

# Spacecraft Tactics

## Technical Breakdown or How a Game Works



# Spacecraft Tactics



## About me

- 37
- German
- Job: Software Architect and Tech Lead
  - Responsible for the integration platform of the leading logistics platform in Europe, integrating
    - hundreds of in-house systems
    - all popular ERP systems
- Spacecraft Tactics is a one man project
  - Doing everything in my free time
  - Coding, Game design, Graphics, Sound / Music, Everything nontechnical, ...
  - Project started in 2016

# Spacecraft Tactics

Your mission:  
Save the last rebel outpost from the Empire!



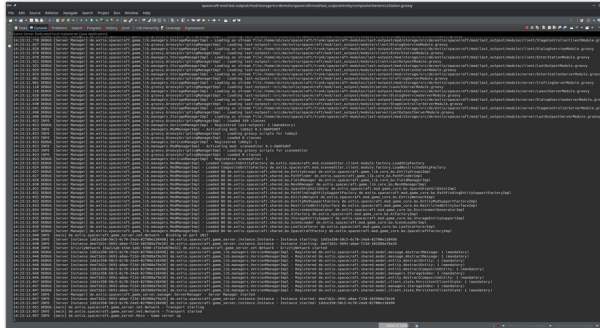
- \* Micromanage your ship
  - + Control your crew
  - + Energy distribution
  - + Damage control (Systems, Cables, ...)
  - + Meshes (Energy, Shield, O2, Network)
  - + Fields (Shield, O2, Healing)
- \* Tactical fights
  - + Control thrusters or assisted flight
  - + Vision / EM Emissions
  - + Capacitor charge (Energy, Shield)
- \* Multiplayer: Various game modes
  - + Coop and PvP, same ship or separate
  - + Official or Dedicated / Embedded (LAN)
- \* Ship editor: Build and share your own ships!
- \* Scene editor: Create and share own levels!
- \* Full native mod support
  - + Custom Tilesets
  - + Entity Editor
  - + Groovy Code

# Spacecraft Tactics

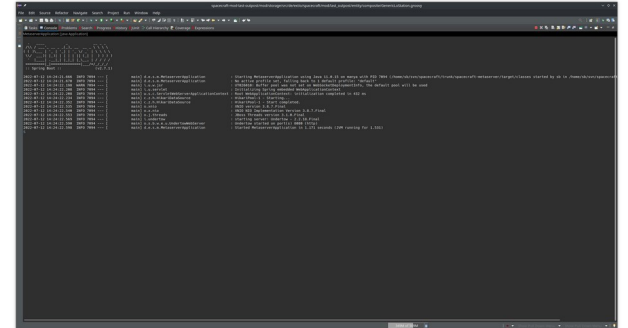
Game Client



Game Server  
Dedicated + Embedded



Metaserver





# Spacecraft Tactics

## Entity Editor

The Entity Editor window displays a list of entity definitions for the '258 Systems:Console M' category. The interface includes a file explorer on the left showing a tree structure of systems and a main table with columns for Name, Value, and Description.

Name	Value	Description
Entity::definition::animatedMovement (boolean)	false	Whether entity movement is animated
Entity::definition::animationTiles::coord::x (int)	0	Cycle trough these tiles during animation
Entity::definition::animationTiles::coord::y (int)	0	Cycle trough these tiles during animation
Entity::definition::animationTiles::dimension::x (int)	0	Cycle trough these tiles during animation
Entity::definition::animationTiles::dimension::y (int)	0	Cycle trough these tiles during animation
Entity::definition::audioOnDamage::modName (String)		Audio to play on damage
Entity::definition::audioOnDamage::resource (String)	sound/effects/damage1.ogg	Audio to play on damage
Entity::definition::audioOnDamageElementPriority (int)	2	Audio priority to play on damage (only 1 damage)
Entity::definition::audioOnDestroyed::modName (String)		Audio to play when destroyed
Entity::definition::audioOnDestroyed::resource (String)	sound/effects/damage3.ogg	Audio to play when destroyed
Entity::definition::audioOnDestroyedElementPriority (int)	0	Audio priority to play on damage (only 1 damage)
Entity::definition::autoOrientation (int)	15	Ship editor - orientation in which entity can be...
Entity::definition::blocksDamage (boolean)	false	Blocks damage when spreading to neighbor...
Entity::definition::category (String)		Meta category of entity. See EntityDefCate...
Entity::definition::consoleControl (boolean)	false	Can be controlled by console module
Entity::definition::consoleControlEnabledState (boolean)	false	Whether entity can be enabled / disabled vi...
Entity::definition::cooldown (int)	0	Cooldown in turns after USE action. 0 to dis...
Entity::definition::cooldownAfterEnable (boolean)	false	
Entity::definition::craftingCategory (String)		Crafting category. Leave empty to disable c...
Entity::definition::damagePlateau (double)	1.0	Limits damage when taking damage, similar...
Entity::definition::displayName (String)	483	Display name localization ID
Entity::definition::edges (int)	0	Inaccessible edges - field itself will be acce...
Entity::definition::emActionEmission (double)	0.0	EM Emission when entity action is executed
Entity::definition::emBaseEmission (double)	0.0	Base EM emission when entity is operational
Entity::definition::health (double)	5.0	Maximum health
Entity::definition::hideHealthBar (boolean)	false	Whether health bar is hidden
Entity::definition::layer (EntityLayer)	OBJECT_EXTRA	Layer the entity operates; FLOOR; STRUC...
Entity::definition::liveEntity (Class, ro)	class de.extio.spacecraft.mod.game_core.e...	
Entity::definition::loggedInTilesetPosition::x (int)	14	Tileset position when console logged in

## I18n Editor

The I18n Editor window displays a list of localization entries. The interface includes a menu bar with 'Add', 'Remove', and 'Clone' buttons, and a table with columns for id, description, English, and Deutsch.

id	description	English	Deutsch
971	CheckpointClientMo...	Loading...	Lade...
972	CheckpointClientMo...	Saving...	Speichere...
973	CheckpointClientMo...	Load	Laden
974	CheckpointClientMo...	Save	Speichern
975	Lobby	There is no official s...	Es ist aktuell kein of...
976	Lobby	Host a game on an ...	Hoste ein Spiel auf ...
977	Menu	Official Server	Offizieller Server
978	Lobby	Password	Passwort
979	Lobby	Set a password tha...	Setze hier ein Pass...
980	Lobby	Enter the password...	Gebe hier das Pass...
981	Server	Invalid password	Ungültiges Passwort
982	Lobby	Type	Typ
983	Lobby	Password	Passwort
984	Lobby	Game Mode	Spielmodus
985	Lobby	Yes	Ja
986	Lobby	No	Nein
987	Lobby	Mods compatible	Mods kompatibel
988	Lobby	In Lobby	In der Lobby
989	CheckpointClientMo...	You can save or loa...	Du kannst dein Spie...
990	CheckpointClientMo...	Checkpoints are dis...	Checkpoints sind de...
991	Speedrun	Cur	Akt
992	Speedrun	Delta	Delta
993	Speedrun	Best	Beste
994	Composite Entity F...	Rift	Spalte
995	Entity Name	Laser Far M AI Artil...	Laser Weit M KI Art...
996	Scene Editor	Load from Ship Edit...	Vom Schiffeditor la...
997	Ship Editor	Different spawn poi...	Verschiedene Spaw...
999	AsteroidComposite...	Prefix	Prefix
1000	AsteroidComposite...	Suffix	Suffix
1001	AsteroidComposite...	Reaction wheel	Reaktionsrad
1002	Server	Server is shutting d...	Server fährt in %s ...
1003	Server	Shutdown of this se...	Die Abschaltung de...

# Spacecraft Tactics

## Admin UI

The screenshot shows the 'Spacecraft Tactics Admin' window. On the left is a sidebar with buttons for 'Health', 'Ops', 'Error reports', 'Statistics', and 'Settings'. The main area contains a table of error reports with columns: hash\_all, hash\_m..., os, jvm, scope, module, thread, message, ts\_insert, ts\_last..., ts\_last..., ack, and reports. The table has three rows of data. Above the table are buttons for 'Refresh', 'Show Acknowledged', and 'Sort by Last Report'.

hash_all	hash_m...	os	jvm	scope	module	thread	message	ts_insert	ts_last...	ts_last...	ack	reports
e853be...	1100bc...	amd64 ...	AdoptO...	Server	-	Server ...	java.lan...	2022-0...	2022-0...	2022-0...	true	1
8f0ab6...	44de9c...	amd64 ...	Eclipse ...	Server	Main	main	java.lan...	2022-0...	2022-0...	2022-0...	true	2
3d7f74...	8cf1f1f...	amd64 ...	Eclipse ...	Client	ViewPo...	Client ...	java.lan...	2022-0...	2022-0...	2022-0...	true	1
a03b8e...	c7d6f1...	amd64 ...	Eclipse ...	Server	Server...	Server ...	java.lan...	2022-0...	2022-0...	2022-0...	true	1

The screenshot shows a Java stack trace window with the following content:

```
java.lang.NullPointerException
    at
    de.extio.spacecraft.mod.last_outpost.entity.composite.GenericLoStation.onClientDraw(GenericLoStation.groovy:50)
    at
    de.extio.spacecraft.mod.game_core.client.module.ui.viewport.ViewPortModule.drawObject(ViewPortModule.java:928)
    at
    de.extio.spacecraft.mod.game_core.client.module.ui.viewport.ViewPortModule.drawCompositeEntity(ViewPortModule.java:917)
    at
    de.extio.spacecraft.mod.game_core.client.module.ui.viewport.ViewPortModule.drawViewport(ViewPortModule.java:895)
    at
    de.extio.spacecraft.mod.game_core.client.module.ui.viewport.ViewPortModule.runAfterEvents(ViewPortModule.java:436)
    at de.extio.spacecraft.game_client.engine.Engine.lambda$run$2(Engine.java:119)
    at de.extio.spacecraft.game_client.engine.Engine.runModule(Engine.java:170)
    at de.extio.spacecraft.game_client.engine.Engine.run(Engine.java:118)
```

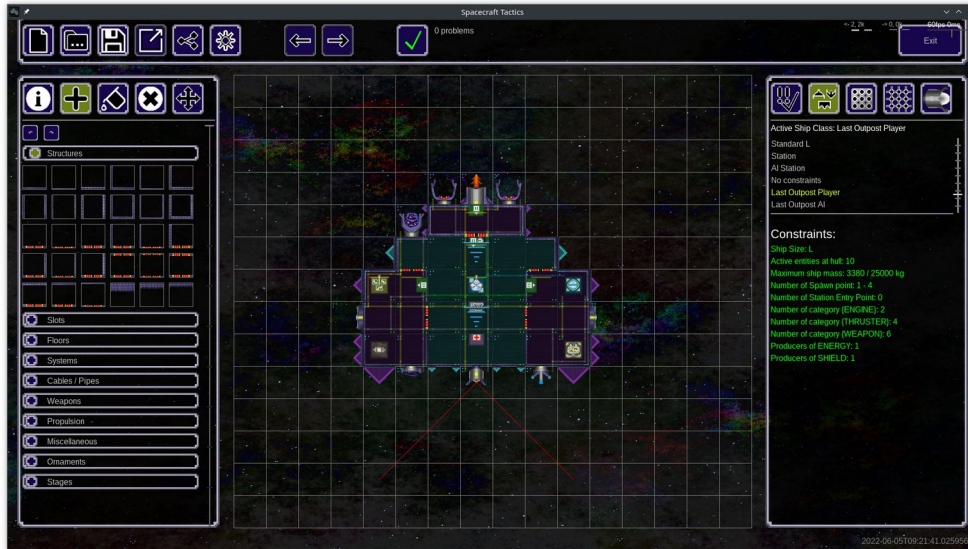
Below the stack trace is a table of system information:

OS	amd64 Windows 10 10.0
JVM	Eclipse Foundation 11.0.12
Scope	Client
Module	ViewPortModule
Thread	Client Engine
TS Insert	2022-04-28T21:20:34.013442+02:00
TS Last Report	2022-04-28T21:20:34.013442+02:00
Number Of Reports	1
Ack	<input checked="" type="checkbox"/> Ack
TS Ack	2022-07-12T00:59:16.987720+02:00

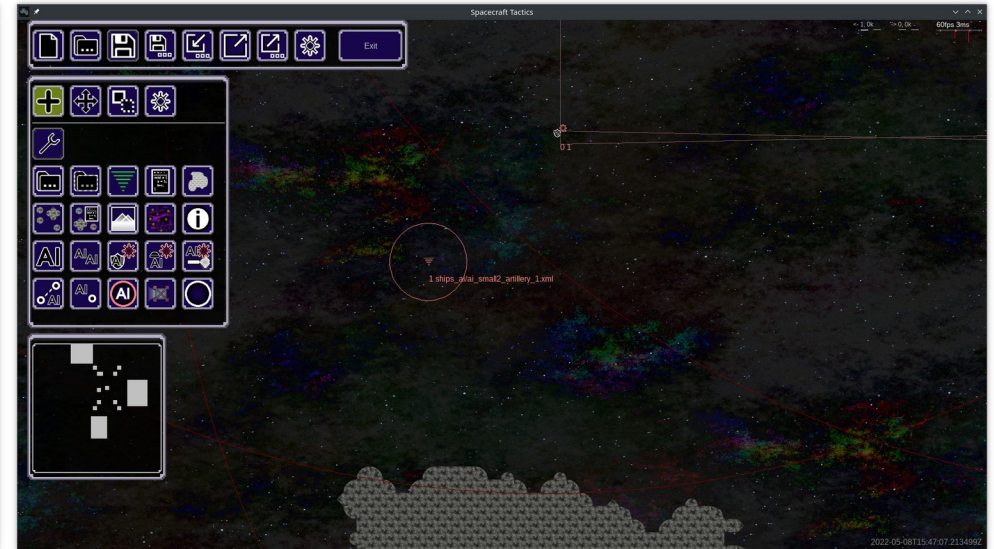
At the bottom right are buttons for 'Acknowledge' and 'Close'.

