fusion

Microfusion

Nanofusion

Slow fusion

Cold fusion

Throttleable fusion

Antimatter

Zero-point

GUT (xeelee)

Farstar (Protoss starlight photosynthesis)

Energy distributors

Energy converters

Energy storage

Kugelblitz

Armor

Shields

Sensors

Directional

Omnidirectional

Adjustable

Range: planetary, system, cluster

Medium: radar, grav wave, tachyon, psionic sweep

Environment control

Resource processors

Production equipment

Weapons

Torpedos

Computers

Communication equipment

Civilian goods

Municipal equipment

Fuels

* Fissile materials
* Fusible materials
* Fission daughters
* Fusion daughters
* Chemical
* Ion
* Antimatter
* Singularion
  + Unit of mass in singularity form
* Bio

Ships

Stations

Buildings

* Lift (space elevator)
* Skyhooks
* Worm projector
  + Trade value +5%
  + Happiness +5%
  + Cultural mixing +5%
  + Migration pull +5%
  + Tourism +5%
* Bridge: structure that maintains a two-point wormhole, a constant spatial warp that significantly decreases the distance between two points.
  + Trade value +15%
  + Happiness +15%
  + Cultural mixing +15%
  + Migration pull +15%
  + Tourism +15%
* Gateway: a structure that acts as an entry into and exit from a network of other bridges; any worm bridge can be accessed by any other worm bridge.
  + Trade value +25%
  + Happiness +25%
  + Cultural mixing +25%
  + Migration pull +25%
  + Tourism +25%
* Jumpgate:

Megastructures

Kilostructures

* Sky hooks
* Loft: space elevator
* Kugelblitz Cell
* Asteroid manufactory
* Dyson swarm
* Voidborne lab
* Ecosystem bubble
* Bastion
* Orchidseed
  + Yggdrasil orchid complex
* Voidborne particle accelerator
* Voidborne habitat
* Weather control

Megastructure

* Climate control
* Ring
  + Equatorial shipyard
  + Elysium
* Core ignitor: re-melts metallic planetary cores, giving them magnetic fields and making them habitable to most carbonaceous and silicaceous life
* Starlifter
* Dyson sphere
* Nova megafusor
  + Type of starlifter that replicates supernova conditions, mass-producing heavy elements
* Ringworld
* Matrioshka brain (star)

Gigastructures

* Neutronium gigaforge
* Nicoll-Dyson beam
* Matrioshka brain (black hole)
* Penrose sphere
* Celestial starship
  + Moon
  + Planet (unicron?)
  + System (galacticus?)
* Birchworld

Research Disciplines. Each of these is a radial origin. A player begins with a handful of these, and more can be acquired by tech trading or breakthroughs.

* Theoretical sciences
  + Postrelativistic physics
    - Relativistic projectiles
  + High energy physics
  + Field theory
  + Computer science
    - Modeling
* Mathematics: research into different fields may increase inspiration or breakthrough chance in other areas.
* Automation
* Applied physics
  + Warp
  + Energy
  + Nuclear physics
  + Particle physics
  + Lasers
  + Sensors
  + FTL communication
  + FTL travel
  + Artificial gravity
* Chemistry
  + Metallurgy
    - Metalysis
    - Metalogenesis
* Engineering
  + Civil engineering
    - Mobile architecture (Starcraft terrans)
    - Build bigger structures and ships
    - Rail systems
    - Transport systems
    - Skyhooks
  + Stellar
    - Starship
    - Stations
    - Structures
    - Kilostructures
    - Megastructures
    - Gigastructures
  + Stellar habitat
  + Computers
    - Hardware
      * Quantum
      * Biological
      * Classical
    - Software
    - AI
    - Upload platforms
    - Em platforms
  + Robots
  + Androids
  + Metamaterials
  + Mining
    - Drills
    - Explosives
  + Bioengineering
    - Environment adaptation
    - Metabolic tuning
    - Biomolecule class compatibility
    - Growth studies
  + Propulsion
    - Sublight
      * Chemical
      * Ion
      * Sail
      * Micropile steam
      * Orion drive
      * Kugelblitz
    - FTL: may be enormously expensive upon first research, or even lethal to the discovering species or to others. Further research can fix this. <https://www.reddit.com/r/scifi/comments/445m8q/whats_the_most_intriguing_ftl_drive_in_scifi/>
      * Warp: first discovery usually produces large amounts of radiation
        + Bubble
        + Jump
        + Bridge

