



March 20-24, 2023  
San Francisco, CA

# AI for testing at EA: From Star Wars to Apex and beyond

Jonas Gillberg  
Principal Engineer  
Quality Verification & Standards (QVS)

#GDC23



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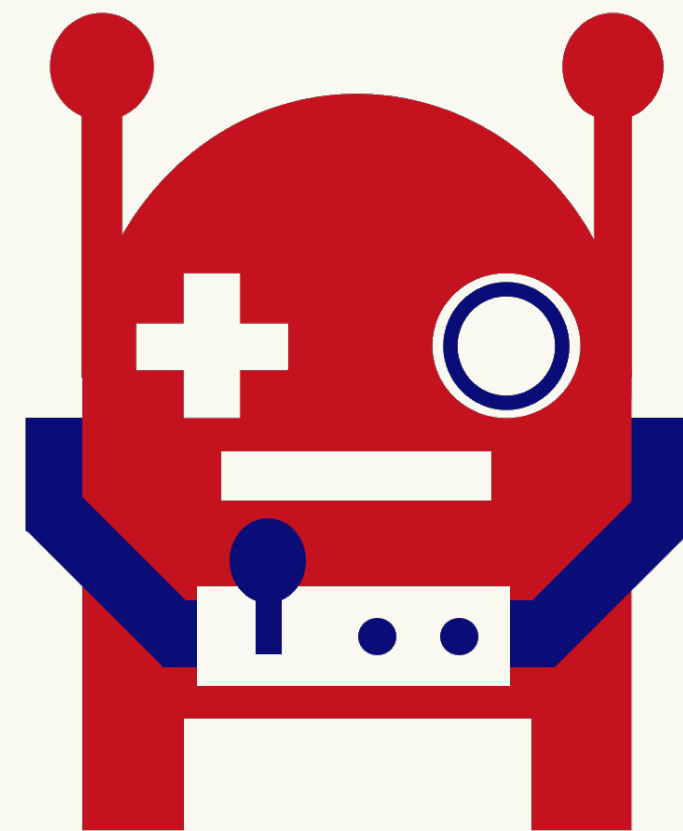
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Principal Engineer  
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#GDC23