# Spacecraft Tactics

## Ship Editor

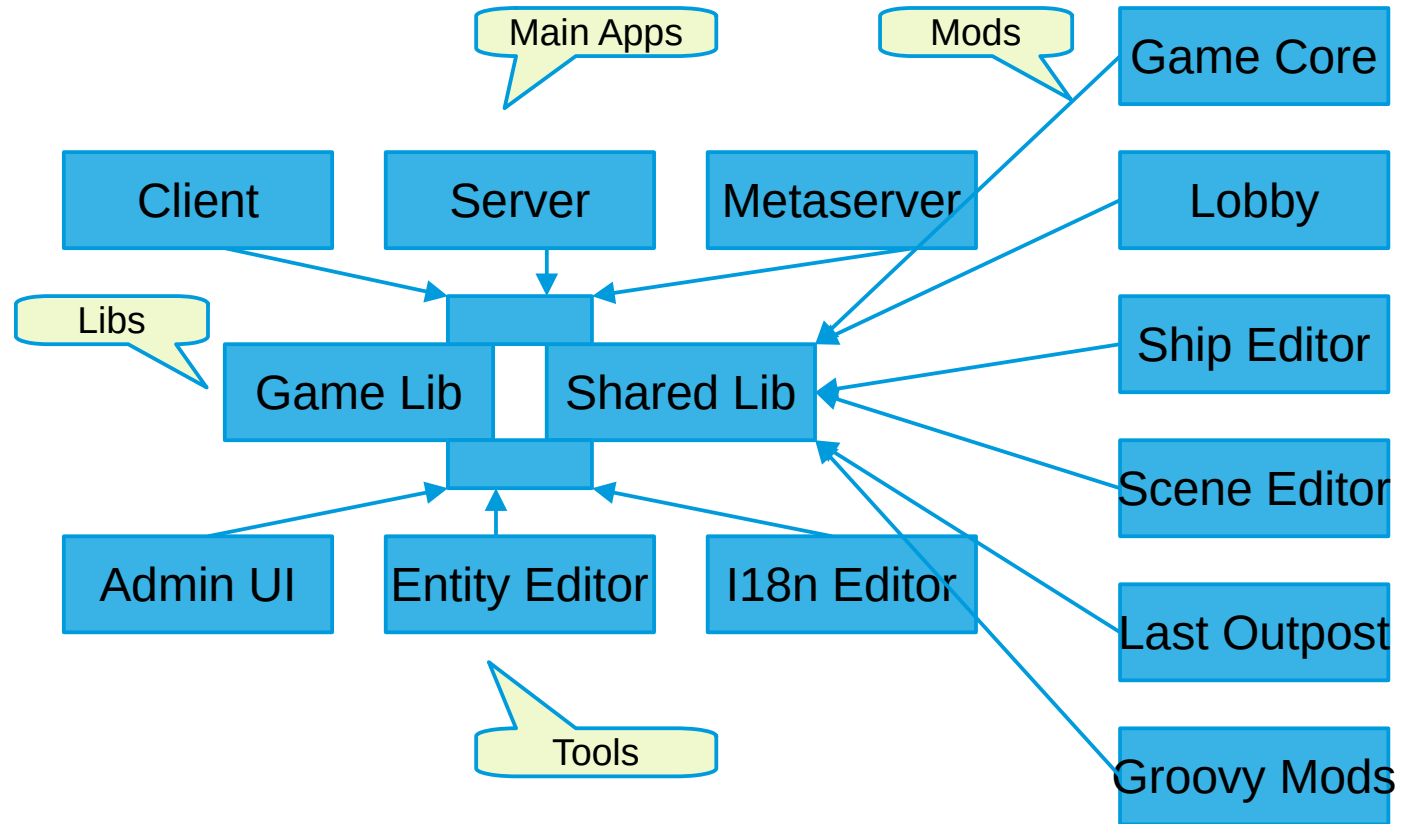


## Scene Editor



# Spacecraft Tactics

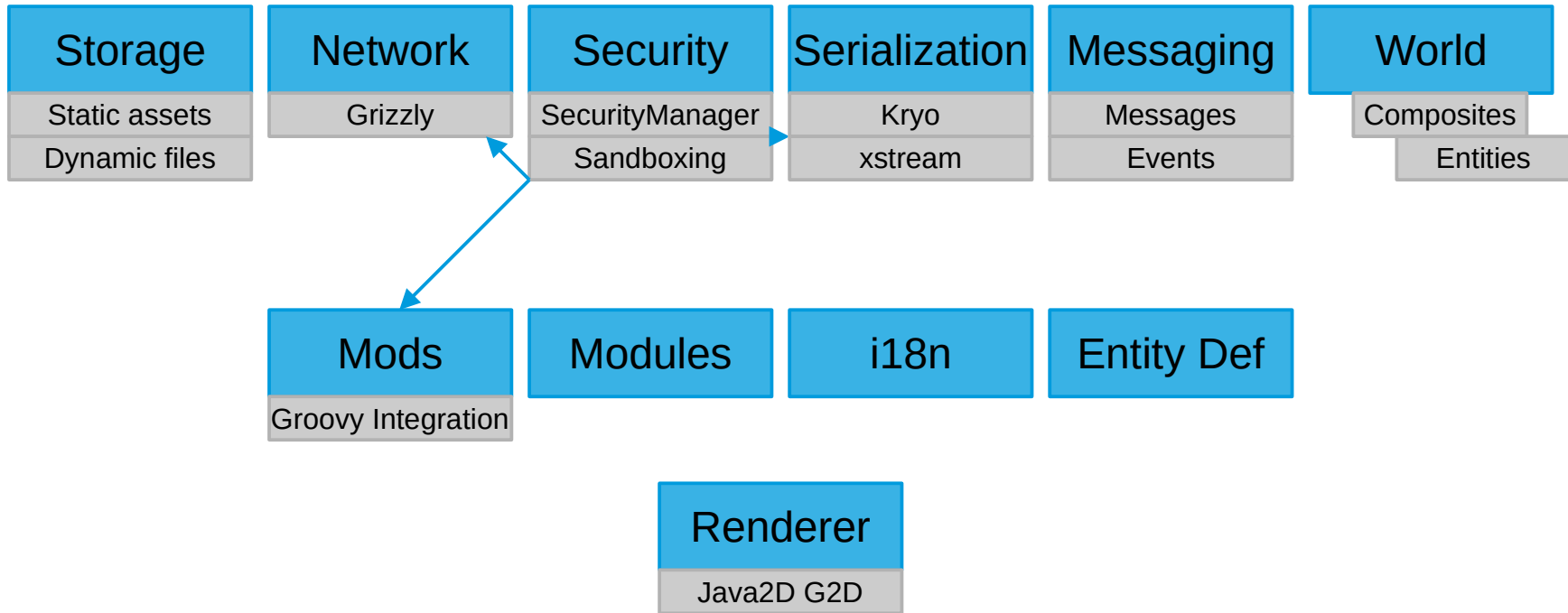
```
spacecraft
├── spacecraft-admin 0.0.1-SNAPSHOT 2597 [svn://
├── spacecraft-entity-editor 0.0.1-SNAPSHOT 2545 [
├── spacecraft-game-client 0.0.1-SNAPSHOT 2570 [
├── spacecraft-game-lib 0.0.1-SNAPSHOT 2578 [svr
├── spacecraft-game-server 0.0.1-SNAPSHOT 2577 [
├── spacecraft-i18n-editor 0.0.1-SNAPSHOT 2595 [s
├── spacecraft-metaserver 0.0.1-SNAPSHOT 2545 [s
├── spacecraft-mod-game-core 0.0.1-SNAPSHOT 25
├── spacecraft-mod-game-lobby2 0.0.1-SNAPSHOT
├── spacecraft-mod-game-sceneditor 0.0.1-SNAPS
├── spacecraft-mod-game-shipeditor2 0.0.1-SNAPS
├── spacecraft-mod-last-outpost 0.0.1-SNAPSHOT 2
├── spacecraft-playground 0.0.1-SNAPSHOT 2534 [
└── spacecraft-shared 0.0.1-SNAPSHOT 2595 [svn://
```