Projected

Static

* + - * + Tesseract
      * Hyper jump
        + Hyperlanes
      * Mass reducer
        + Less mass, faster to lightspeed you can go
      * Resurrection
        + FTL method kills people involved; this tech makes it viable by either converting people into a medium they can survive or by resurrecting them after death
      * Translation
        + Temporarily translates ship into tachyon beam. The longer the ship remains tachyons, the more likely it is to decohere and retranslate with errors that could kill passengers or damage/destroy the ship.
      * Reference shift
      * Dereference
        + Everywhere is the same place, look at the universe as a single point and then zoom back in
      * Bloat drive
        + Atoms within the bloat field explode to encompass an enormous radius, up to and including the entire galaxy. Then the atom closest to the target destination is used as the point upon which the atoms recollapse
      * Probability drive
        + DeBroglie wavelength shift
      * Churten
      * Multiverse selection
        + Parallel universes like 40k’s Warp
        + Skip drive like Old Man’s War
      * Void drive
        + Step outside the universe and step back in
      * God engine
        + Precursors like you enough to move you around
* Life sciences
  + Social: how people interact, social structures, how to organize and use those two
    - Training
    - Skill transmission
    - Governments
    - construction safety measures
    - Mind integration
    - Uploading
    - Personality editing
    - Consciousness duplication
    - Consciousness manufacture
      * Going straight to manufacturing rather than duplication creates much higher risk of AI uprising
    - Diplomacy
  + Agriculture
  + Permaculture
    - Deep planning: the art of adapting and cultivating both nature and culture to suit each other. The two are slowly intertwined, and both become more vibrant the more closely they are twined.
      * Massively buffs export costs.
      * Buffs construction speed.
      * Significantly buffs construction and production output.
      * Debuffs construction and production cost as a function of production diversity that asymptotically approaches zero. The more different things the civ produces, the cheaper it becomes for them produce them.
      * Debuffs tourism and migration appeal.
      * Debuffs stability.
      * Production quality increases over time in established permaculture areas.
  + Xenobiology
  + Medicine

Overlaps

* Theology
* Nanotech
  + Nanites
    - Nanobot disassemblers: earliest research allows construction of non-replicating nanites that can disassemble specific materials into simpler components
    - Nanobot replicators: earliest research allows construction of non-replicating nanites that can combine simple materials into specific, more complex materials
    - Universal Nanites: self-replicating, customizable for any task
    - Grey goo
    - Nanoplague
  + Nanite ecosystems
  + Smart matter
  + Utility fog
  + Nanocomputing
  + Nanomedicine
  + Nanomanufacturing
  + Nanomaterials
* Picotech
* Femtotech
* Military
  + Training
  + Weapons
    - Biological
    - Energy
    - Kinetic
    - Missile
    - Computer
    - Superweapons
  + Defenses
    - Armor
    - Shields
      * Ray shield: protects against radiation low levels are discovered for safe space travel, tech can evolve to protect from energy weapons
      * Barrier: randomly blocks some percent of incoming damage. Bette rbarriers block more damage. Uses up charge much more slowly than shields.
      * Shield: fully blocks incoming damage of certain types up until it runs out of charge.
        + Depending on discovered techs, can customize damage type and percent blocked. Higher percent consumes more charge.
      * Deflector shield: redirects damage
    - Point defense
* Metaphysics
  + Psionics
  + Telepathy
* Exploration
  + Habitability
    - Different kinds of worlds
    - How to get infrastructure to work in a different environment
    - How to survive in different environment
  + Language translation
    - Universal translators

# Backend

## Github open source projects

* <https://github.com/nebula44/nebula-game-server-connector> Nebula 44 MMORTS
* <https://github.com/Astron/Astron> MMORPG
* <https://github.com/TrinityCore/TrinityCore>

<https://gdcvault.com/play/1016640/Guild-Wars-2-Programming-the> backend for guildwars2

Redis is an open-source, in-memory data structure store that can be used as a database, cache, and message broker. It is often referred to as a "data structure server" because it enables the storage and retrieval of various data structures in memory. Here are key characteristics and use cases for Redis:

1. **In-Memory Data Store:**
   * Redis stores data in RAM (Random Access Memory), providing fast read and write operations. This makes it well-suited for use cases where low-latency access to data is crucial.
2. **Data Structures:**
   * Redis supports a variety of data structures, including strings, hashes, lists, sets, and sorted sets. Each data type has associated commands that allow for efficient manipulation and retrieval of data.
3. **Caching:**
   * One of the common use cases for Redis is as a cache. It helps reduce the load on databases by storing frequently accessed data in memory, accelerating read operations.
4. **Pub/Sub Messaging:**
   * Redis supports Publish/Subscribe messaging patterns. Clients can subscribe to channels and receive messages when other clients publish to those channels. This makes Redis suitable for building real-time communication systems.
5. **Atomic Operations:**
   * Redis provides atomic operations on these data structures, ensuring that operations are executed in an all-or-nothing fashion, even in a concurrent environment.
6. **Persistence Options:**
   * While Redis primarily operates in-memory, it offers persistence options to save data to disk. This allows data to be recovered after a restart.
7. **Scalability:**
   * Redis can be used in a distributed setup to achieve scalability. Redis Cluster is a distributed implementation that allows horizontal scaling across multiple nodes.
8. **Versatility:**
   * Due to its simplicity and versatility, Redis finds applications in a wide range of use cases, including session storage, real-time analytics, leaderboards, and task queues.
9. **High Throughput:**
   * Redis is known for its high throughput, making it suitable for scenarios where fast data access and manipulation are critical.
10. **Open Source:**
    * Redis is open-source software, and its source code is available on GitHub. It has a large and active community, contributing to its ongoing development and support.

<https://www.reddit.com/r/gamedev/comments/1w746u/comment/cezcb8u/?utm_source=share&utm_medium=web2x&context=3>

* ClusterNodes: nodes that handle realtime gameplay, game logic, AI, etc. As many clusters as needed to support the game world.
* ClusterServer: stores every avatar of the gameworld, handles getting packages and sending them to the correct node, avatars moving between nodes, minor gameplay logic, all database saving
* FrontEnd: handles all incoming client traffic and forwards it to ClusterServer or LoginServer
* LoginServer: handles login sessions, sends clients to ClusterServer when OKd
* Manager: UI interface to manage all other components, auto-boots every day and auto-reboots nodes if they crash
* Daemons: one per component to handle traffic from manager; starts nodes and related tasks. Collects PID of .exe files like nodes and server, does heargbeat checks to be sure they’re all present and accounted for
* E.g. position update goes client -> FrontEnd -> ClusterServer -> ClusterNode

Redis is widely used by developers and organizations for its speed, versatility, and ease of use. Its ability to handle a variety of data structures and its support for caching and real-time applications make it a popular choice in the development of scalable and responsive systems.

**Modular Architecture:**

1. **Service-Oriented Architecture (SOA):**
   * Design the server code as a collection of loosely coupled services. Each service handles specific functionalities (e.g., player management, world simulation, messaging).
2. **Microservices:**
   * Break down the server functionalities into microservices, allowing independent development, deployment, and scaling of different components.

**Scalability:**

1. **Horizontal Scaling:**
   * Architect the server to scale horizontally by adding more servers/nodes to handle increased load. This can be achieved through load balancing and distributing services across multiple instances.
2. **Load Balancing:**
   * Implement load balancing mechanisms to evenly distribute incoming player connections and game requests among different server instances.
3. **Distributed Database:**
   * Choose a database system that supports horizontal scaling and can be distributed across multiple servers. Consider NoSQL databases for flexibility.

**Persistence and State Management:**

1. **Stateless Services:**
   * Aim for stateless server components where possible. Keep player state externalized (e.g., in a database) to facilitate easier scaling and resilience.
2. **Database Sharding:**
   * If using a relational database, plan for future sharding to distribute data across multiple database instances. This helps manage data growth.

**Communication:**

1. **Message Queues:**
   * Implement message queues for asynchronous communication between server components. This allows for decoupling and handling tasks without affecting real-time gameplay.
2. **Event-Driven Architecture:**
   * Use an event-driven approach to handle in-game events and updates. This enables responsiveness and facilitates future integration of additional features.

**Flexibility and Future Expansion:**

1. **Feature Flags:**
   * Implement feature flags to enable or disable specific features dynamically. This allows for controlled rollouts and easy testing of new functionalities.
2. **API Versioning:**
   * Design a robust API with versioning to ensure backward compatibility. This allows for gradual updates without disrupting existing game clients.
3. **Dynamic Configuration:**
   * Use dynamic configuration settings that can be adjusted without requiring a server restart. This flexibility helps in tweaking parameters for performance or feature testing.
4. **Plugin System:**
   * Design a modular architecture that supports plugins or modules. This allows for easy integration of new features or services without major code overhauls.

**Monitoring and Analytics:**

1. **Telemetry and Monitoring:**
   * Implement robust telemetry and monitoring tools to gather data on server performance, player behavior, and potential issues. Use this data to inform future optimizations and expansions.
2. **Scalability Testing:**
   * Regularly conduct scalability testing to identify potential bottlenecks and ensure that the server can handle increased loads.

**Documentation:**

1. **Comprehensive Documentation:**
   * Document the server code comprehensively, including APIs, data structures, and system architecture. This aids in onboarding new developers and facilitates future enhancements.