# AutoPlayers





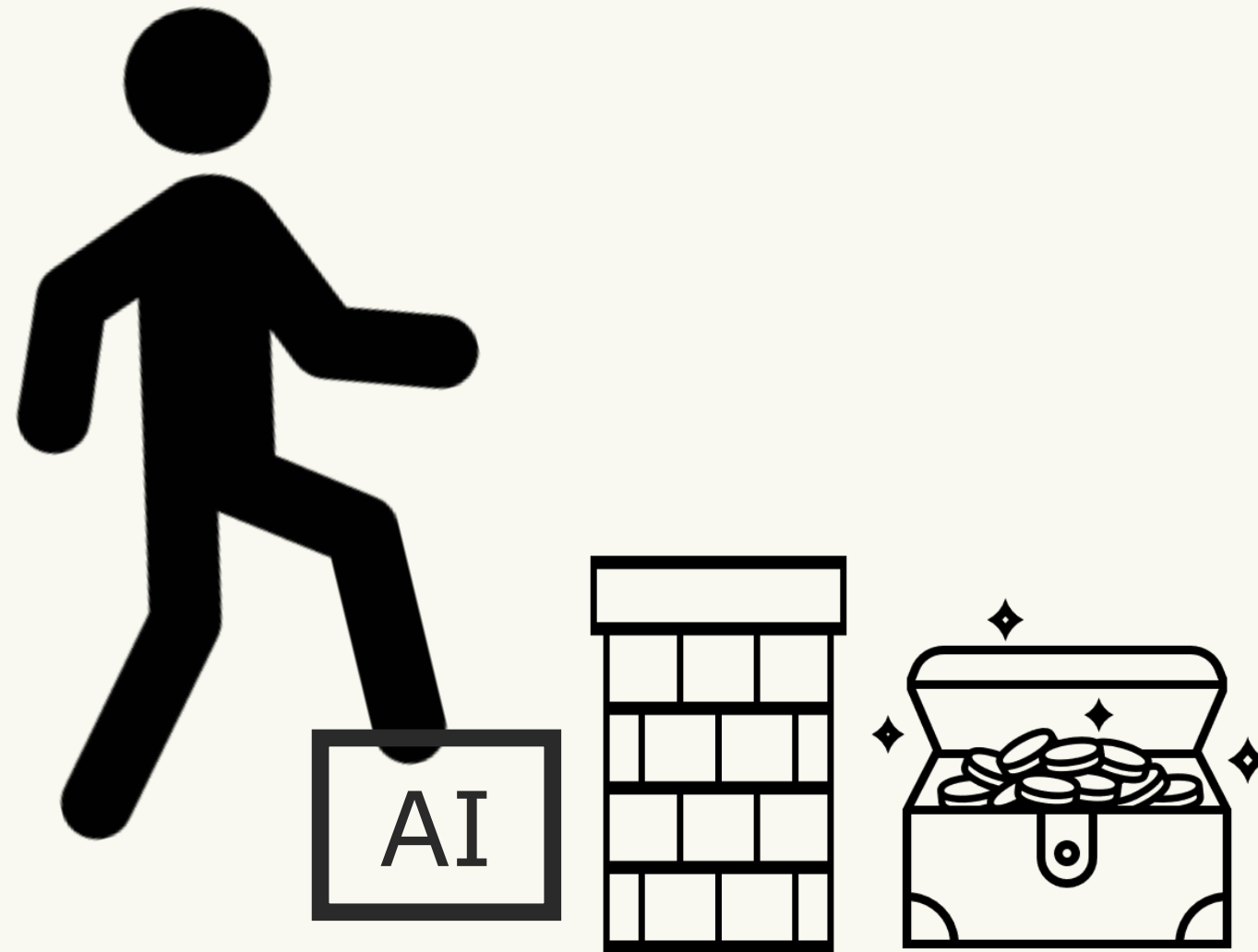






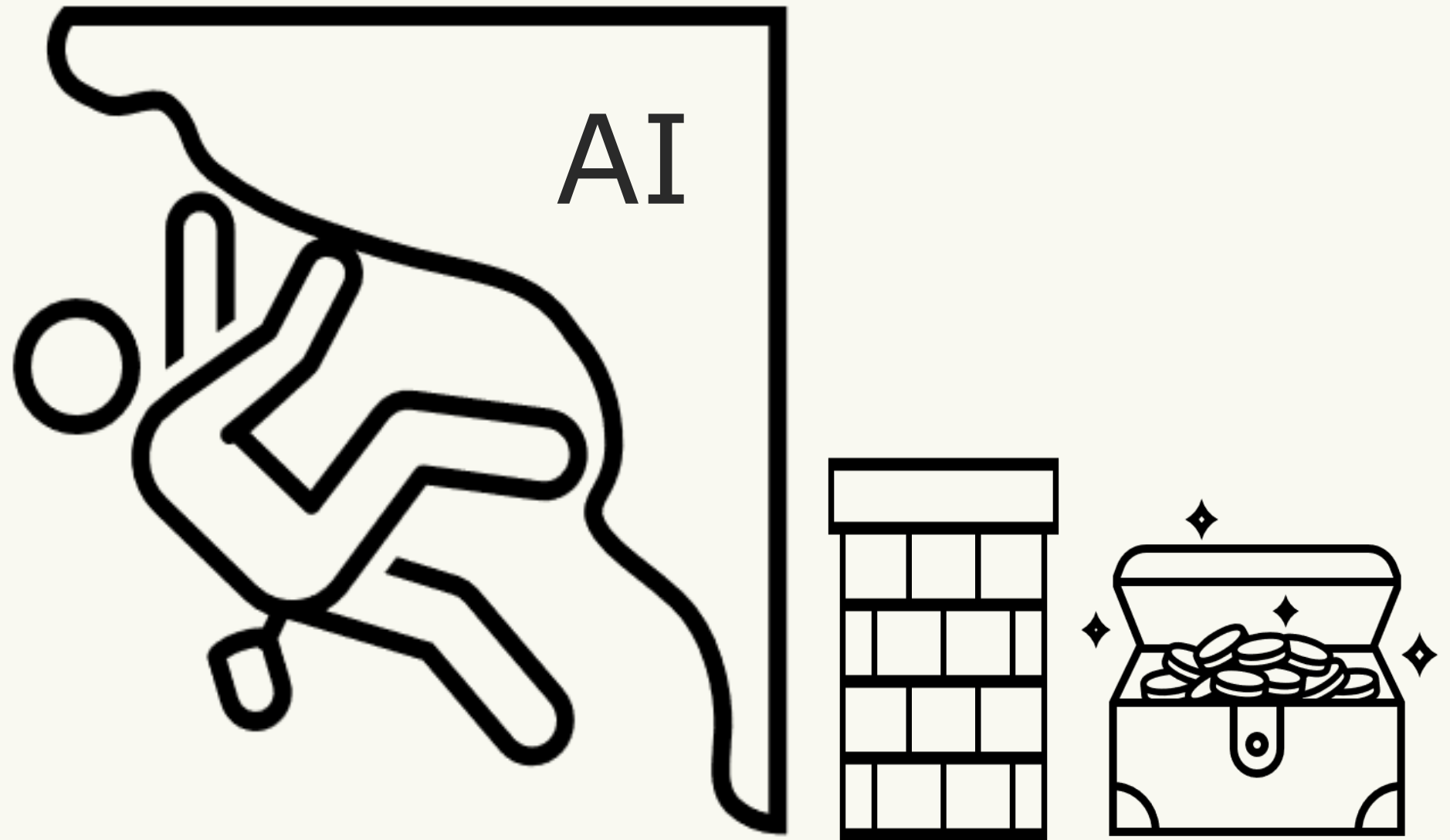
# Technical Takeaways

## 1. Keep it Simple



# Technical Takeaways

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# Technical Takeaways

1. Keep it Simple
2. End Use Focus



# Technical Takeaways

1. Keep it Simple
2. End Use Focus