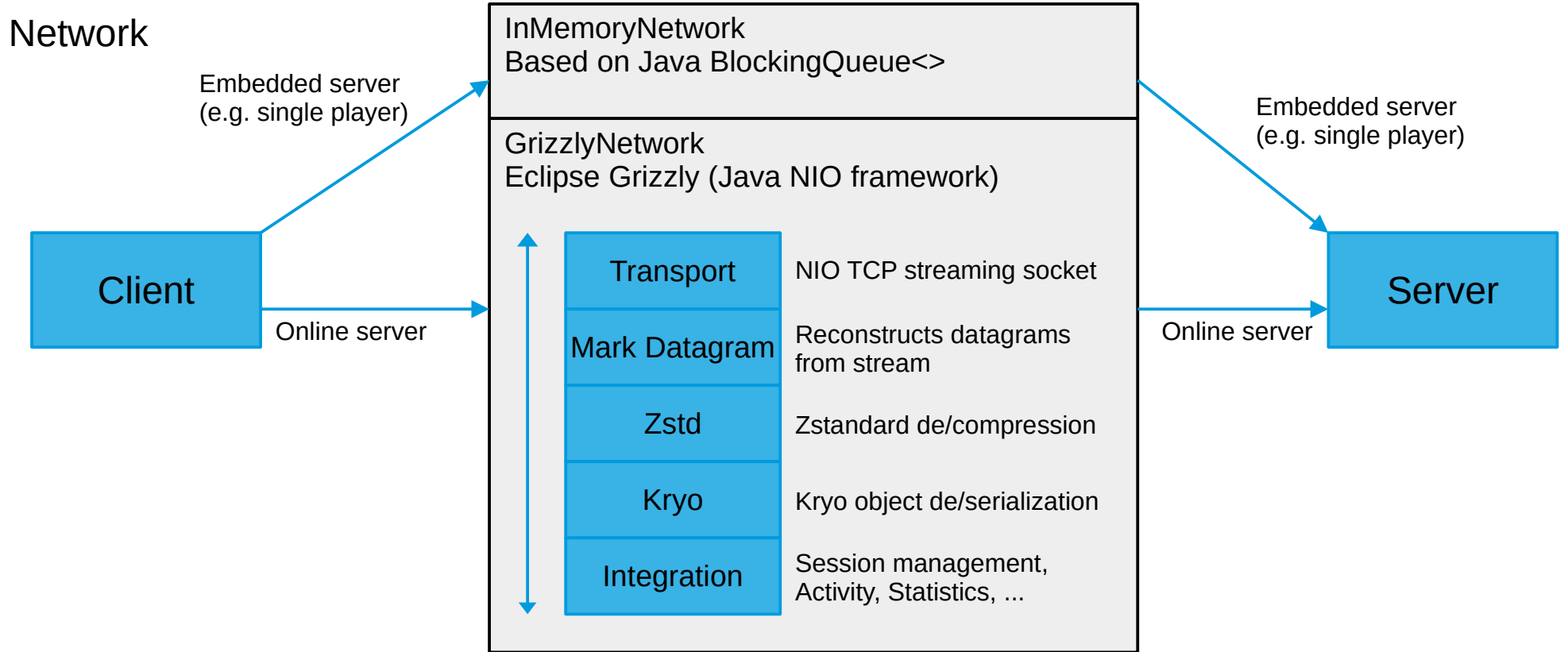


# Spacecraft Tactics

## Basic game engine sub-systems



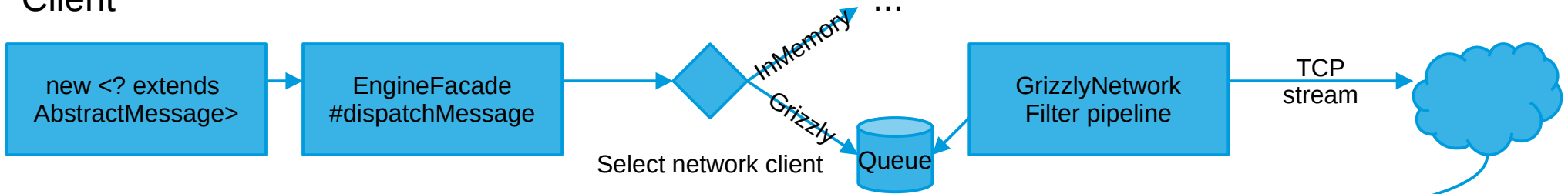
# Spacecraft Tactics



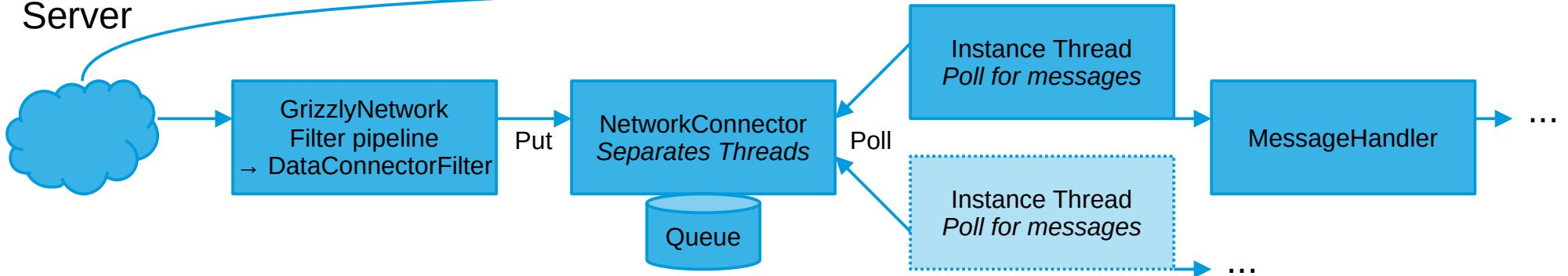
# Spacecraft Tactics

## Message flow

### Client



### Server



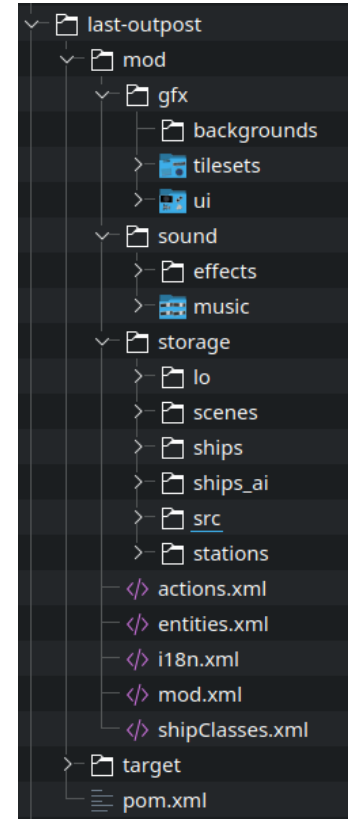
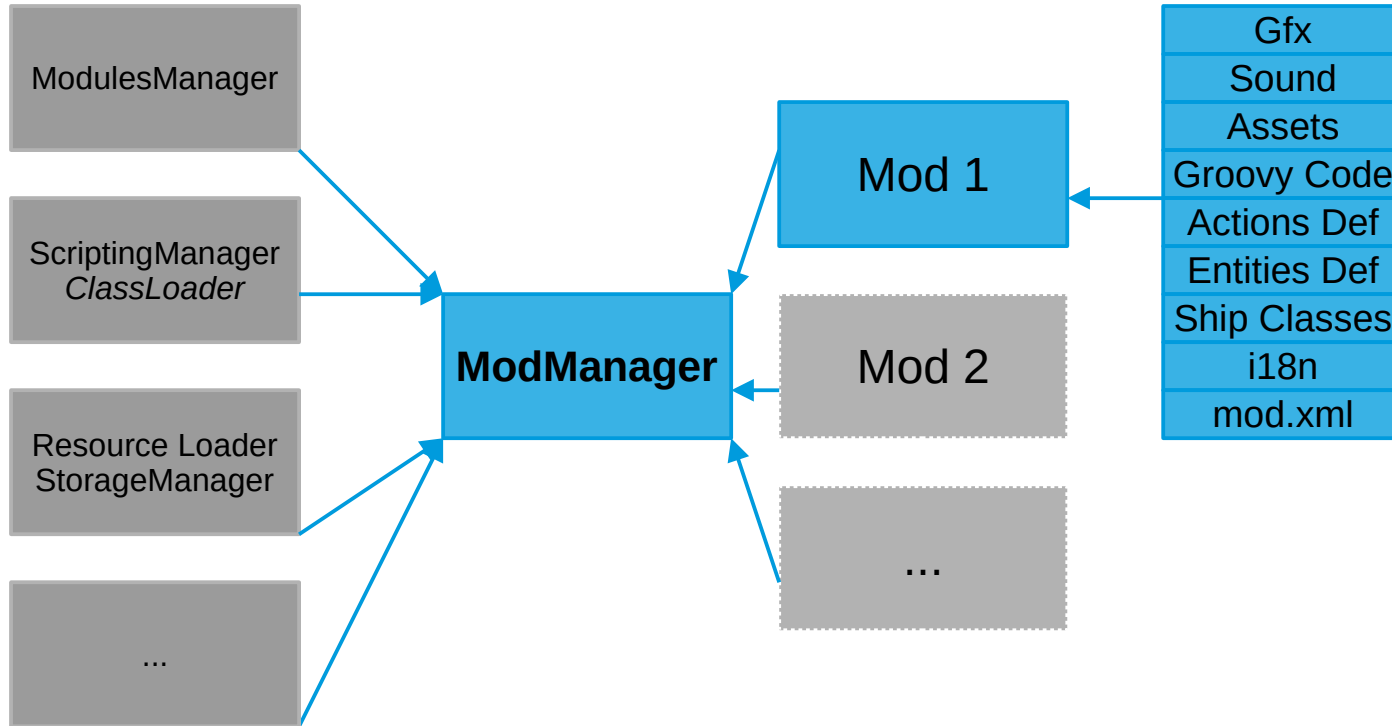
# Spacecraft Tactics

## Types of messages

→ Server	→ Client	Bidirectional	Local	Client Internal	Server Internal
CheckpointCreate	Dialog	Chat	Local Session Ctrl	Client Dialog	Internal Session Ctrl
Session Ctrl	Session Mngt	Checkpoint Data	Speedrun Ctrl	Display	Session Assignment
Session Setup	<b>Session Update</b>	<b>Composite Def</b>		KeyStroke	Metasv announce
Session Unpriv Ctrl	Server Join Resp.	EntityDef		Mouse Messages	
Scene Transfer	Server Message	<b>GameAction</b>		Net Connected	
Server Join Msg	Speedrun Update	Session compat		Net Shutdown	
		Ping			
		Ship Class Def			

# Spacecraft Tactics

## Mods





# Spacecraft Tactics

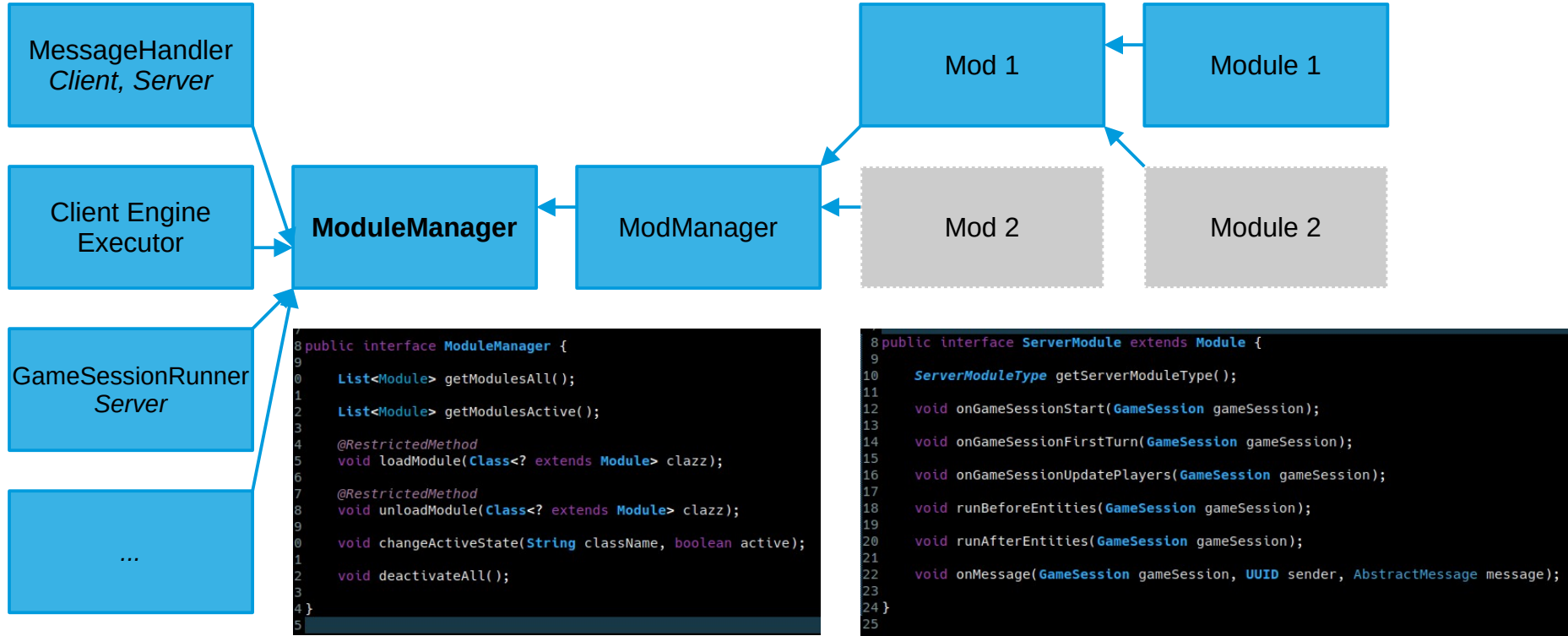
## Mods - Groovy

```
18 @CompileStatic
19 class StageControllerClientModule extends AbstractClientModule {
20
21     private final static List<Class<? extends AbstractMessage>> RELEVANT_MESSAGE_TYPES = ImmutableList.of(G
22
23     @Override
24     public Map<Class<? extends Event>, Integer> getEventSubscriptions() {
25         return null;
26     }
27
28     @Override
29     public List<Class<? extends AbstractMessage>> getMessageSubscriptions() {
30         return RELEVANT_MESSAGE_TYPES;
31     }
32
33     @Override
34     public void onMessage(AbstractMessage message) {
35         if (message instanceof GameActionMessage) {
36             if ("StageController_Objectives".equals(message.getAction())) {
37                 List<ObjectiveMarker> markers = null;
38                 Optional<List<MissionObjectiveCoordinate>> missionObjectives = ((Optional<List<MissionObjec
39                 if (missionObjectives.isPresent()) {
40                     markers = missionObjectives.get().stream().map({o -> new ObjectiveMarker(o.getCoord(),
41                 }
42
43                 Objective main = new Objective((String) message.getParameters().get("objective"), markers);
44
45                 List<Objective> secondary = ((List<MissionObjectiveCoordinate>) message.getParameters().get
46                     .stream()
47                     .map({moc -> new Objective(moc.getDescription(), ImmutableList.of(new ObjectiveMarker(m
48                     collect(ImmutableList::of, ImmutableList::of));
```

- Last Outpost campaign implemented as mod in groovy code
- Seamless integration in java
- Mods can just place their groovy code in the mod directory
- Challenges
  - Sandboxing
    - → Java Security Manager
  - Object serialization (network)
    - → Custom class loader

# Spacecraft Tactics

## Modules



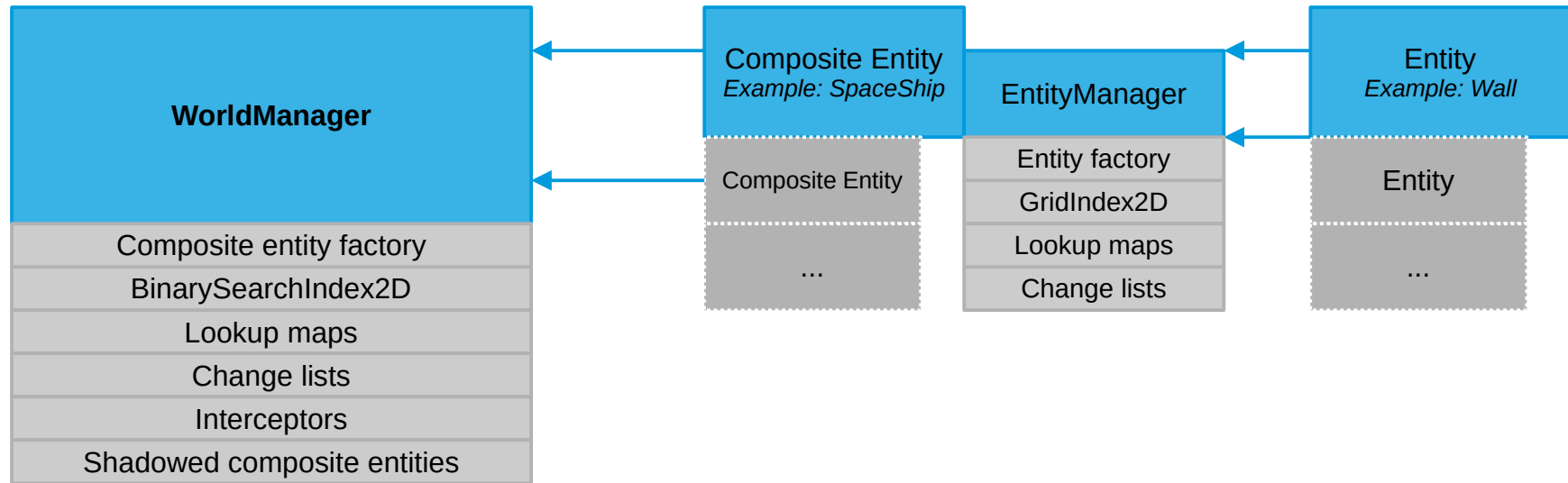
# Spacecraft Tactics

## Modules

Client UI	Client UI IG	Lobby	Ship Editor	Scene Editor	Server	Server UI
Dialog Display	Energy Distribution	<b>LobbyModule</b>	ShipEditorModule	SceneEditorModule	Check Points	Chat
Disclaimer	<b>MenuBar</b>	ChatView	Bars	MenuBar	Scene Transfer	Console
File Selection	<b>Quick Action Bar</b>	ConnectView	InfoBar	ToolBar	<b>AI</b>	Energy Distr.
<b>Main Menu</b>	Speedrun	Game Browser	MenuBar	Minimap	...	Minimap
Message Display	<b>Console</b>	InfoView	ToolBar	Tools	<b>Entity controllers</b>	Quick Action Bar
Mod Manager	Entity View	GameModeView	Tools	Clone	Engines	Speed run
<b>Options</b>	Info View	MenuView	Create	Move	Weapons	ViewPort
Ship Selection	Mesh View	ModsView	Delete	Place	Storage	...
<b>Social</b>	<b>Minimap</b>	OptionsView	Fill	Properties	...	
Welcome	DamageStatus	ServerView	Move	Factories	<b>Game Modes</b>	
<b>ViewPort</b>	SensorMap	ShipView	Problems	20+ Factories	Editors	
...	...	...	...	...	...	