By adopting these principles and building a modular, scalable, and flexible server architecture, you lay the foundation for potential expansion to an MMO if the game gains popularity and additional resources become available. This approach allows for incremental growth and updates without significant reengineering.

## Eve references

Eve’s CCP has released lots of devblogs about their server and how it works; these may be useful references.

<https://www.eveonline.com/news/view/introducing-time-dilation-tidi>

## Misc

Distributed consensus systems

These may allow P2P multiplayer without relying as heavily on central server authority, especially for player counts below that of an MMO. However, they would be slow to operate, difficult to implement, and might not be able to handle more than a few players interacting at a time.

* Blockchain (financial, not very scalable)
* DAG (financial)
* **Lockstep Consensus:**
  + **Description:** Lockstep consensus is a synchronous approach where all game nodes advance their states in lockstep, ensuring that each node processes the same inputs in the same order.
  + **Use Case:** Suitable for turn-based or slower-paced multiplayer games where synchronous updates can be maintained without causing significant delays.
* **State Synchronization:**
  + **Description:** This approach focuses on synchronizing the game state across nodes by exchanging updates. Each node periodically sends its state or relevant changes to others.
  + **Use Case:** Effective for real-time multiplayer games with a moderate level of interactivity, where rapid synchronization of the entire game state may not be necessary.

Multiplayer

* Central server for:
  + Player registry
    - Name
    - Gamespace locations associated with them
    - IP to connect with
* blacklist and whitelist modes
  + Blacklist: your consensus system doesn’t consult blacklisted players
  + Whitelist: your consensus system only consults whitelisted players
* Function of server in MMO <https://www.reddit.com/r/gamedev/s/2cqqACCuEa>
  + Mmos work like this:
    - a) the server consists of one or more machines, with each machine running a part of the game.
    - b) clients run their own version of tbe game centered around the player.
    - c) server machines and clients talk between themselves by exchanging messages.
    - d) the client talks to the server in order to get updates about the state of the world.
    - e) the server machines push updates about the world to the clients.
    - f) the servers do all the needed checks and validate the state of the game, take corrective measures etc.
    - g) the servers talk to some databases for the game's persistence.
* JWT
  + <https://fusionauth.io/articles/tokens/jwt-components-explained>
* Player authentication to server
  + <https://www.reddit.com/r/learnprogramming/comments/uyk311/how_to_handle_player_authenticationsession_to/>
  + Two parts:
    - How do you establish a secure connection with a single user that can't be hijacked?
    - How do you verify that user is who they claim to be?
    - Solve first with TLS for streams, DTLS for datagrams, or some other standard and well tested protocol
    - Pass JWT or some other token over the stream once established to solve second

# Timeline

0.x

1. player can add build buildinɡ, add worker from pool, acquire resource
   1. civ generic class
   2. building generic class
   3. resource generic class
   4. extremely basic map: render sphere and simple UI when it is selected
   5. Player input directed to civ class
   6. can select sphere and see UI representing it
   7. player can use UI to add building to the sphere
   8. building extracts from resource, which accumulates in an inventory
   9. Multiplayer 2 player
2. Units, unit movement
   1. multiplayer v0.2
3. Basic resource types
   1. Enerɡy, metallics, alloys, workers
4. Buildinɡs for each resource
5. Max resource capacity
   1. Buildings to increase storage
6. System map: players choose buildings to add to celestial bodies or areas of a system
7. Basic activities
   1. Production
   2. Municipal
8. Persistent world PvE
   1. Distributed consensus system? Central authority server? On demand server? Calculate changes since last login?
9. Associations
   1. Activity: diplomacy
10. Civ fundamental: stats and traits
    1. Populations, workers
    2. Activity: warfare and PvP server
11. Basic components
    1. Tools
    2. Goods
    3. Ship components
    4. Building components
12. Protos
13. Whitelist and blacklist multiplayer modes (if take persistent external server option)
14. Basic research
    1. Activity: science
    2. Activity: engineering
    3. Activity: technology

1.x

1. More resources
2. Garden behavior
3. Civs start out with established and self sustaining layouts
4. More activities
   1. Training
   2. Exploration
5. More object types
6. Degradation
7. Environments
8. 2d art
9. Megastructures
10. Civ cultures
11. Civs start out with building layouts influenced by their culture
12. Building placement: rather than simply selecting what buildings get added to a planet, players may explicitly place down buildings
13. Galaxy map: many star systems
14. Unit movement: render units and their positions
15. Latency? Consider building game so that actions further away take longer to effect
16. Galaxy map and system map route planning
17. Tourism, migration
    1. New activity: communication
18. Civ species
19. Ecosystems and permaculture
    1. New activity: community
    2. New activity: culture
20. Civ starting infrastructure influenced by species traits

2.x

1. Generative AI art
2. Biological tech type
3. Civ compositions and origins
4. Psionic tech type
5. Proto appearance customization
6. Stellar terrain
   1. Warped space
   2. Spaces bigger on the inside
7. Nomads

# Misc notes

Ecobalance in ecology update. Name as fertility? Can increase, reducing amenity cost, increasing health, increasing habitability

Compute how beautiful a species finds an environment? Function of biological familiarity and novelty. Or wrap into habitability?