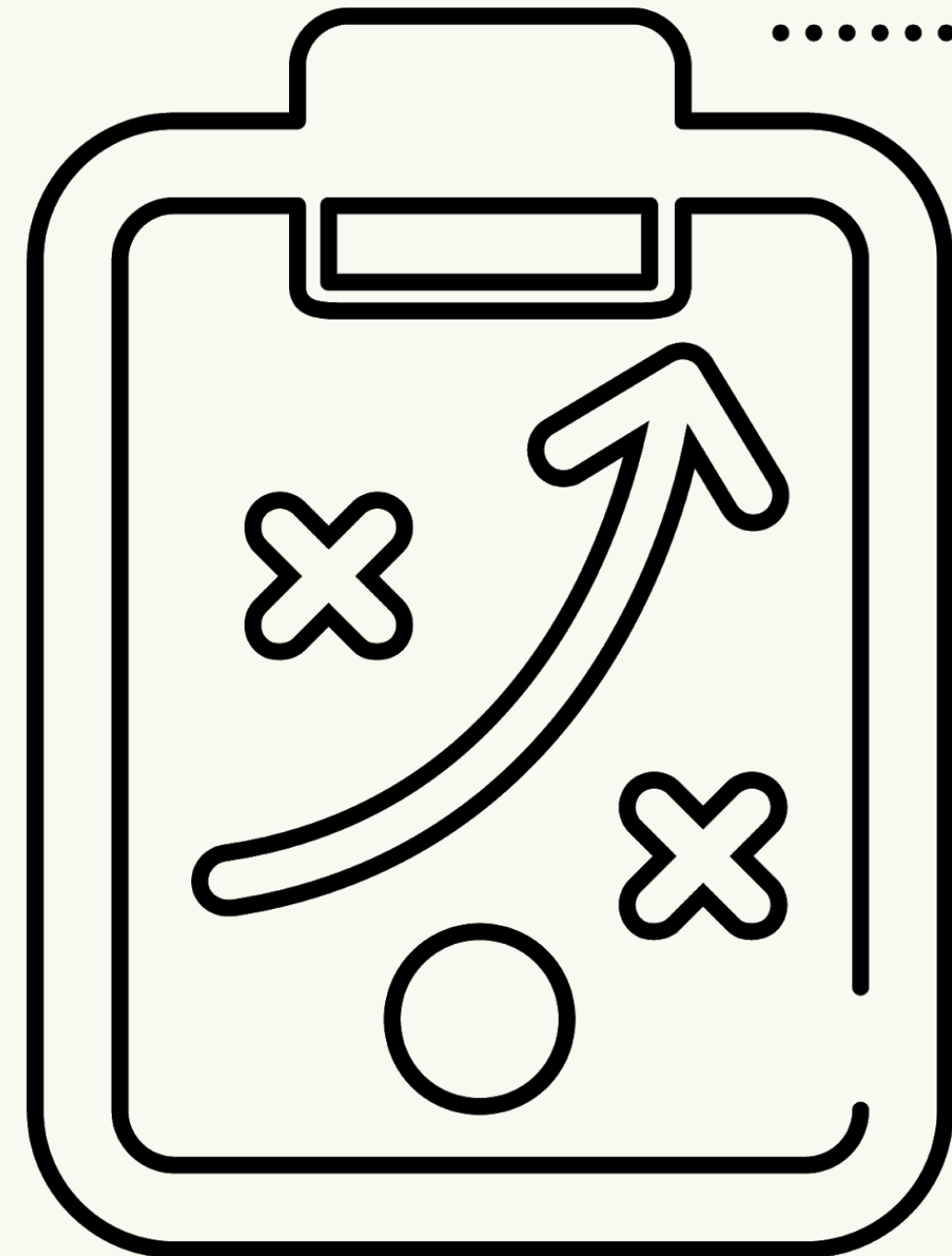
# Technical Takeaways

1. Keep it Simple
2. End Use Focus
3. Clear Priority



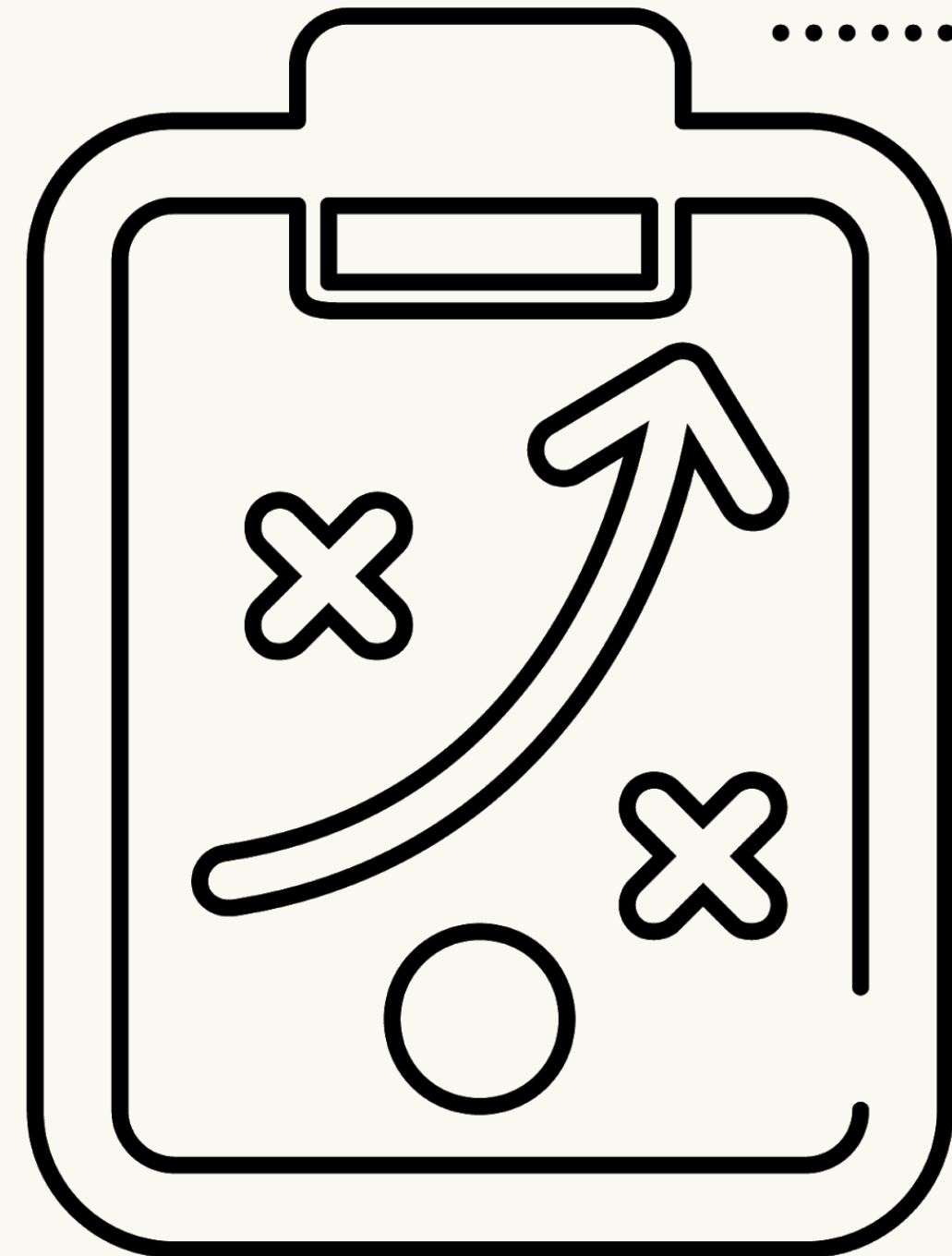
# Culture Takeaways

## 1. Pioneering



# Culture Takeaways

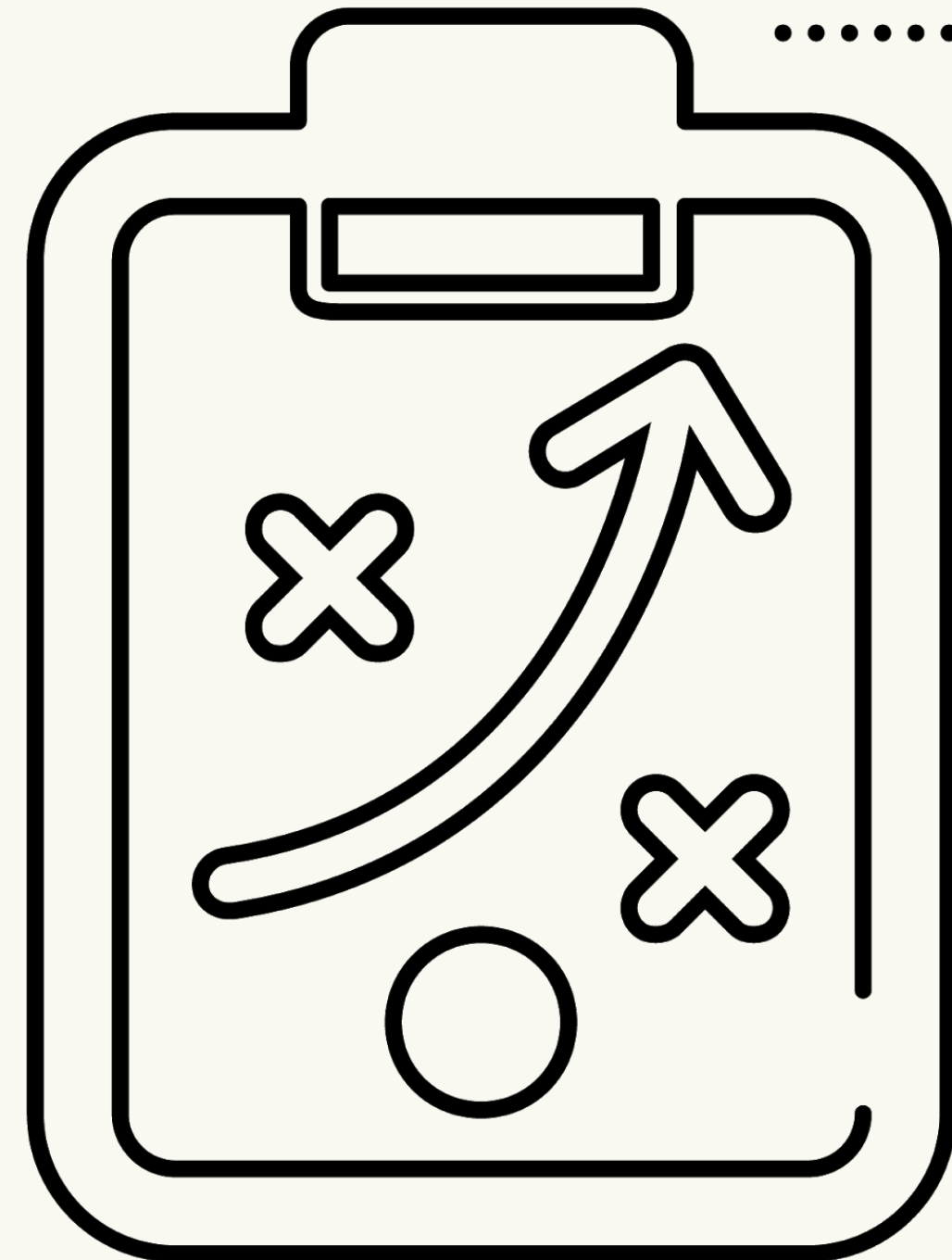
## 1. Pioneering





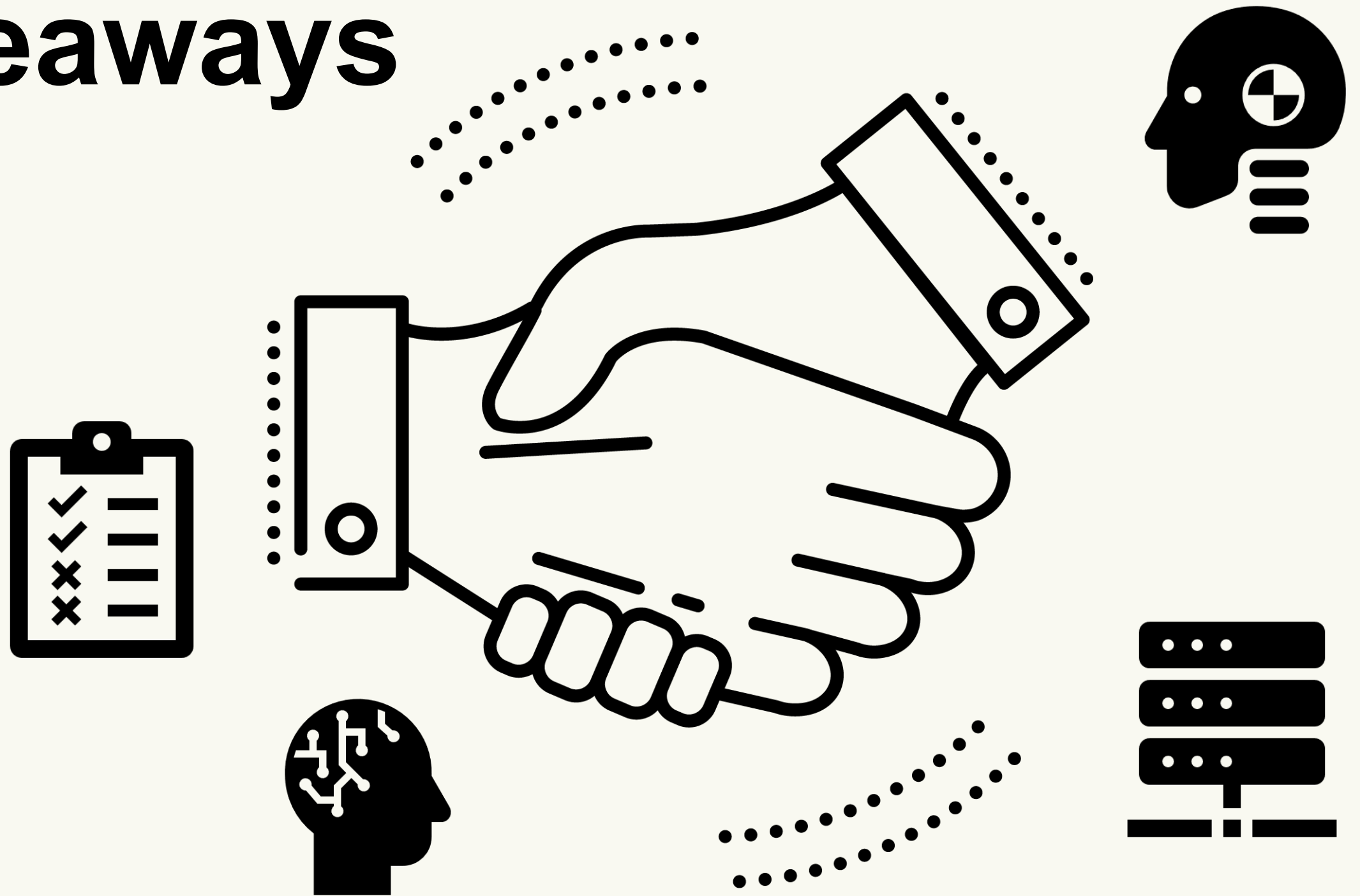