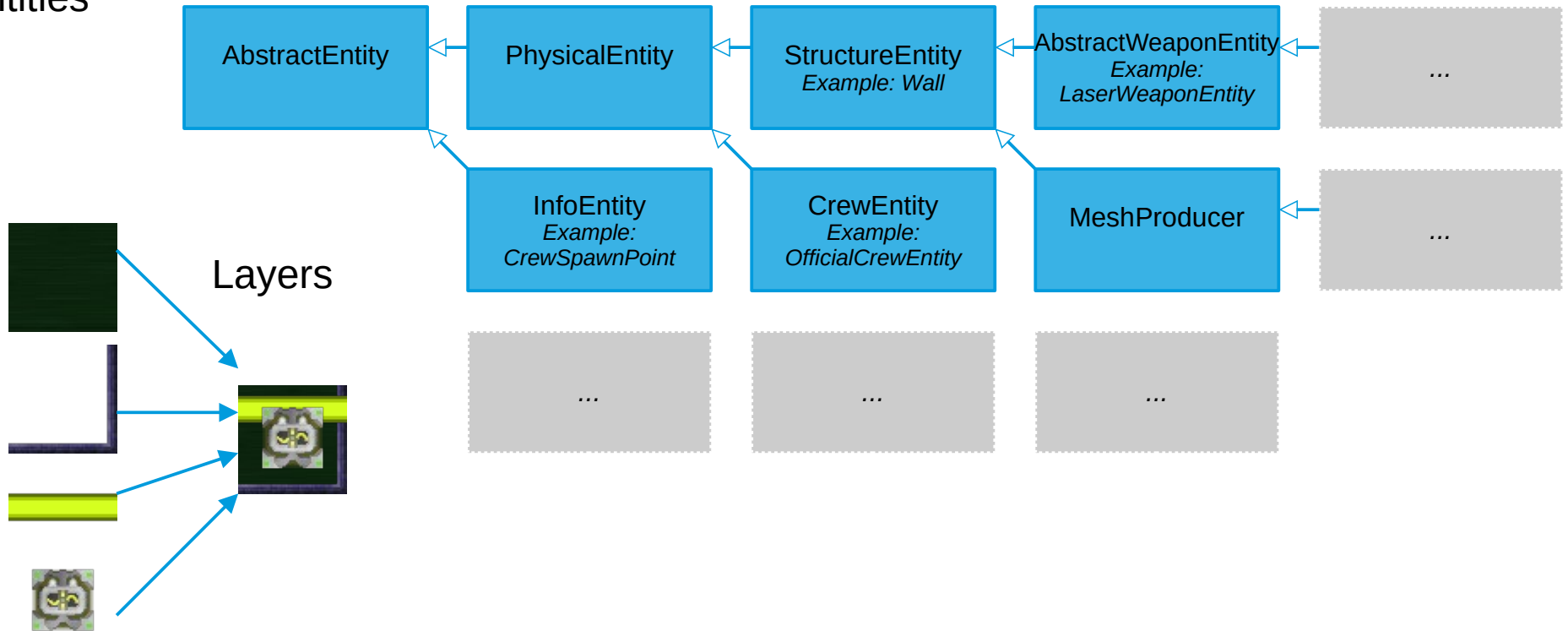
# Spacecraft Tactics

## World Manager



# Spacecraft Tactics

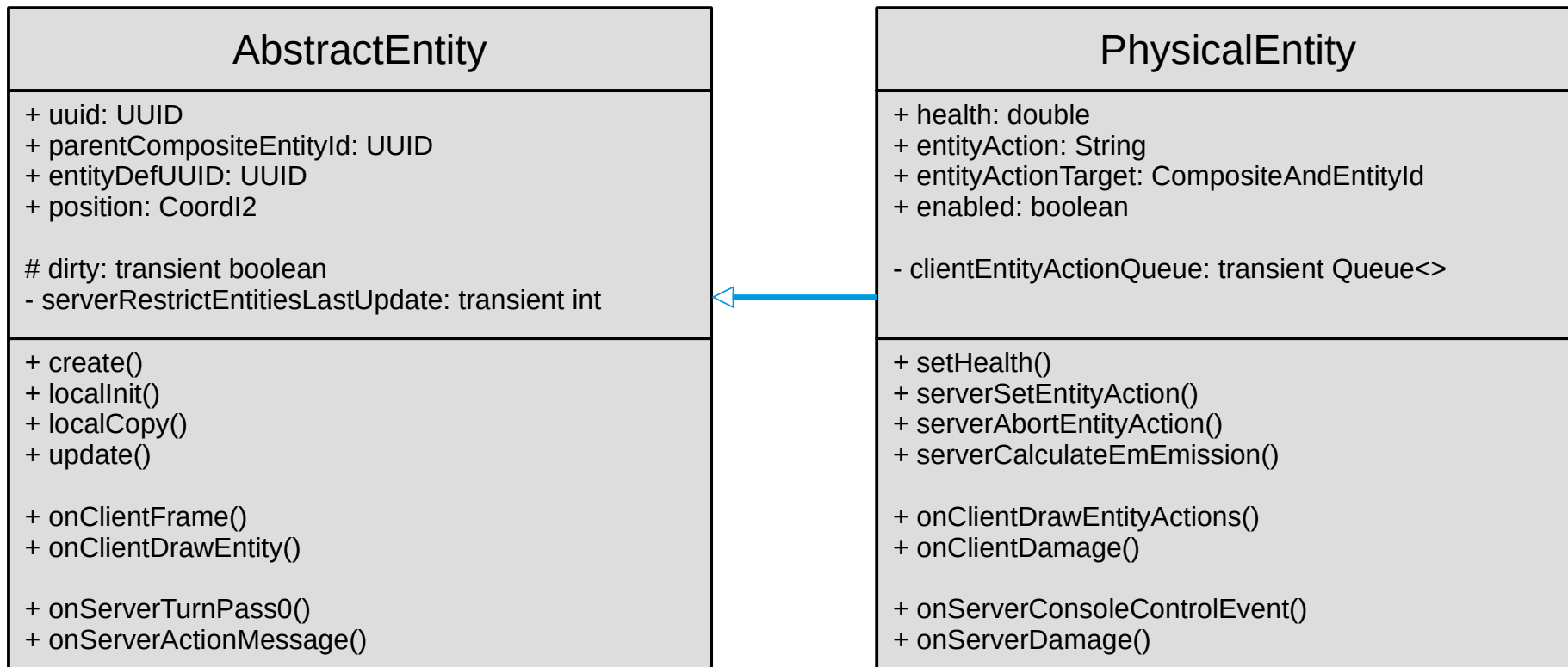
## Entities





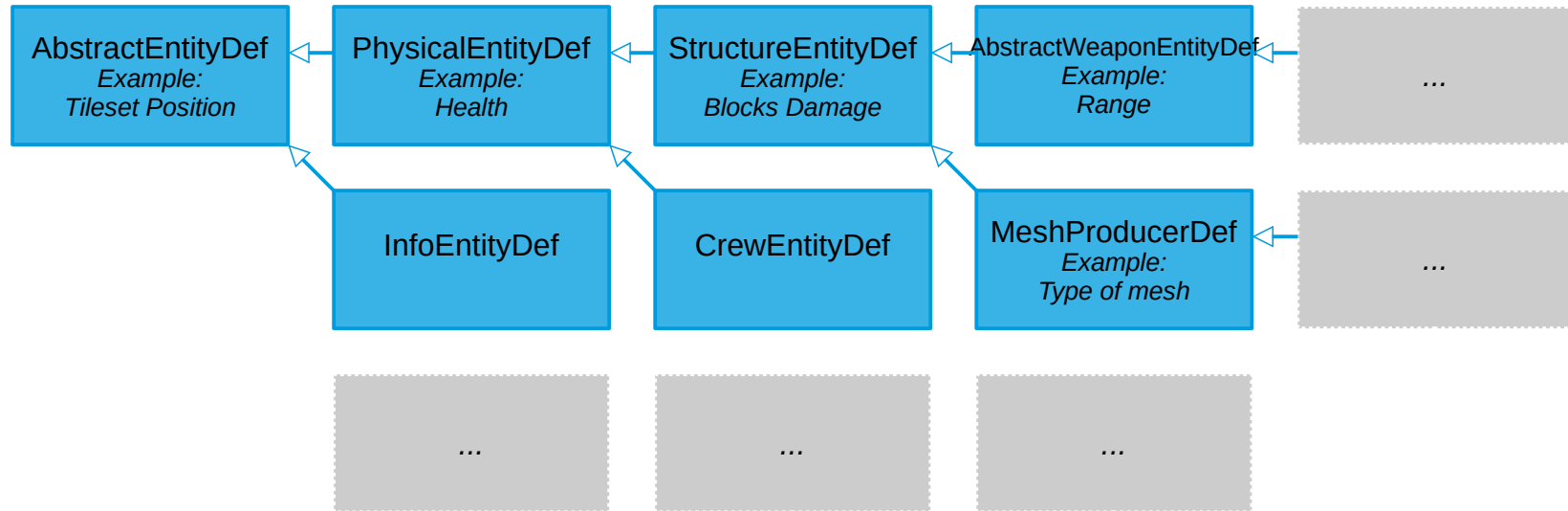
# Spacecraft Tactics

## Entities



# Spacecraft Tactics

## Entity Definitions



# Spacecraft Tactics

Entity Editor

File

258 Systems::Console M

Name	Value	Description
Entity::definition::animatedMovement (boolean)	false	Whether entity movement is animated
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Entity::definition::cooldownAfterEnable (boolean)	false	Initial cooldown after entity has been enabled
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Entity::definition::loggedInTilesetPosition::x (int)	14	Tileset position when console logged in

Content: #961; Structure: #1; Last modification: 2022-07-05T11:32:56.213+0000

# Spacecraft Tactics

## Business Objects / Entities implementations by category

BO	Composites	Entities	Entity Automation	AI Mngr	AI Blocks	Game Modes
<b>Path Finding</b>	Mines / Missiles	Entity Mods	<b>Handlers</b>	Artillery	Attack	Sandbox (custom)
<b>Meshes</b>	Dark matter	Crafting Materials	ConsoleOp	Bandit	Escort	Tutorial
<b>Fields</b>	Image Surfaces	Info Entities	Heal	Ctrl Bandit	OptimalRange	Last Outpost
Checkpoints	Portals	Mesh Entities	Repair	Ctrl Guard	Static	...
Entity mods	Info composites	<b>Crew</b>	Resupply	Escort	EngineController	
<b>Environment Gen</b>	<b>Scripting comp.</b>	<b>Floors</b>	Revive	Floating	Sensor	
<b>Entity Network</b>	Loot containers	Weapons	<b>Actions</b>	SpaceStation	Target	
Loot scatterer	<b>SpaceCraft</b>	Armor	Login	Transporter	Closest	
<b>Scene Loader</b>	<b>SpaceShip</b>	<b>Structures</b>	Move		Artillery	
<b>Ship Validator</b>	<b>SpaceStation</b>	<b>Systems</b>	Repair		Ctrl Guard	
Restr. Surfaces	<b>SpaceObject</b>	Field emitters	Resupply		WeaponController	
... many more	... many more	... many more	Revive		... many more	

# Spacecraft Tactics

## Meshes

### Types

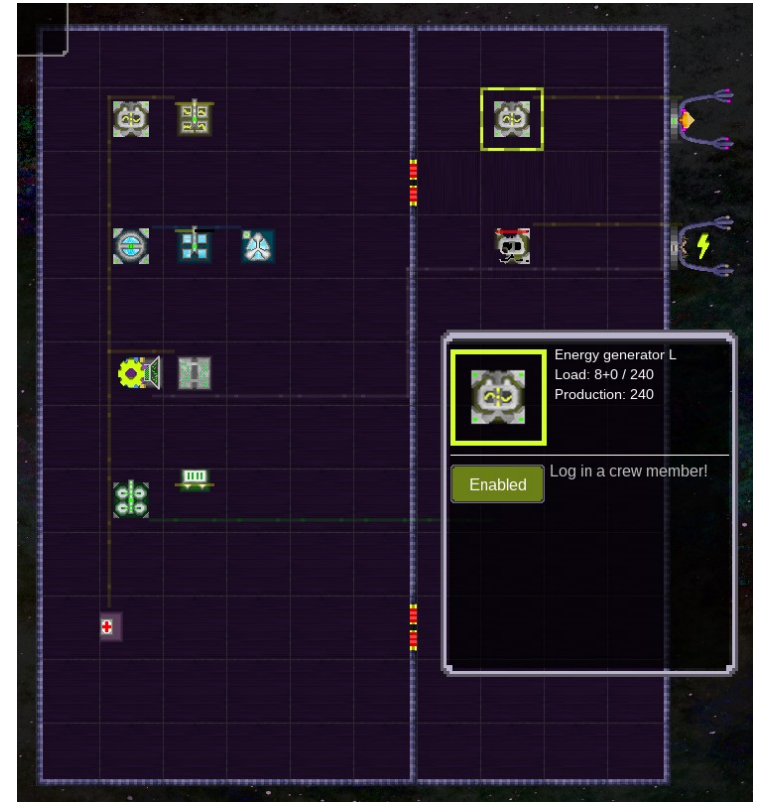
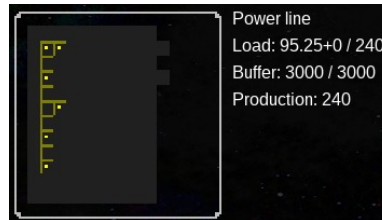
- Energy (yellow)
- Shield (blue)
- Network (gray)
- O2 (green)

### Components

- Cables
- Producers
- Buffers
- Consumers

### Features:

- Base load
- Action load
- Production reduced by damage
- Damaged cables leak
- Destroyed cables split mesh!
- Energy distribution 50% ↔ 150%





# Spacecraft Tactics

## Fields

### Types

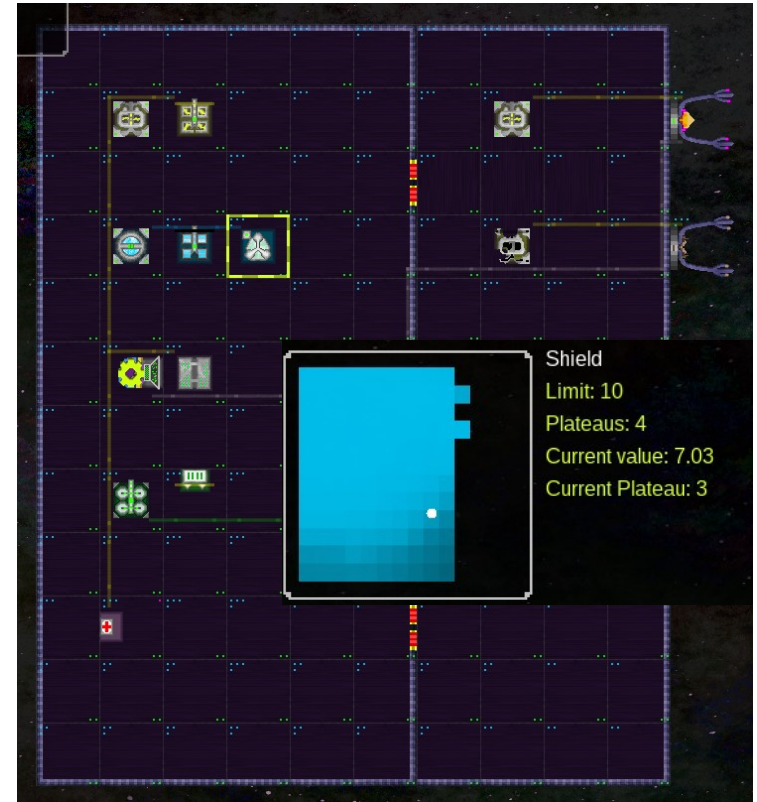
- Shield (blue)
- O2 (green)
- Healing (purple)