Aesthetic hacking as a gene mod

Terraforming activity

No single button to press, but can set out buildings and projects like surviving mars

Non-industrial civs still have a great deal of value:

* Culture
* Products more likely to be valued as art
* High tourist appeal
* Maintenance of population centers extremely easy for nonindustrial types
* Medicines, foods, spices, misc organics all highly valued from nonindustrial types

Objects degrade with time and use; must spend resources for upkeep

Nomadic civs

Yards; shipyard, drive yard, scrapyard

War

Raiding

Stealing

piracy

Art

Influences other cultures

Usually improved by cultural mixing

Performances

Periodic events

Astronomical

Celebrations

Sports

Government events

Festivals

Religious events

Any event can be associated with any institution

Associations

Federations

Troupes

Cooperatives

Corporations

Universities

Alliances

Guilds

Religions

Comm networks

Each player may make their own

Each network may use different tech to transmit and distribute

Each player may require others to pay for access

Players may also make their networks open access or collaborative

Citizens may demand access to networks, or that the state close off access to networks

Players creating their own currency

Research stuff

Sociology

* Workplace safety
  + Reduces construction deaths
* Environmentalism campaigns

Economics

Ecology

* Theory of
* Ecosystem lab (artificial ecosystem)
  + Boosts ecological and biological research speed. Gain knowledge of ecosystems over time
* Ecosystem engineering
  + Reduces chance of something going wrong with synthetic biology
  + Allows artificially boosting productivity and health of ecosystems
  + Allows de extinction
  + Leads to radical terraforming

Physics

* Wormholes
* Nuclear physics
* Particle accelerators
  + High enough research is a way to superstructures
* Singularity chambers
  + Can build kugelblitz drives and store Energy
  + High research: can access energy and mass from black holes
* Fission reactors

Propulsion

* Energy density
* Kugelblitz drive
  + Low level: massive range, constant, invariable amount of thrust
  + High level: can accelerate and decelerate thrust, better containment
  + Ship is destroyed in the event of containment failure
* Wormhole bridges
  + Connection only between two points
  + Higher level: wormholes are closer together in their space: travel takes less time
* Wormhole gates
  + Can make temporary wormholes between any two points in range, takes time to generate wormholes
  + Higher level: wormholes are closer together in their space: travel takes less time
* Warp drive
* Warp jump
* Warp tunnels
* Quantum tunneler
* “Hyperspace"

How to encourage players to cooperate

Make resources very widely distributed so that players need to cooperate and trade in order to get everything they need

Make it much easier to gather resources communally rather than getting it all yourself

Make complex projects require many degrees of specialization, and be much easier and faster with other people

Make projects come out much better when specializing

Consider single player vs multiplayer vs persistent multiplayer mode that tweak these settings

Types of objects

* Resource
  + Raw
  + Refined
* Tools
  + Weapons
  + Building tools
  + Smelter
  + Agricultural equipment
* Building, district, city
* Infrastructure
* Satellite
* Starship
* Space structure
* Material
* Component
* Structure, structure complex
* Unit
* Class
* Activity
* Environment
* Traits
* Environment
* Trait

1. <https://www.reddit.com/r/factorio/comments/7eu8m1/given_the_opportunity_players_will_optimize_the/>
   1. Optimization is just solving a problem
      1. Problems to be solved are just what games are
      2. Of course if you run out of game you are going to run out of fun. The solution is keep giving them problems to solve and issues to optimize
   2. Try to make gameplay circular or replayable to extend “problem”
   3. Decide whether this is a game meant to appeal to people who *like* optimizing or people who don’t, or whether it’s possible to offer something to both

1. <https://www.reddit.com/r/BaseBuildingGames/comments/4umb2n/are_there_any_games_like_minecraft_without/>

   <https://wolfsgamingblog.com/2014/05/24/landmark-preview-i-built-a-something/>

   <https://www.youtube.com/watch?v=UCM1-lrNPjU> [↑](#footnote-ref-1)