# Culture Takeaways

## 1. Pioneering



# Culture Takeaways

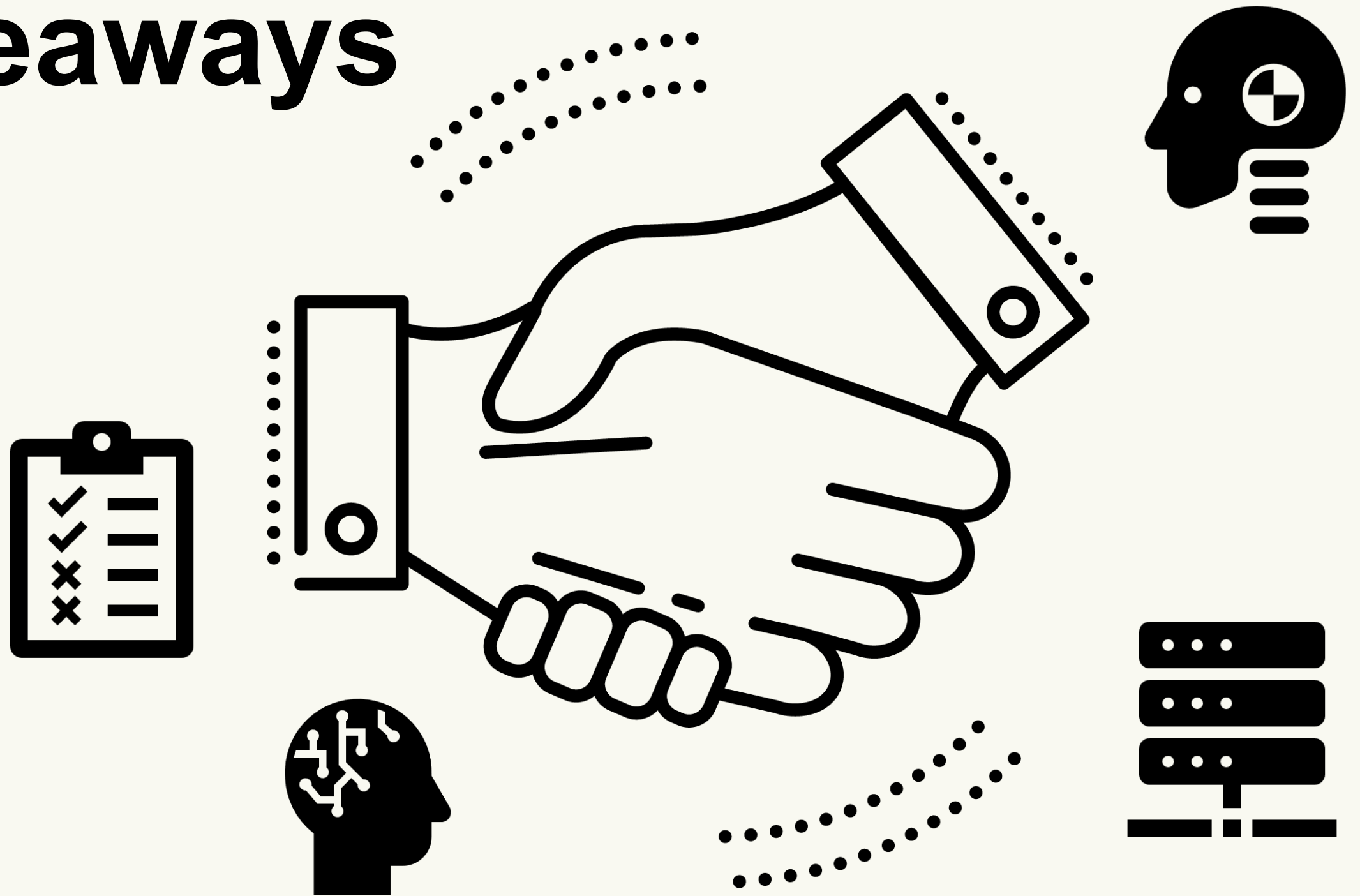
1. Pioneering
2. Teamwork





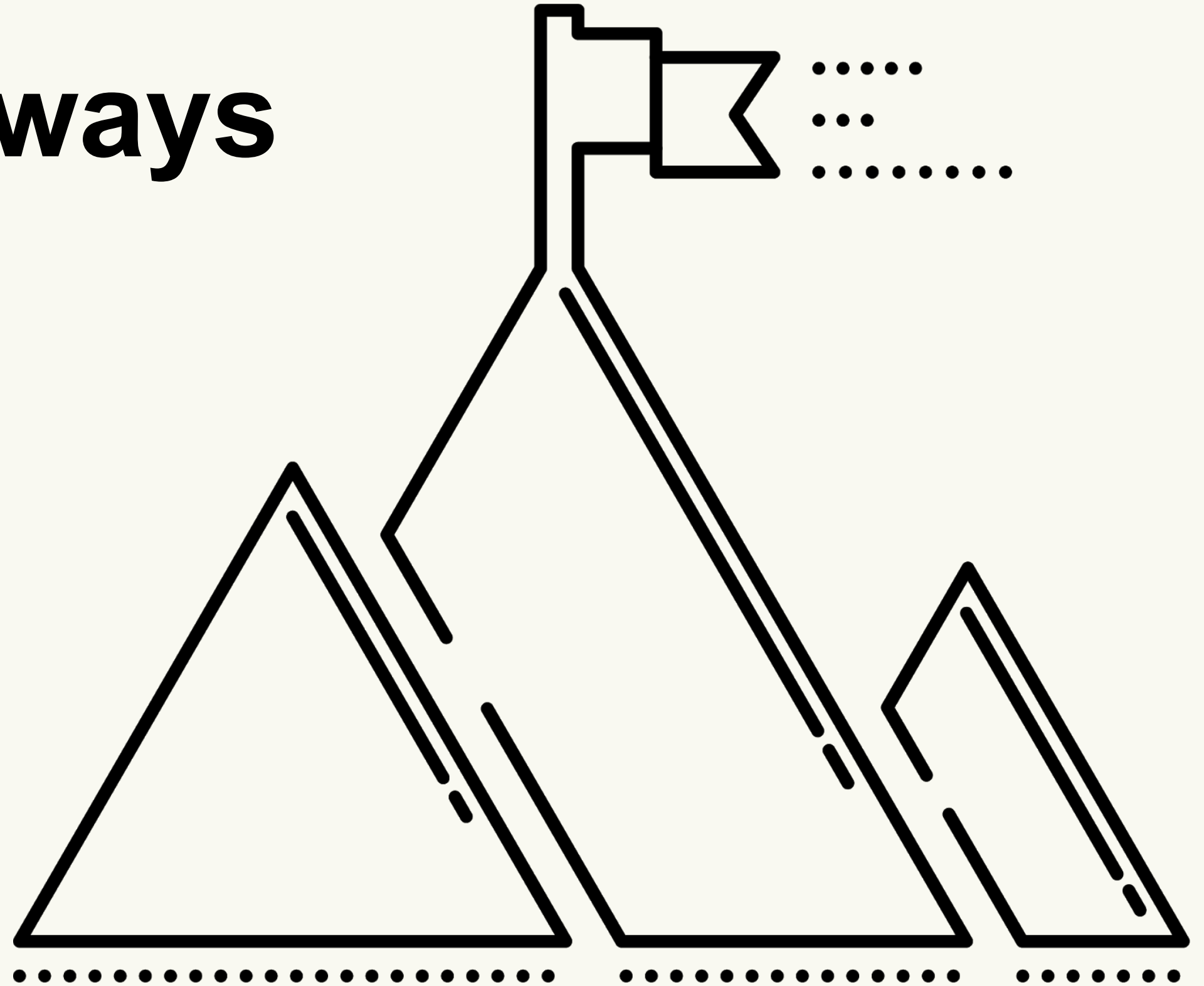
# Culture Takeaways

1. Pioneering
2. Teamwork



# Culture Takeaways

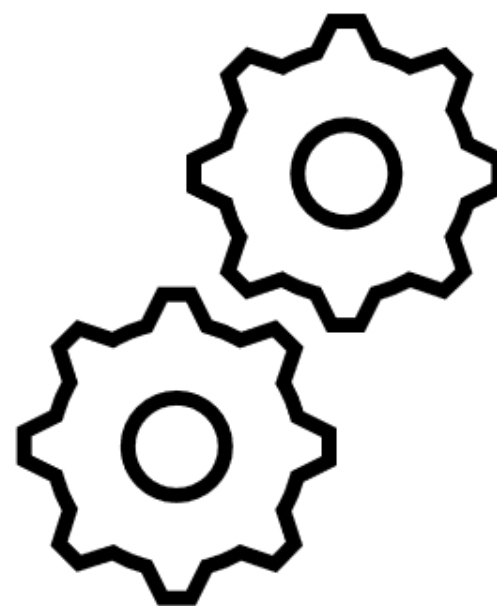
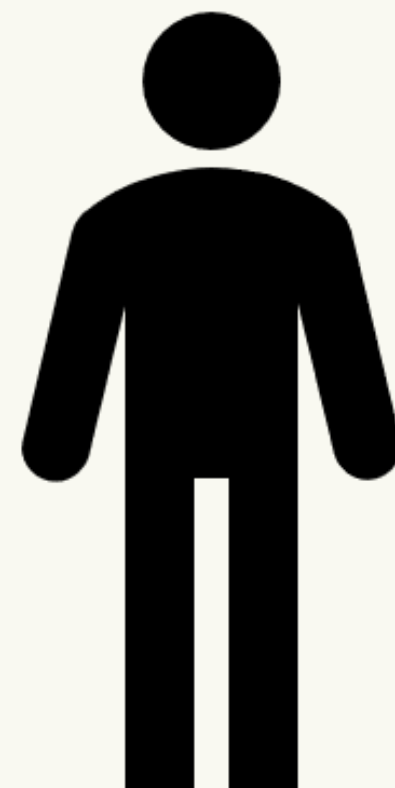
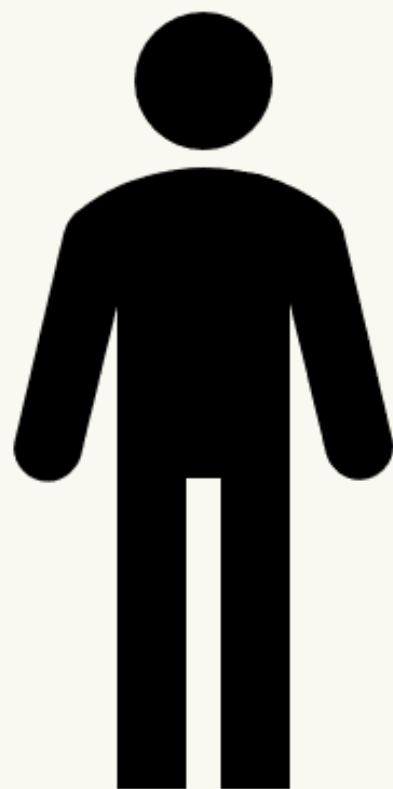
1. Pioneering
2. Teamwork
3. Determination