### Components

- Emitters

### Features:

- Room fields (O2)
- Circular fields (Shield)
- Plateaus
- Fields mix
- Field decay
- O2 leaks on destroyed tiles w/o shields



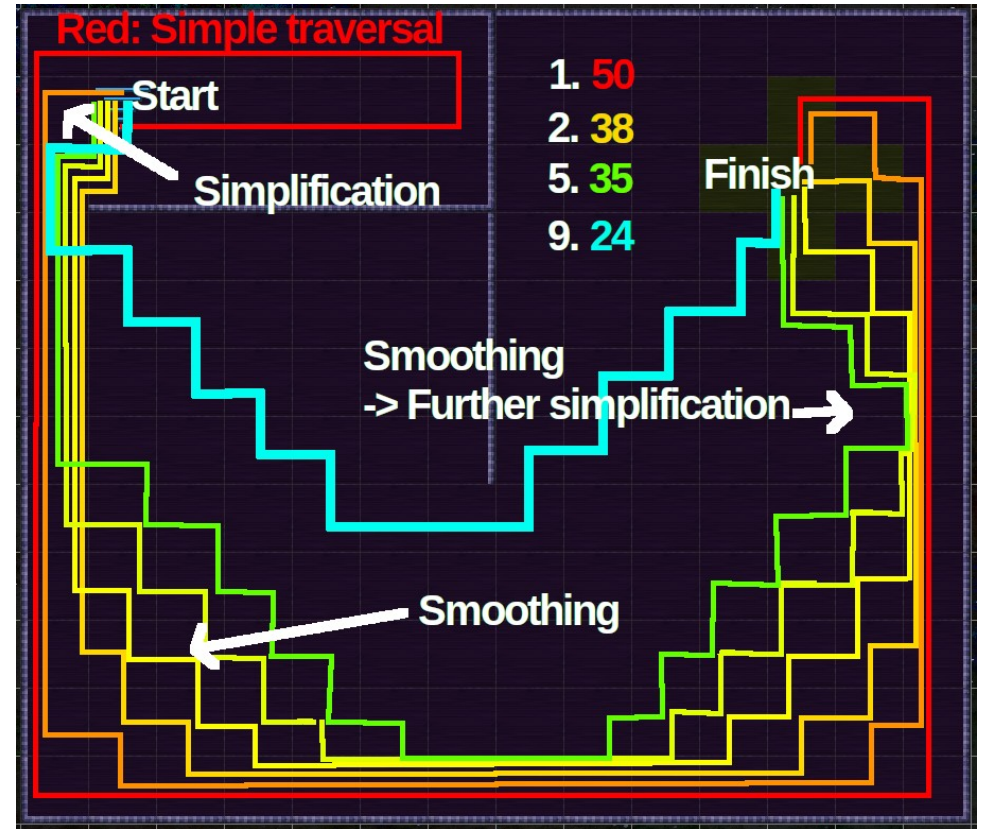
# Spacecraft Tactics

## Path Finding (Entities)

Perfect approach:  
Heuristic traversal algorithm

Much faster approach:

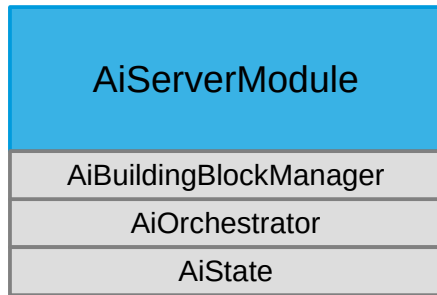
1. Simple traversal algorithm  
→ Goal: Find any path
2. Repeat these operations on the resulting curve until no further opt. possible:
  - 2.1 Simplification  
→ Shorter curve
  - 2.2 Smoothing  
→ Enables further simplification



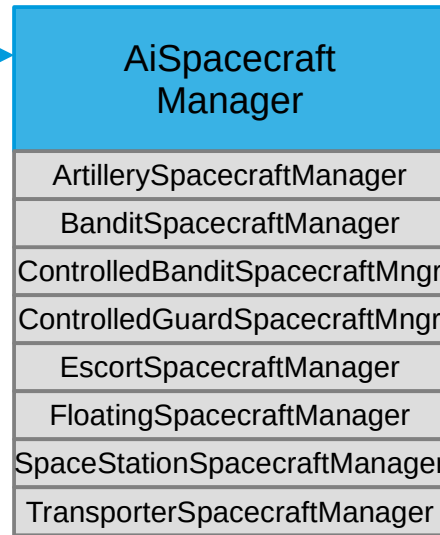
# Spacecraft Tactics

AI (Spacecraft)

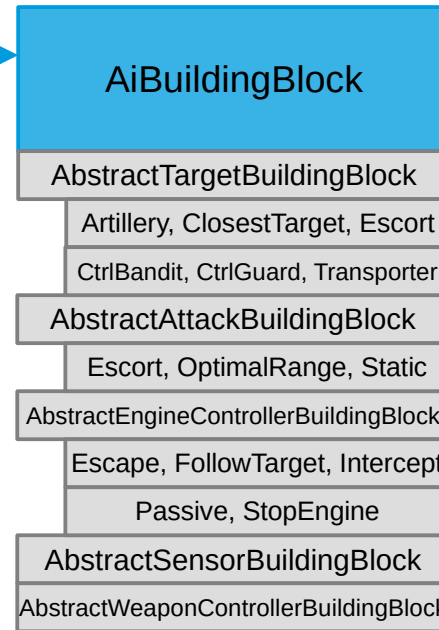
Management  
Process flow



Asses high level situation,  
chooses and configures  
building blocks



Analyzes and executes  
in detail



Chooses target  
(Fly to abc,  
Attack ship xyz, ...)

Chooses attack pattern  
(+ orchestration)

Executes engine ctrl  
(based on target and  
policy)

Executes sensors  
/ weapons control  
(based on target)

# Spacecraft Tactics

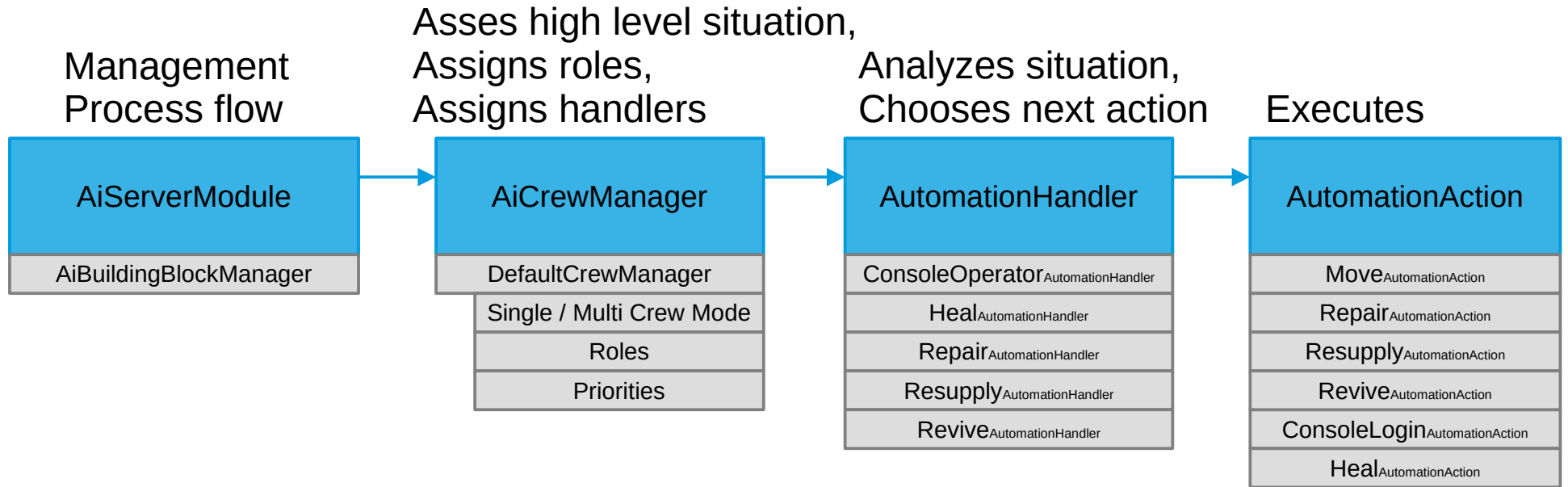
## Evasion

Demonstration video here  
collision.mp4

See presentation  
on my youtube channel

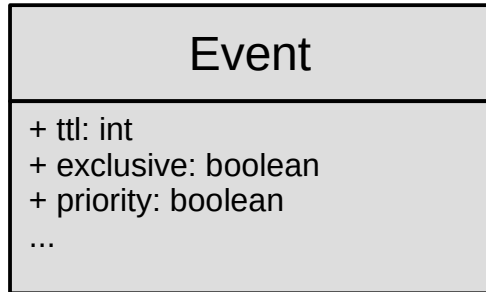
# Spacecraft Tactics

## AI (Crew)

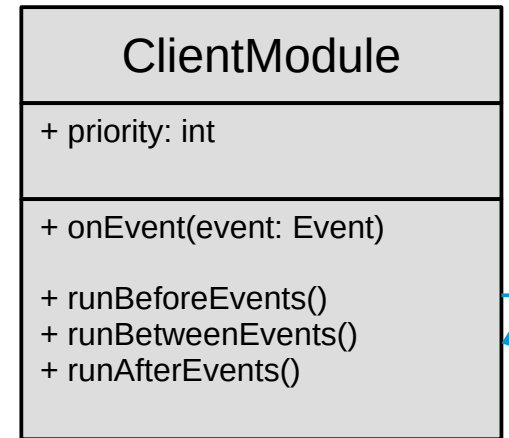


# Spacecraft Tactics

## Client Event System

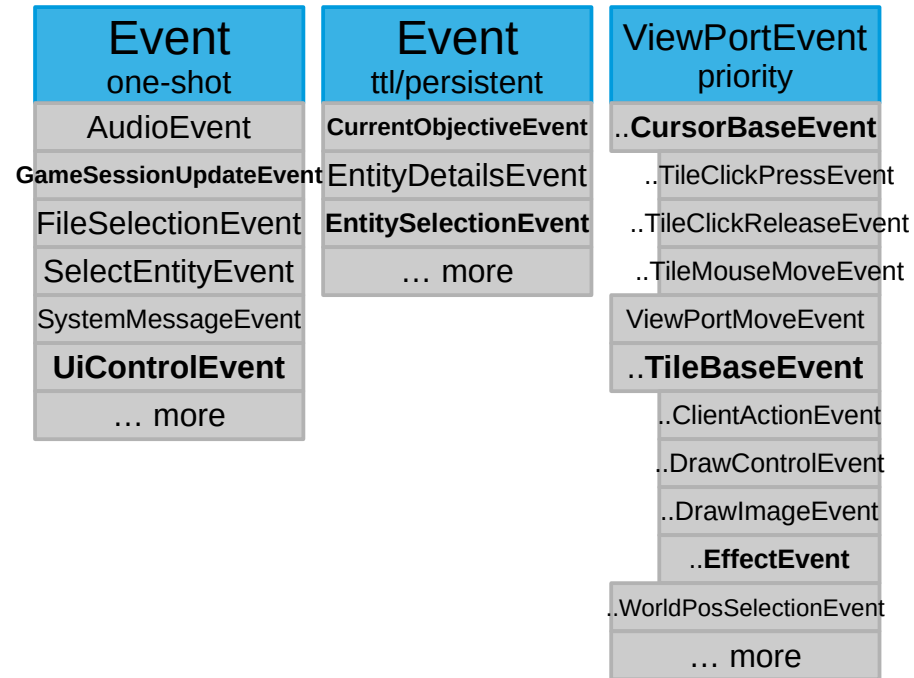


- ttl:
  - 0 persistent
  - 1 one-shot
  - > 1 n frames
- exclusive: invalidates same type of active event
- priority: Priority events are executed in the same frame



# Spacecraft Tactics

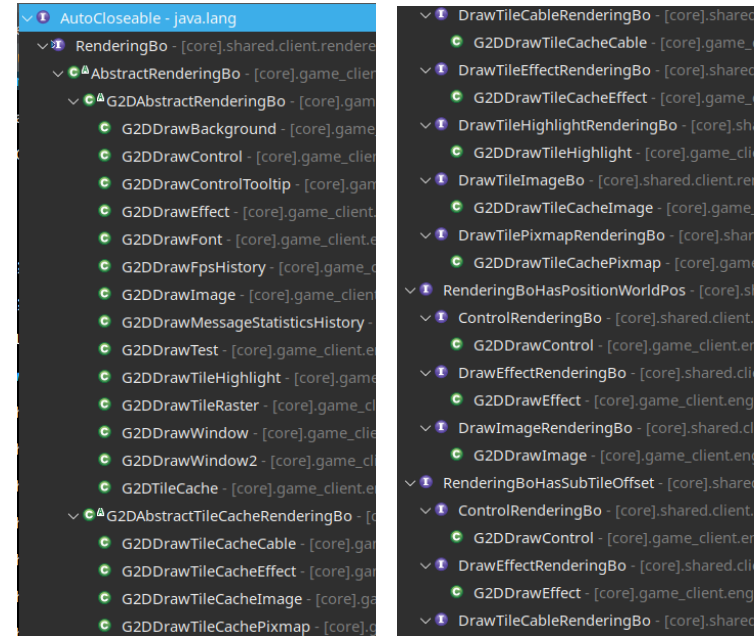
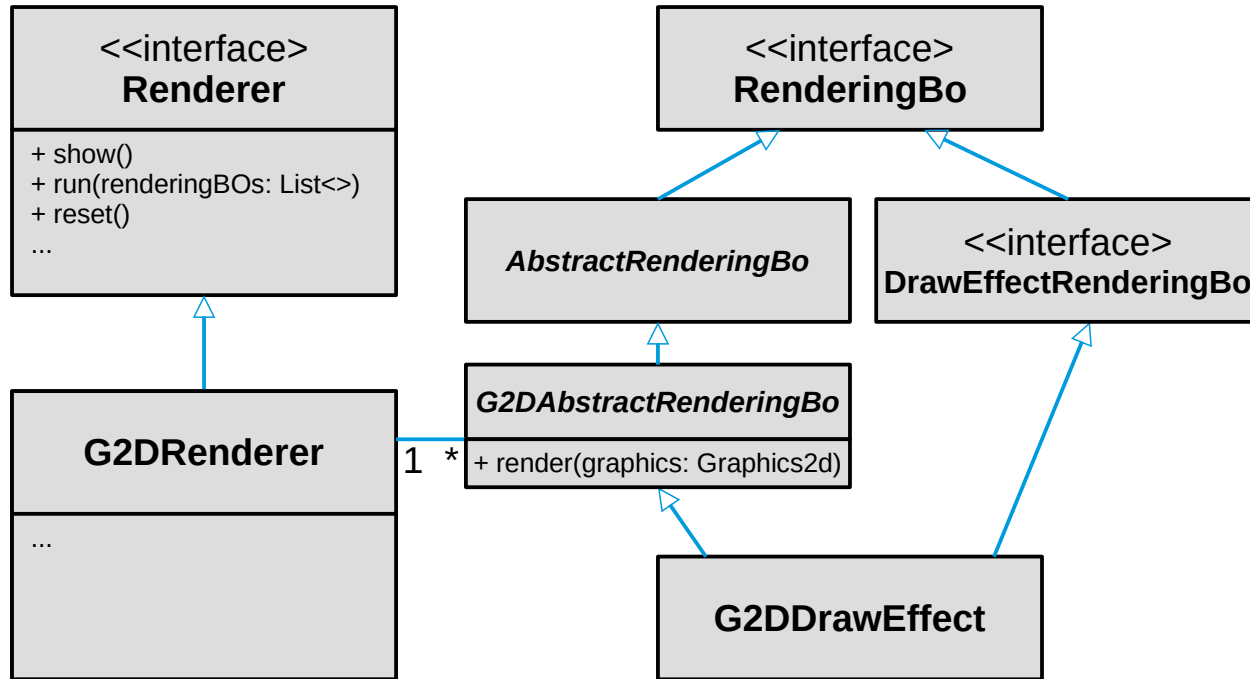
## Client Events



# Spacecraft Tactics

## Java2D Graphics2D Double Buffering Renderer

Class diagrams and relationships simplified!





# Spacecraft Tactics

## Java2D Graphics2D Double Buffering Renderer

PortalModule.java

Base  
Interface

Bo Pool

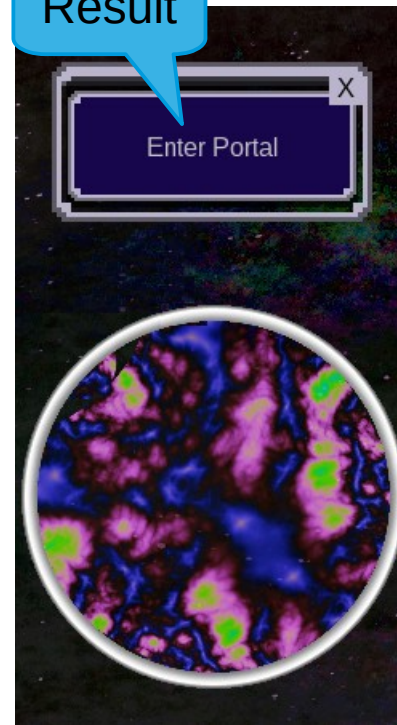
Interface

```
private void renderEnterPortal(final List<RenderingBo> renderingBo) {
    this.window.render(renderingBo, this::addRenderingBo);

    final RenderingBo bo = EngineFacade.instance().getRenderingBoPool().acquire(ControlRenderingBo.class)
        .setId("PortalModule_Enter")
        .setType(ButtonControl.class)
        .setCaption(EngineFacade.instance().getLocalizationManager().translate("726"))
        .setVisible(true)
        .withDimensionAbsolute(181, 70)
        .withPositionAbsoluteAnchorTopLeft(this.window)
        .withPositionIncrementalAbsolute(10, 18);
    renderingBo.add(bo);
}
```

Reference Resolution  
1080p  
Renderer scales before  
drawing

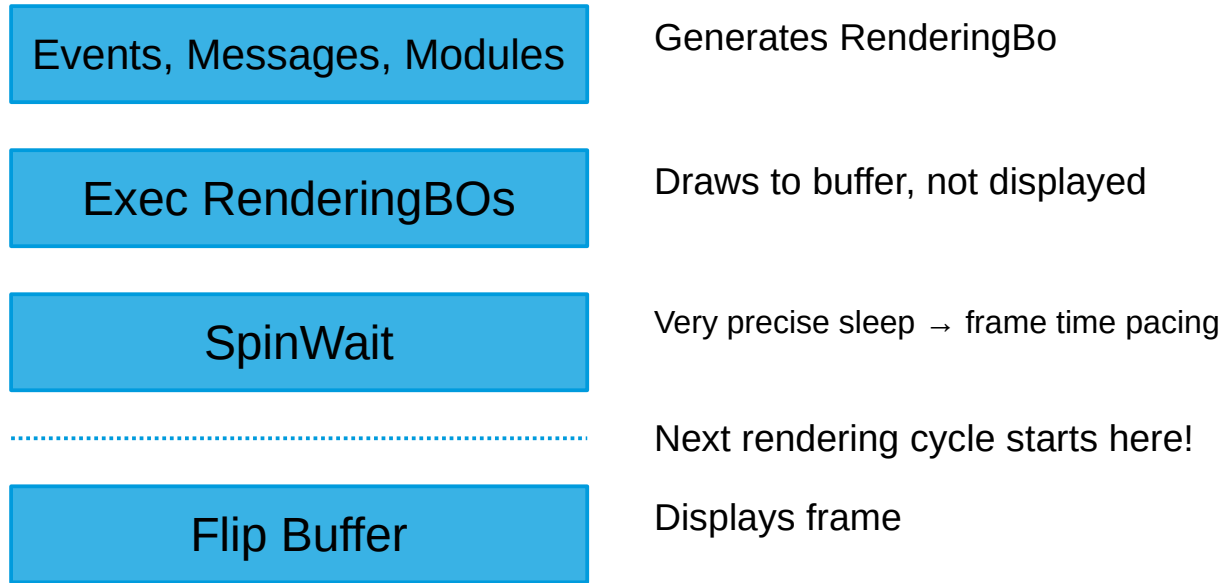
Result



# Spacecraft Tactics

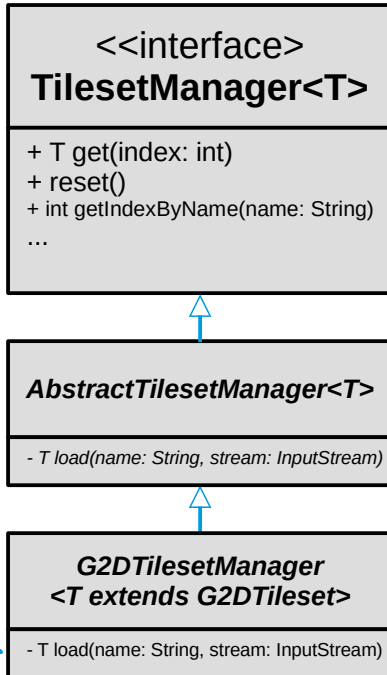
## Java2D Graphics2D Double Buffering Renderer

*Simplified!*

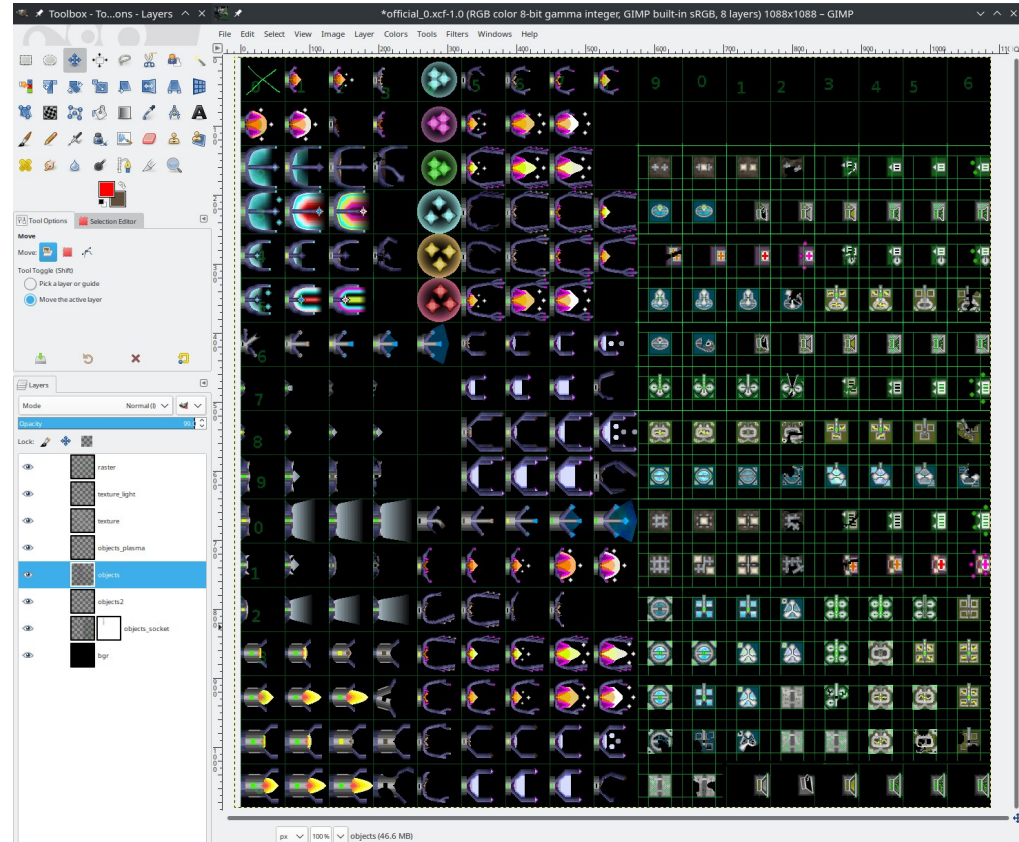


# Spacecraft Tactics

## Tilesets



Affine transformations



# Spacecraft Tactics

Java2D Graphics2D  
Double Buffering Renderer



Tile cache



# Spacecraft Tactics

## Java2D Graphics2D Double Buffering Renderer

### Translations

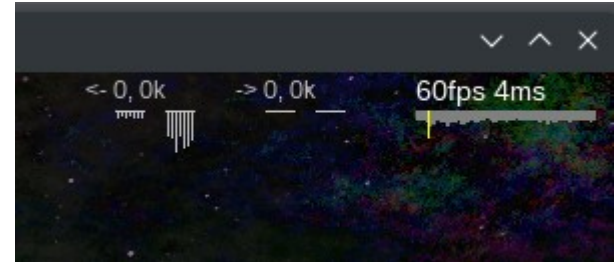
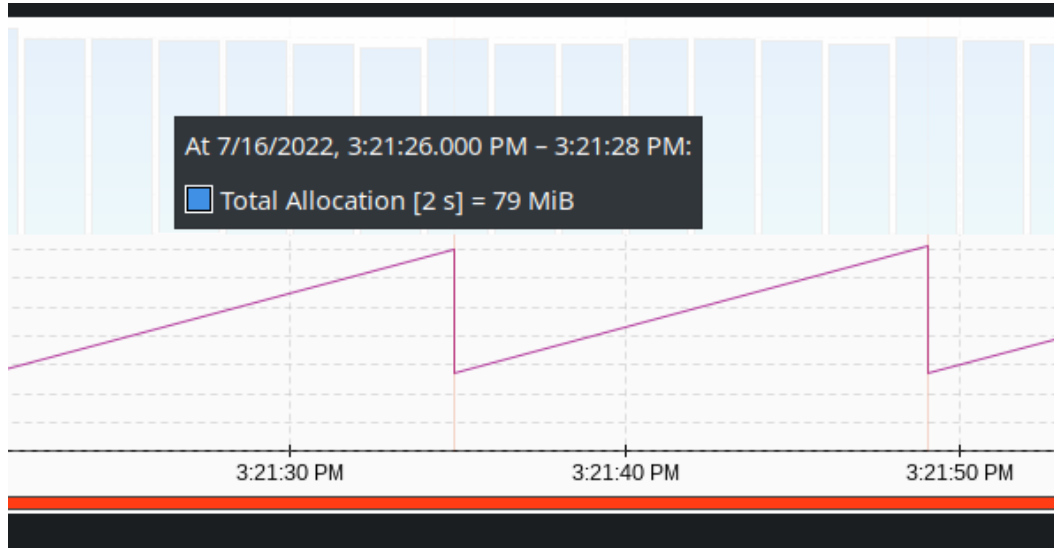


translation.mp4

- World Position: 13 | 7
- View Position: 16 | 8
- Absolute Position: 1079 | 561
  - SubTileOffset – composite entity movement
  - AnimationOffset – inside composite
  - Zoom factor
  - Global scale factor
- Rounding errors were a big issue
  - Animations don't look straight with the slightest rounding problem