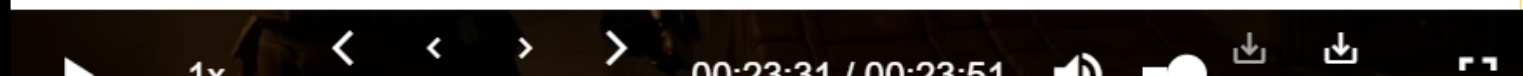
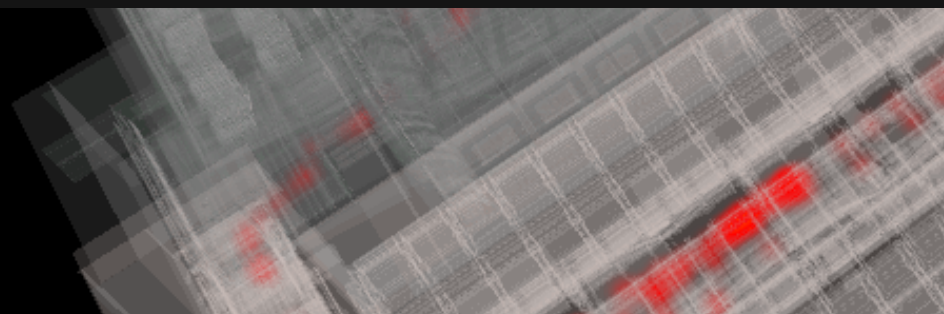
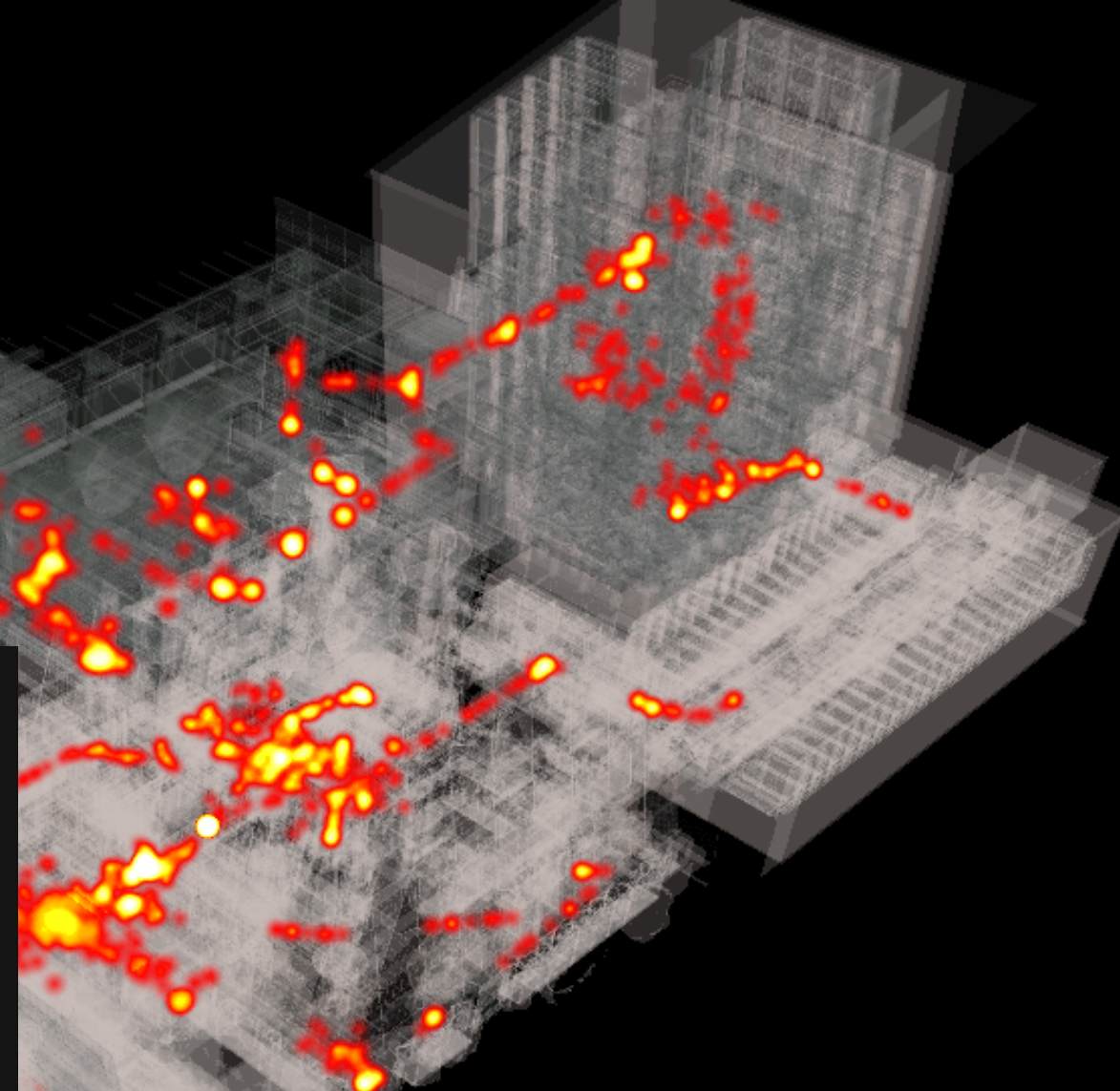
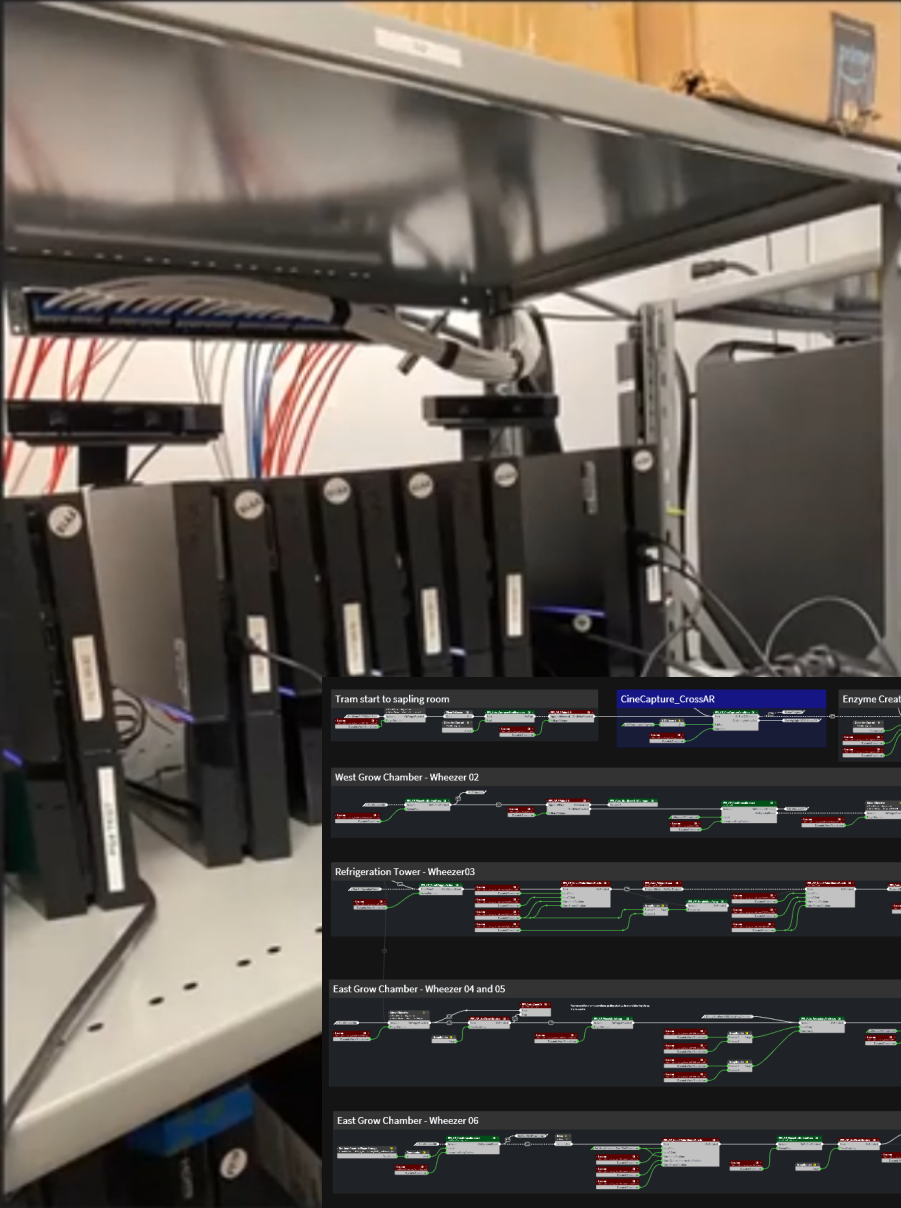
QVS