# Spacecraft Tactics

## Client Performance

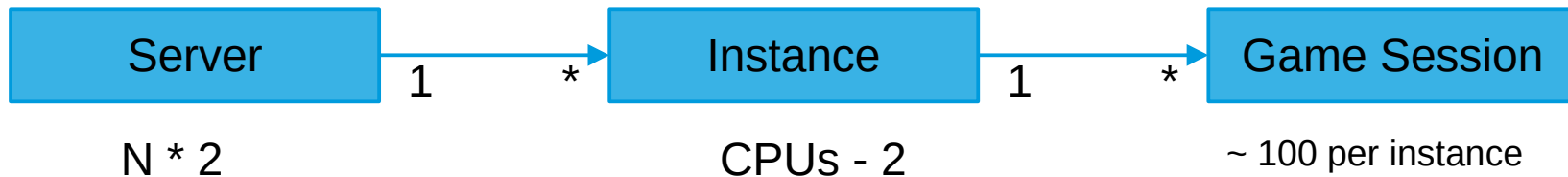


# Spacecraft Tactics

## Game Server Overview

- Client / Server architecture
  - Security by Server:
  - Client displays state
  - Server changes state
- Embedded
- Dedicated
- Official Servers

```
Game Server Dedicated local metaserver [Java Application]
15:05:40.735 INFO [main] de.extio.spacecraft.game_lib.logging.Log4j2Configurer - Changing log level to DEBUG
15:05:40.740 INFO [main] de.extio.spacecraft.game_server.Main - Launching standalone game server SNAPSHOT
15:05:40.744 INFO [main] de.extio.spacecraft.game_lib.security.SecurityManagerActivator - SecurityManager activated
15:05:40.749 INFO [main] de.extio.spacecraft.game_lib.managers.StorageManagerImpl - Storage location /home/sb/svn/spacecraft/trunk/spacecraft-
15:05:40.758 INFO [main] de.extio.spacecraft.game_lib.managers.ModManagerImpl - Mods locations: [/home/sb/svn/spacecraft/trunk/spacecraft-
15:05:40.758 INFO [main] de.extio.spacecraft.game_server.ServerProperties - Loading server properties from /home/sb/svn/spacecraft/trunk/s
15:05:40.759 INFO [main] de.extio.spacecraft.game_server.ServerProperties - Threads: 2
15:05:40.759 INFO [main] de.extio.spacecraft.game_server.ServerProperties - Default password for game sessions: Not set
15:05:40.759 INFO [main] de.extio.spacecraft.game_server.ServerProperties - Announce quick join codes: true
15:05:40.759 INFO [main] de.extio.spacecraft.game_server.ServerProperties - Announce game sessions in game browser: false
15:05:40.759 INFO [main] de.extio.spacecraft.game_server.ServerProperties - This is not an official server
15:05:40.759 INFO [main] de.extio.spacecraft.game_server.ServerProperties - Consent for error reports: false
15:05:40.761 INFO [main] de.extio.spacecraft.game_lib.managers.MetaserverClientImpl - Metaserver URL: http://localhost:8080/metaserver
15:05:40.779 INFO [Server Manager] de.extio.spacecraft.game_server.manager.ServerManager - Server Manager up
```

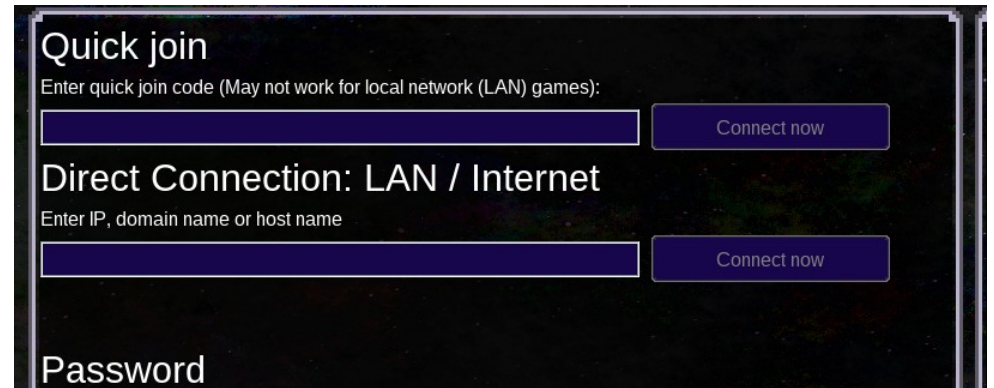
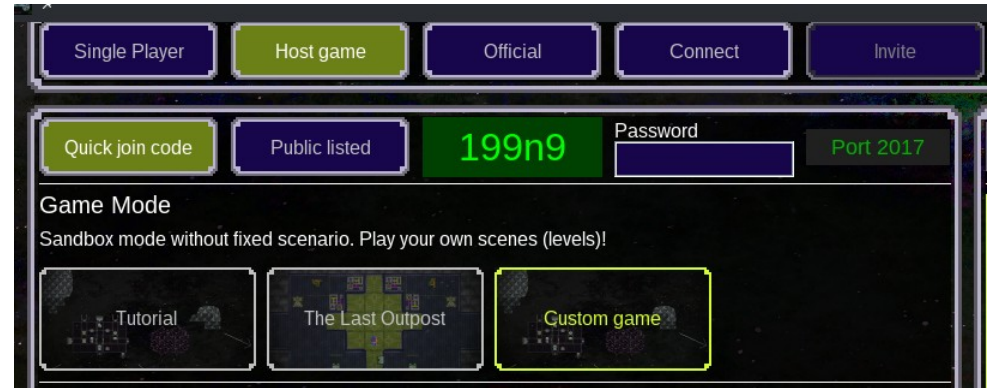




# Spacecraft Tactics

## Match Making Options

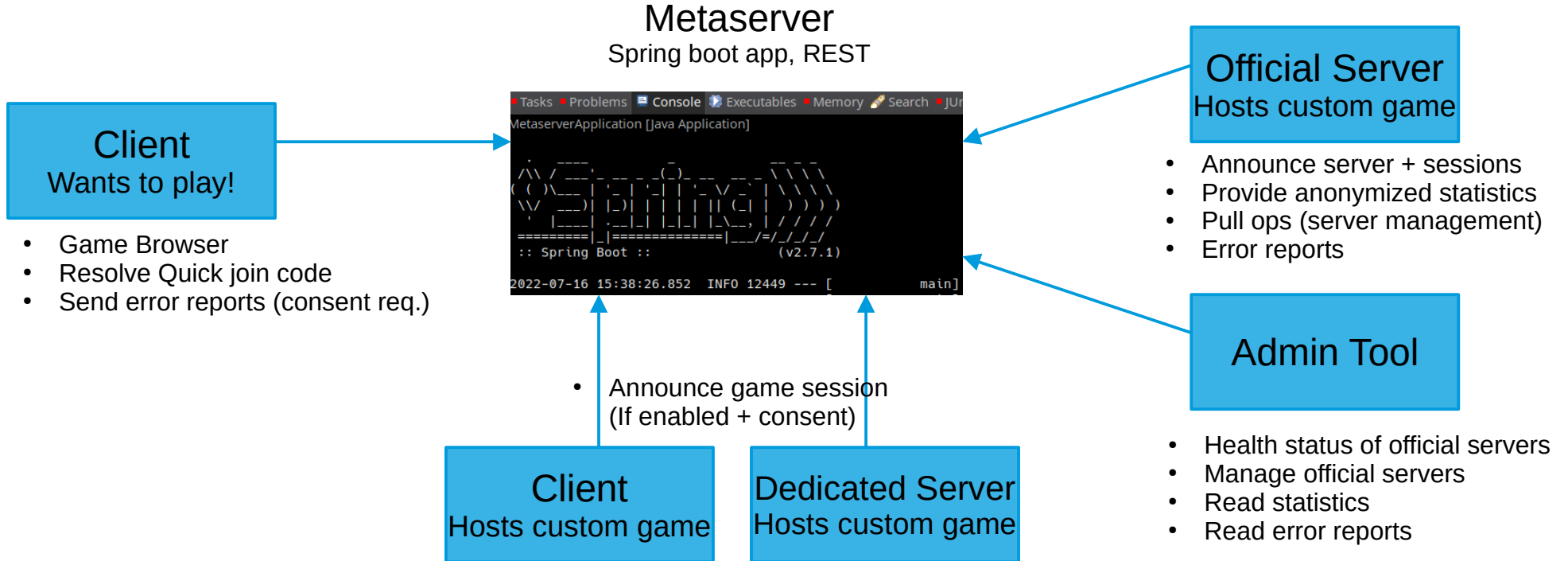
- Single Player
- Host Multiplayer
  - Official Server
  - Host Game (embedded server)
    - Forward port: 2017
  - Custom Dedicated Server
- Joining
  - Quick Join Code
  - Game Browser
  - Direct Connection
- PvP / PvE / Coop
  - Each player controls separate ships
  - Players join the same ship





# Spacecraft Tactics

## Metaserver



# Spacecraft Tactics

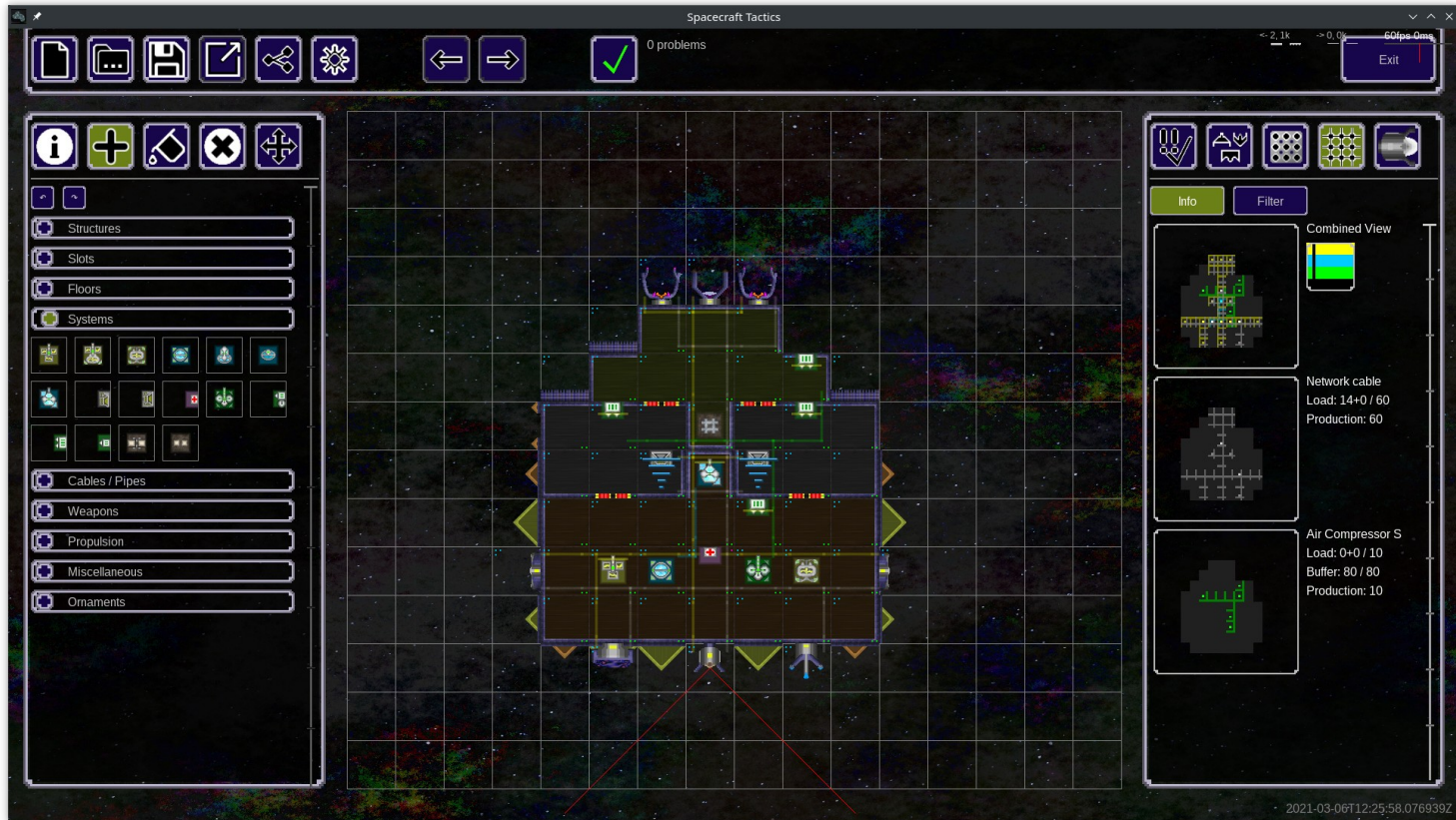
## Game Design: Balancing

- 4 Types of Mesh
- 3 Types of Fields
- 2 Types of Propulsion
- 7 Types of Weapons
- Systems
  - Producers, Buffers, Emitters,
  - Sensors, Collectors, Storage, ...
- Different kind of Structures, Armor, ...
- ALL modules in size S, M and L
- Processing, Crafting, Upgrading
- Entity Mods
- **In total ~ 350 different entities**

	A	F	G	H	I
1					
2	<b>Defense - Hull</b>	Cre Armor S		Hull System S	Sy
1					
2	<b>Defense - Hull</b>	Cre Armor S		Hull System S	Sy
3	health	200.00		30.00	
4	damagePlateau	32.00		4.00	
5		(not repairable)			
6					
7	<b>Offense</b>	La: Laser_Medium_S		Laser_Medium_S	Le
8	cooldown	2.00		2.00	
9	weaponBaseDamage (double)	50.00		50.00	
10	weaponDamageReduction (doubl	0.75		0.75	
11	weaponPlateauDamageHull (int)	1.00		1.00	
12					
13	Turns needed	12.50		15.00	
14	Hits needed	6.25	50.00	7.50	50.00
15	Wave 0	32.00	13.50	4.00	34.50
16	Wave 1	1.69	0.00	4.00	1.88
17	Wave 2	0.00	0.00	0.12	0.00
18	Wave 3	0.00	0.00	0.00	0.00
19	Wave 4	0.00	0.00	0.00	0.00
20	Wave 5	0.00	0.00	0.00	0.00
21					

# Spacecraft Tactics

## Ship Editor



# Spacecraft Tactics

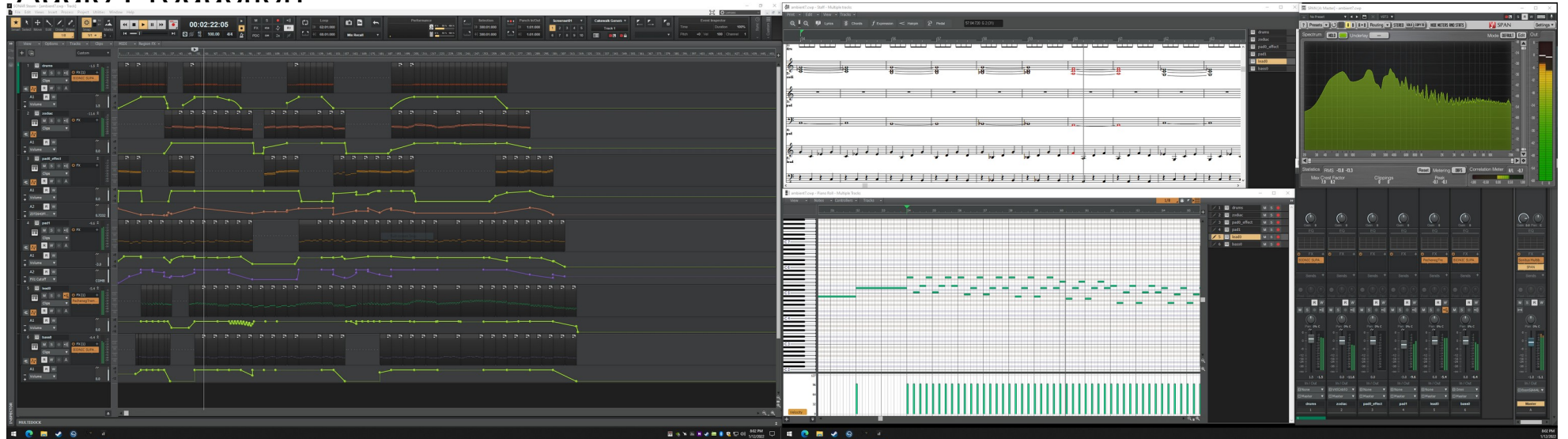
## Scene Editor





# Spacecraft Tactics

## Audio Production

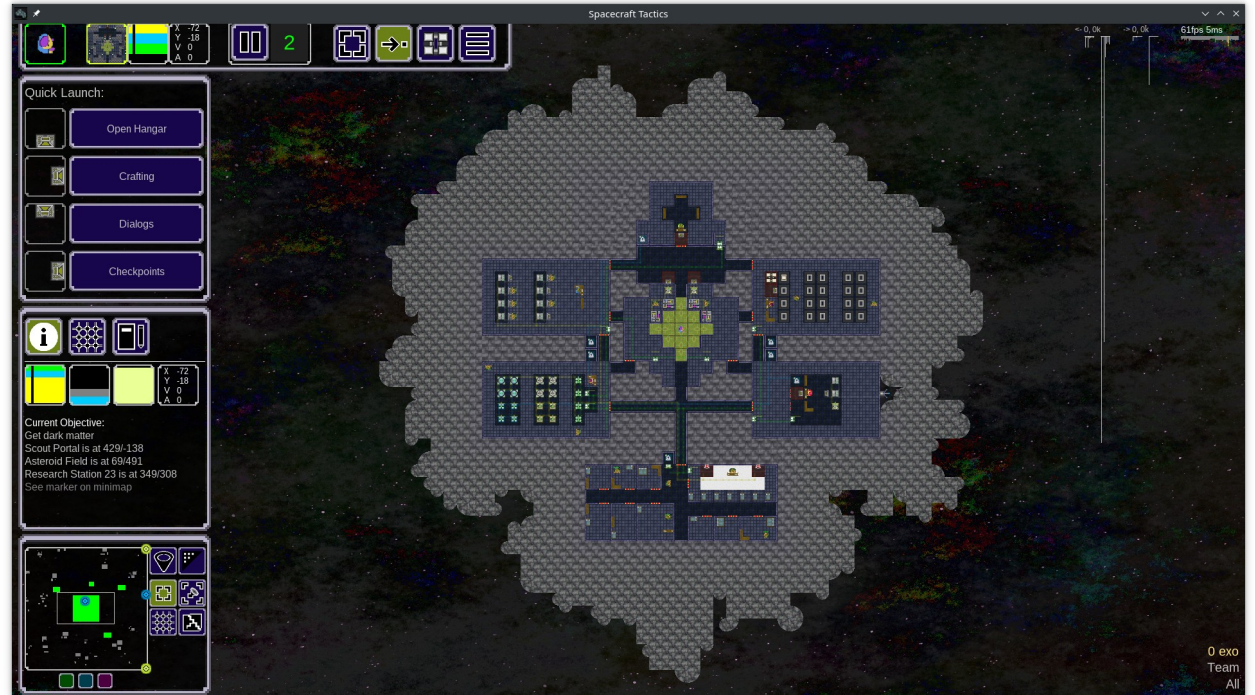


- I used to play piano and keyboard when I was younger and I'm a hobby music producer
- Everything composed and produced by myself -> Music (14) and Effects (27)
- Music: Themes (6) and ambient (8) tracks, > 2h play time
  - Software: Sonar (→ DAW) (unfortunately discontinued, but still very good)
  - Hardware: AKAI MIDI keyboard, Korg nanoKontrol2 mixer, Asus Xonar sound card for ASIO

# Spacecraft Tactics

## The Last Outpost

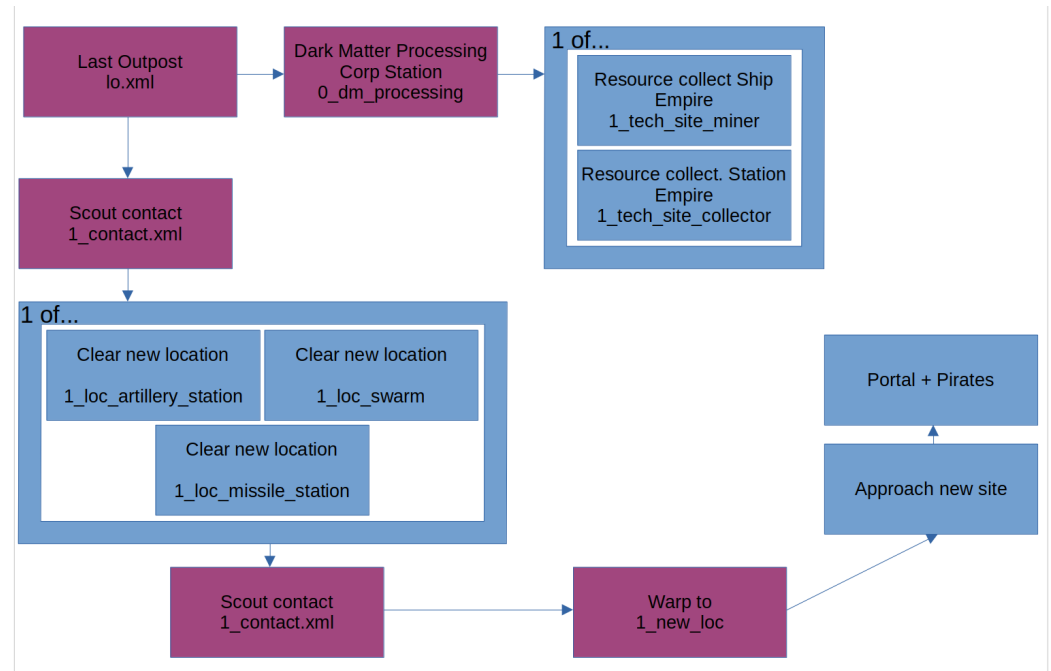
- The last rebel outpost got spotted by imperial scouts
- Goal is to relocate the outpost before the main fleet attacks



# Spacecraft Tactics

## The Last Outpost – Main missions

- 5 Chapters
- Each chapter marks a certain milestone to reach the goal
- Random elements and also different scenarios each playthrough
- Additional to the main story also several side missions and random encounters to get more / different loot, ship blueprints etc



# Spacecraft Tactics

## The Last Outpost – Stages embedded in environment

- Missions consists of one or multiple scenes
- Scenes are spawned within a certain range and position relative to other scenes
- Procedural generated environment between scenes
- Hybrid between open world and handcrafted stages
- → Multiple playtroughs with different starting conditions / challenges

```
<scenes>
  <de.extio.spacecraft.mod.last__outpost.model.MissionScene>
    <name>scenes/lo/stages/1_loc_artillery_station.xml</name>
    <spawnMode>PROBABILITY_GROUP</spawnMode>
    <spawnGroup>c1_pirate_stations</spawnGroup>
    <spawnProbability>0.33</spawnProbability>
    <distanceMin>2000</distanceMin>
    <distanceMax>2000</distanceMax>
    <countMin>1</countMin>
    <countMax>1</countMax>
    <nextTo>scenes/lo/stages/1_contact.xml</nextTo>
    <nextToPlacementMode>PEDAL</nextToPlacementMode>
    <nextToDistanceMin>500</nextToDistanceMin>
    <nextToDistanceMax>500</nextToDistanceMax>
    <disposeCandidate>true</disposeCandidate>
  </de.extio.spacecraft.mod.last__outpost.model.MissionScene>
```



# Spacecraft Tactics

## The Last Outpost

## Crafting

- Process
- Upgrade
- Craft



# Spacecraft Tactics

## The Last Outpost

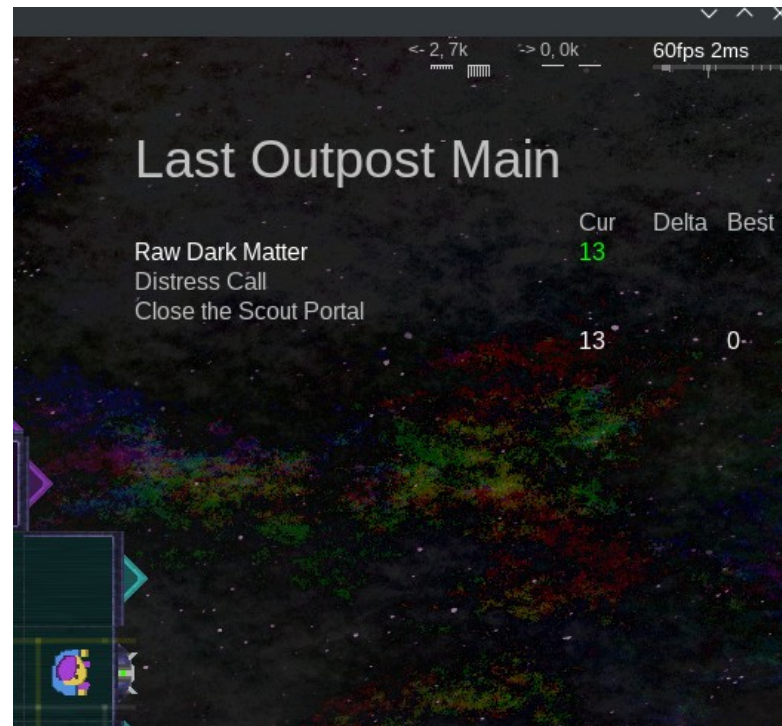
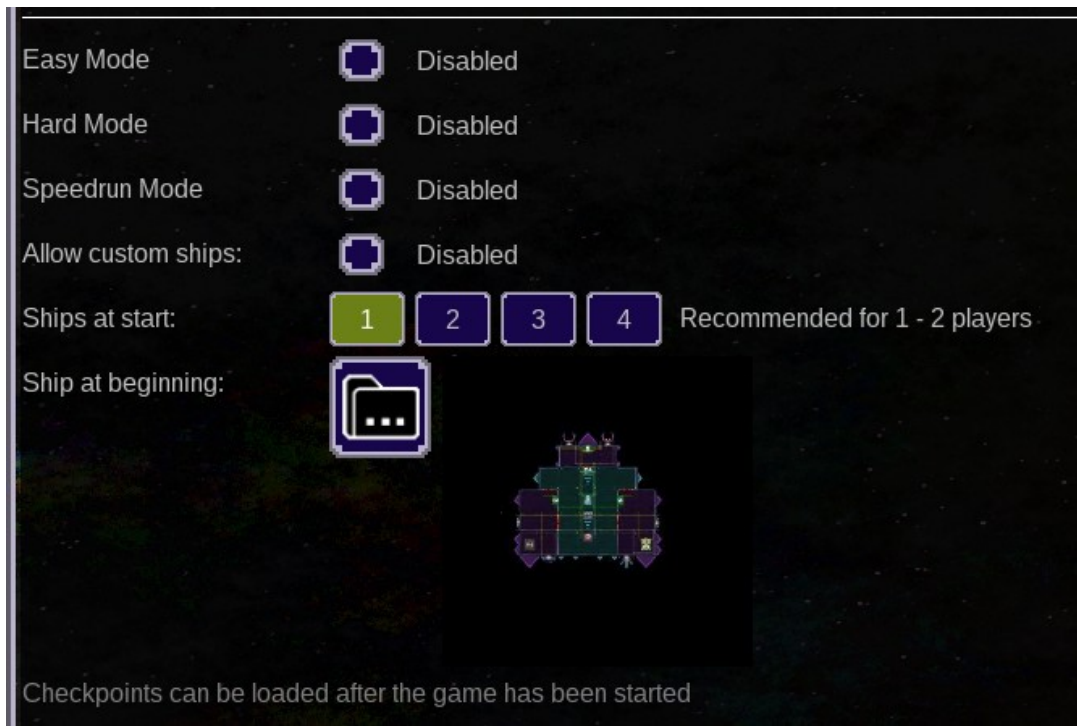
### Integrated Ship Editor

- Construct
  - Add/Swap
  - Remove
  - Rotate
  - Cables
- Repair
- Mod entities
- Upgrade entities
- Manage entities
- Load ship blueprints
- Strip ship



# Spacecraft Tactics

## The Last Outpost – Game Modes





# Spacecraft Tactics

## Progress (July 2022)

- Game Design → finished ☑
- Game Core Implementation → finished ☑
- Tools → finished ☑
- Metaserver → finished ☑
- Tilesets → finished ☑
- Audio → Effects finished ☑, Music mostly finished ✓
- Last Outpost → 4 of 5 chapters, side missions todo
- Additional game modes → todo
- Extended play testing → todo
- Organizational and legal topics → todo

**Thank you!**