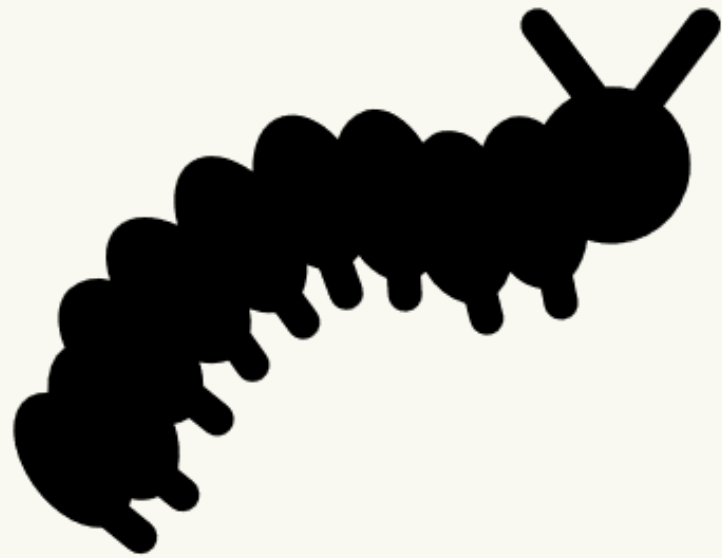
# Great games, made better







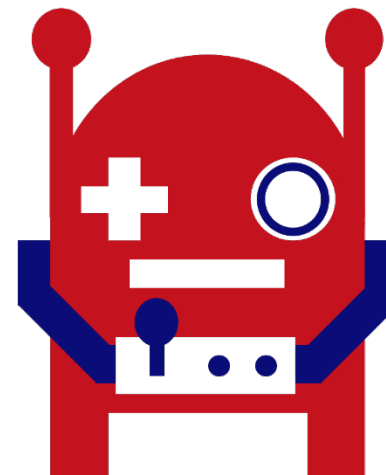
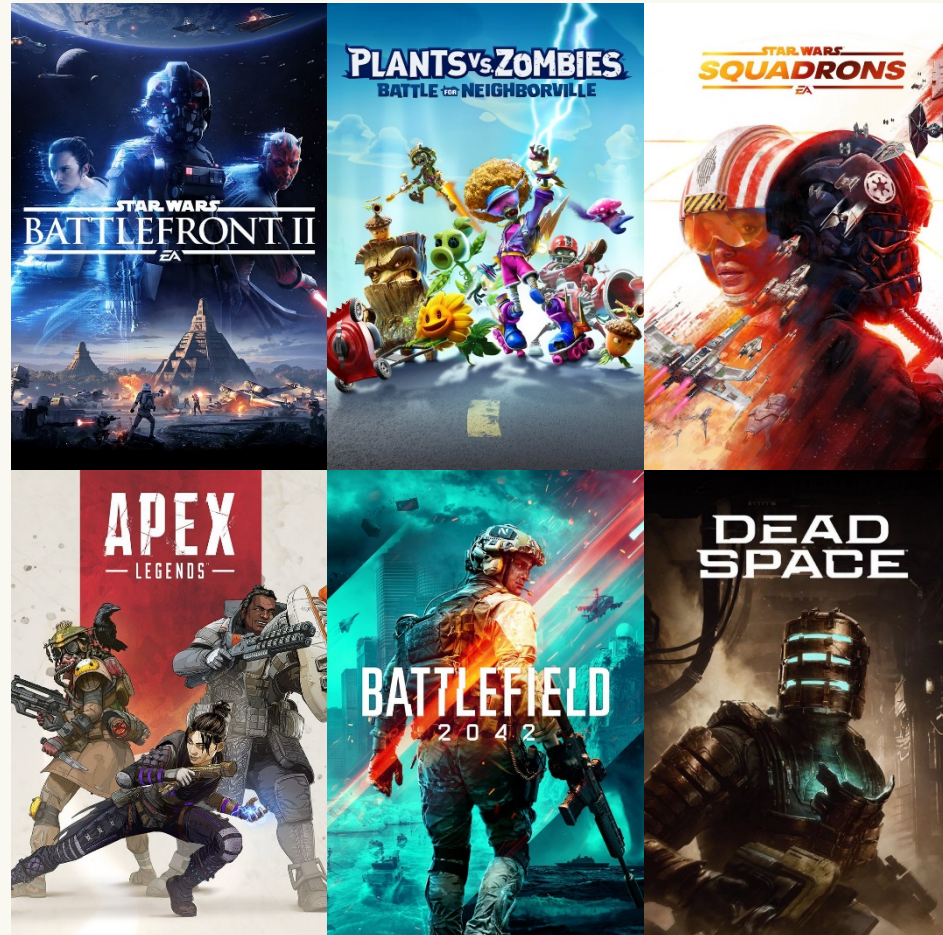






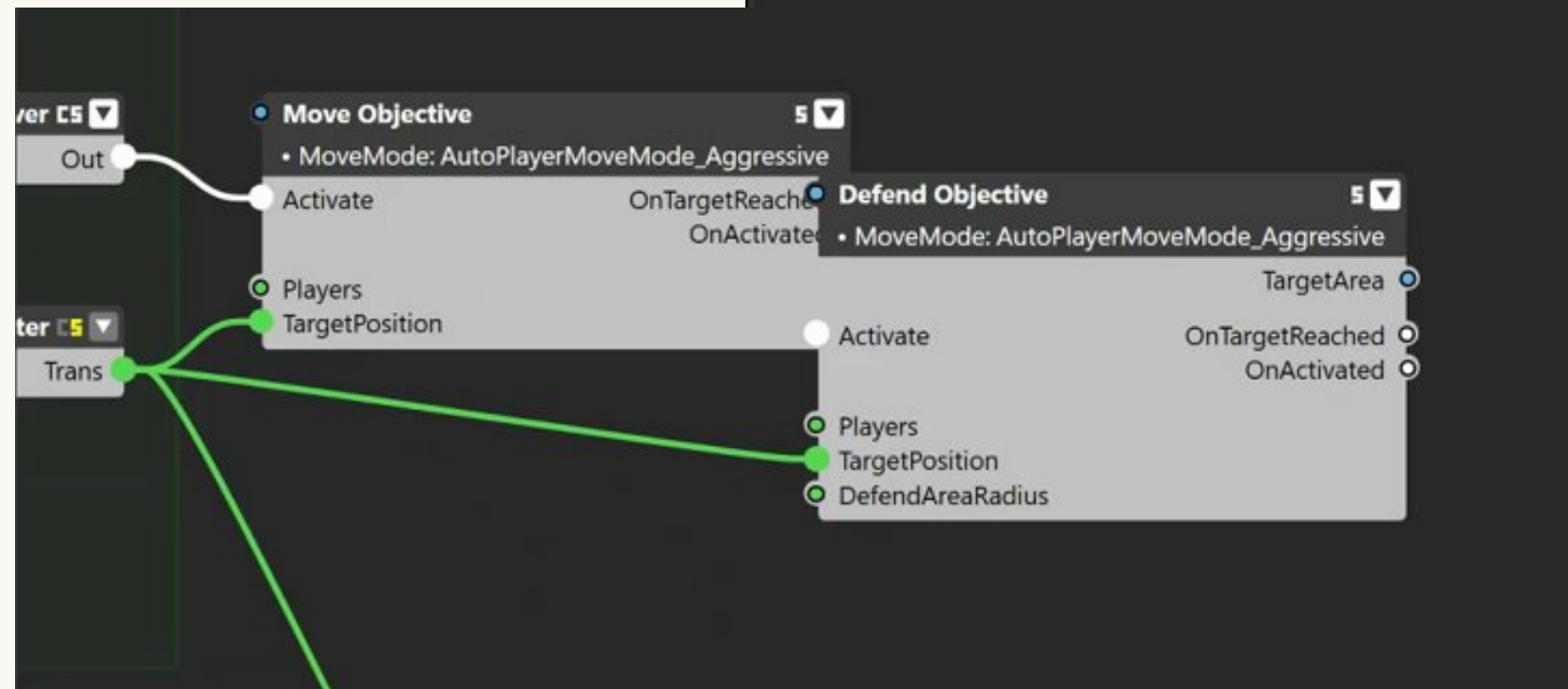


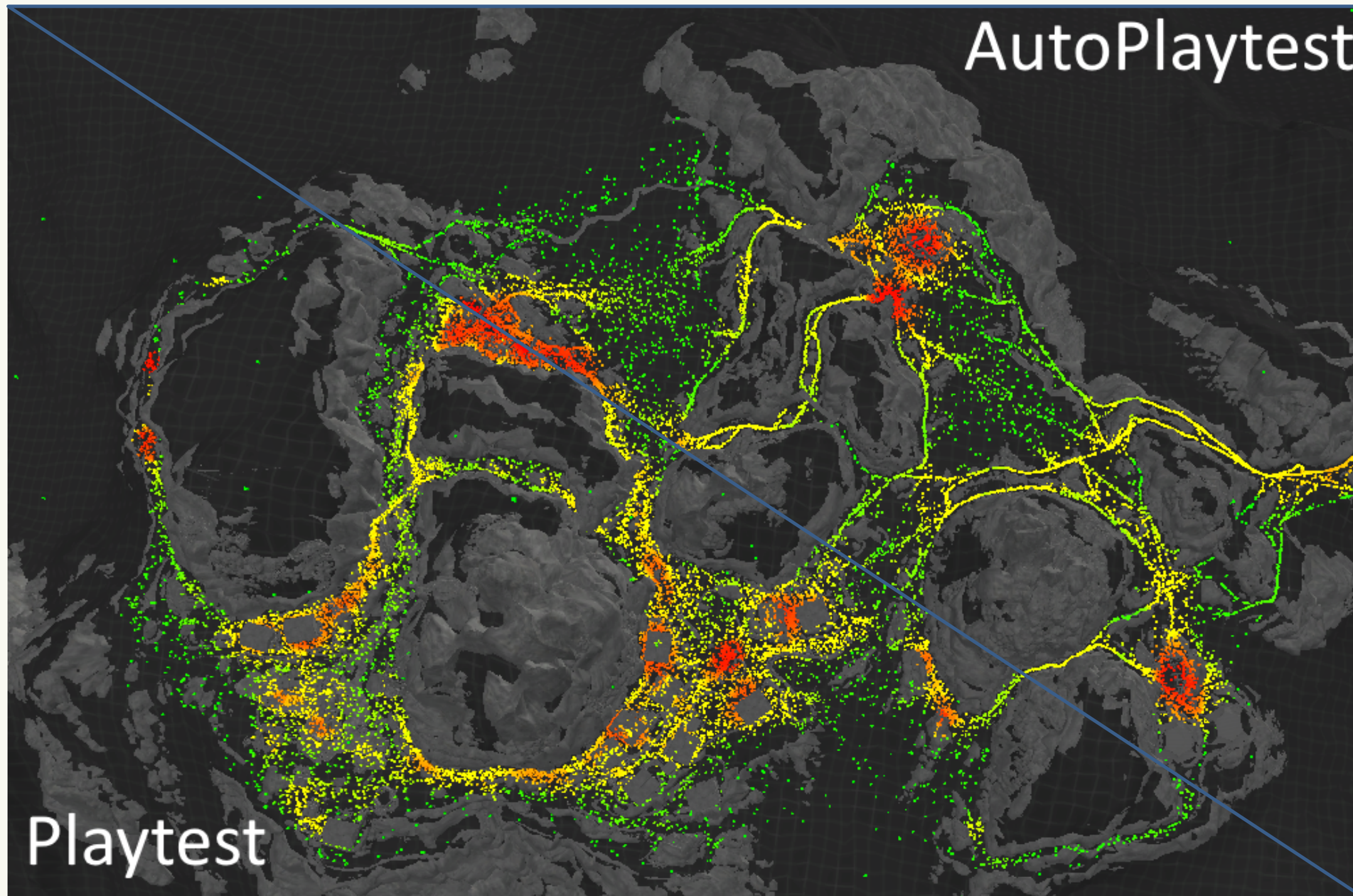




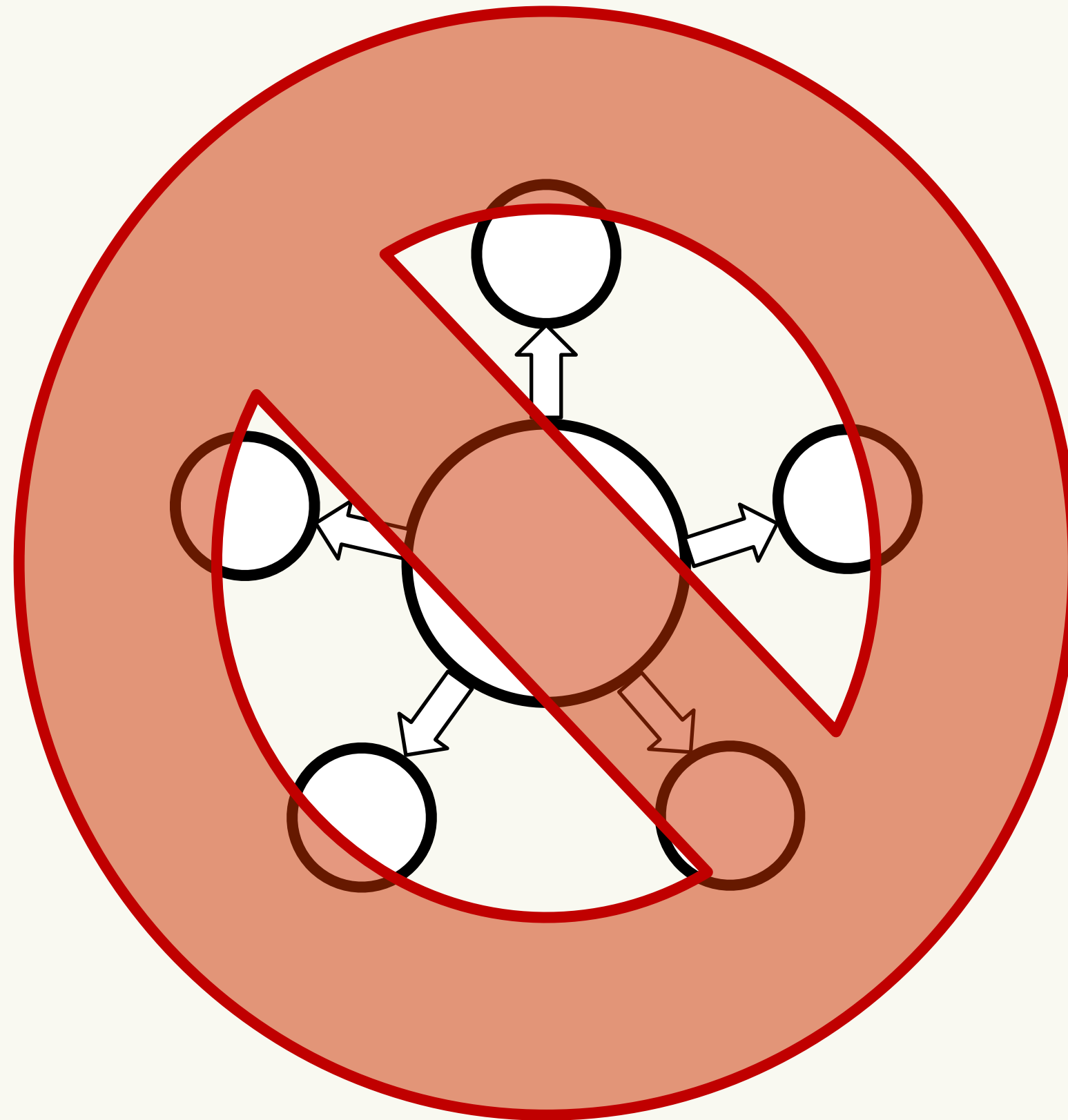




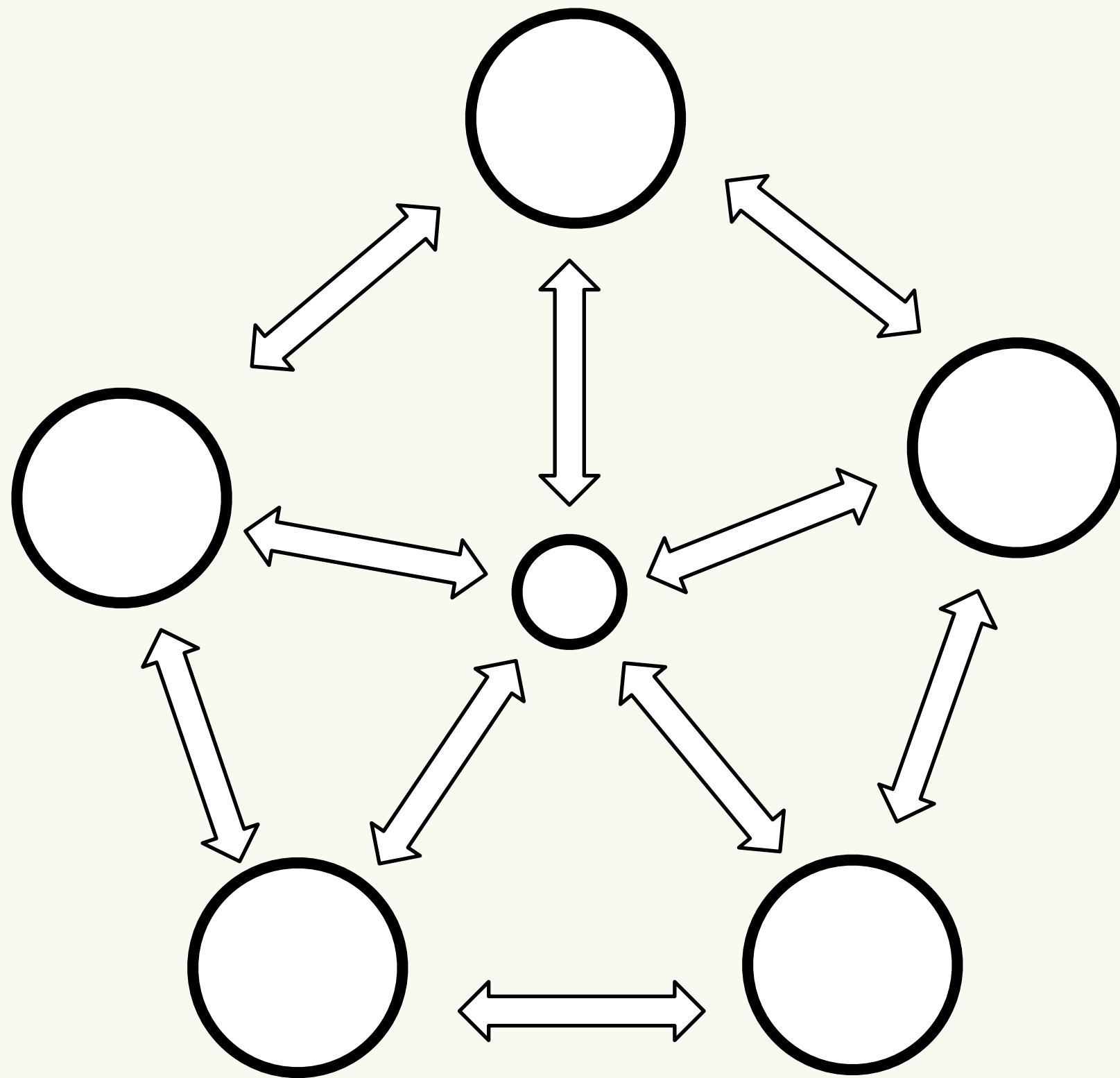


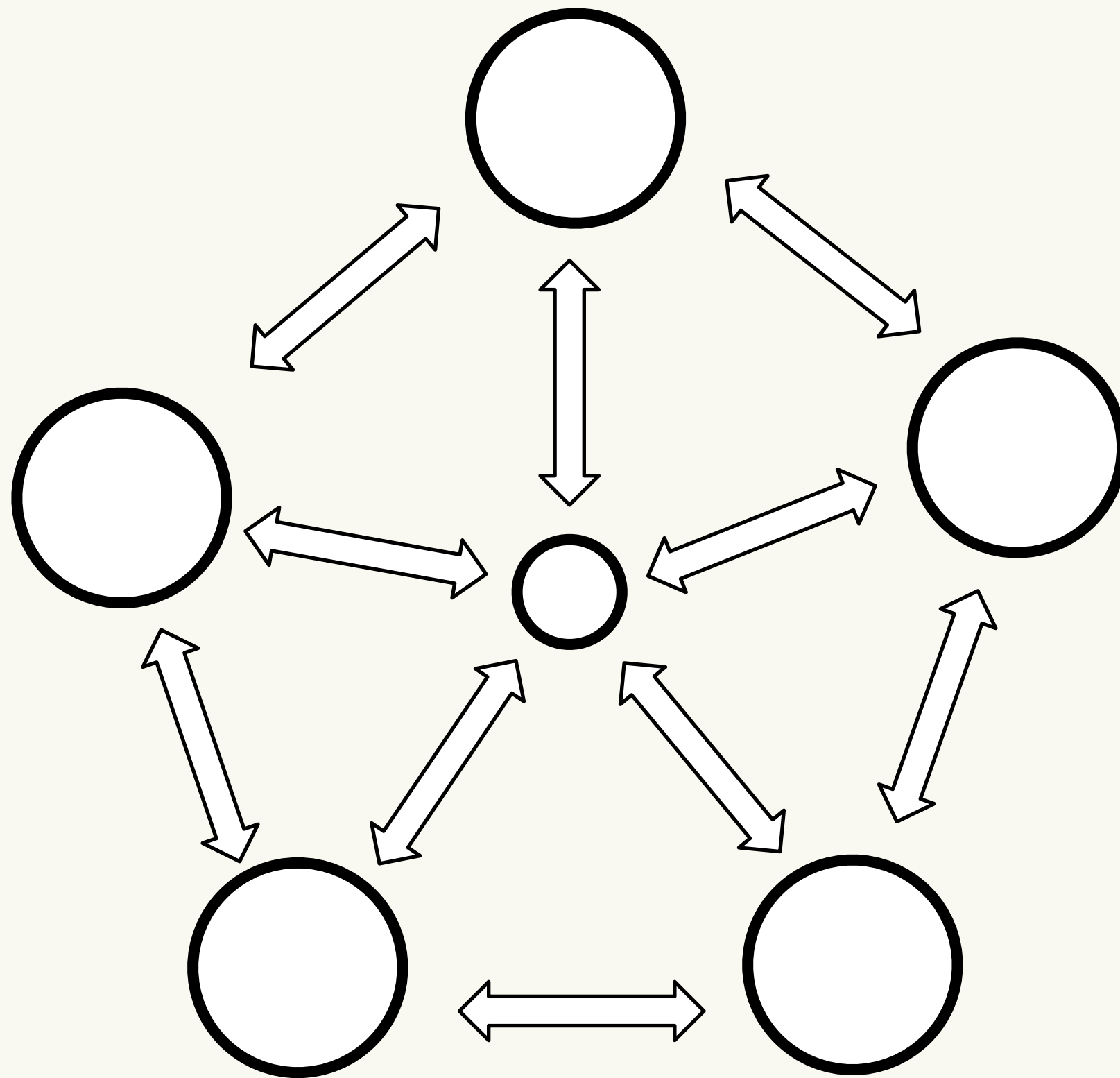












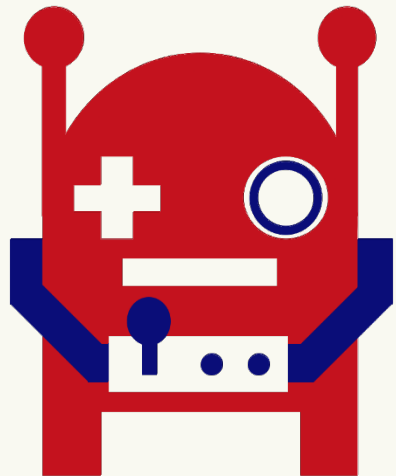






# **“How Artificial Intelligence Has Evolved Star Wars Battlefront II”**

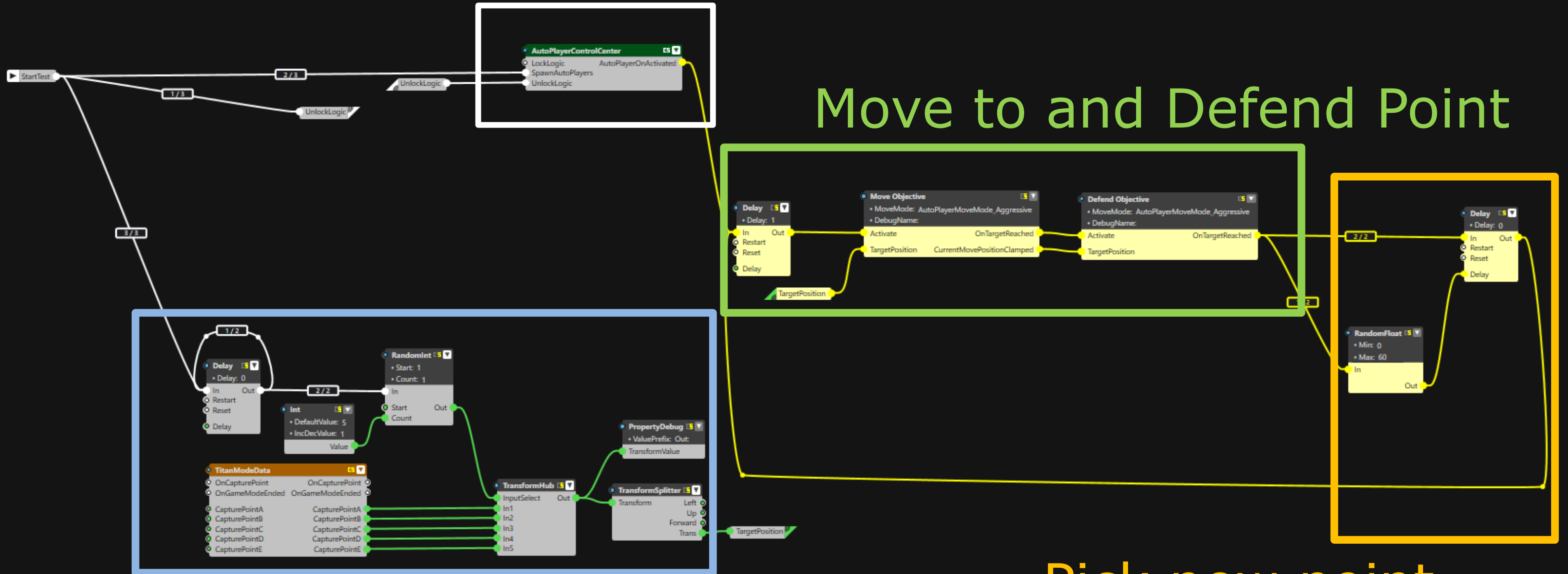
<https://www.ea.com/games/starwars/battlefront/star-wars-battlefront-2/news/ai-article-deep-dive>



AutoPlayers  
Fork



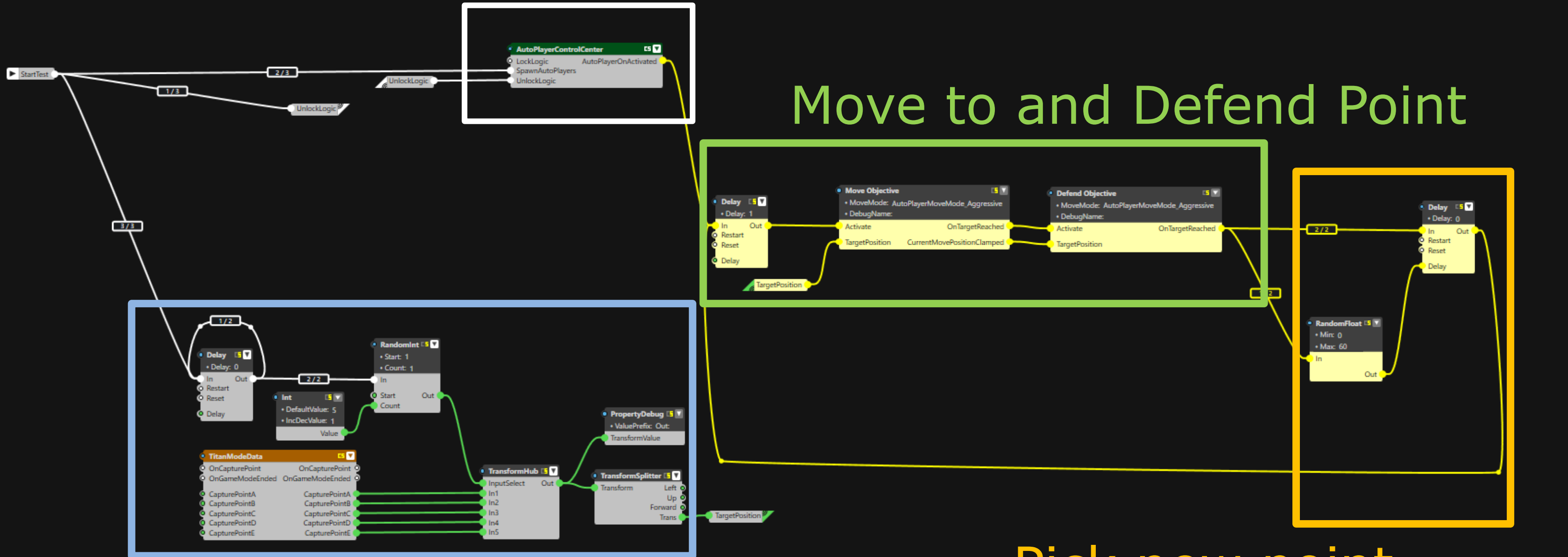
# Trigger Per Player



Pick Control Point at random

Pick new point  
after random interval

# Trigger Per Player



Move to and Defend Point

Pick Control Point at random

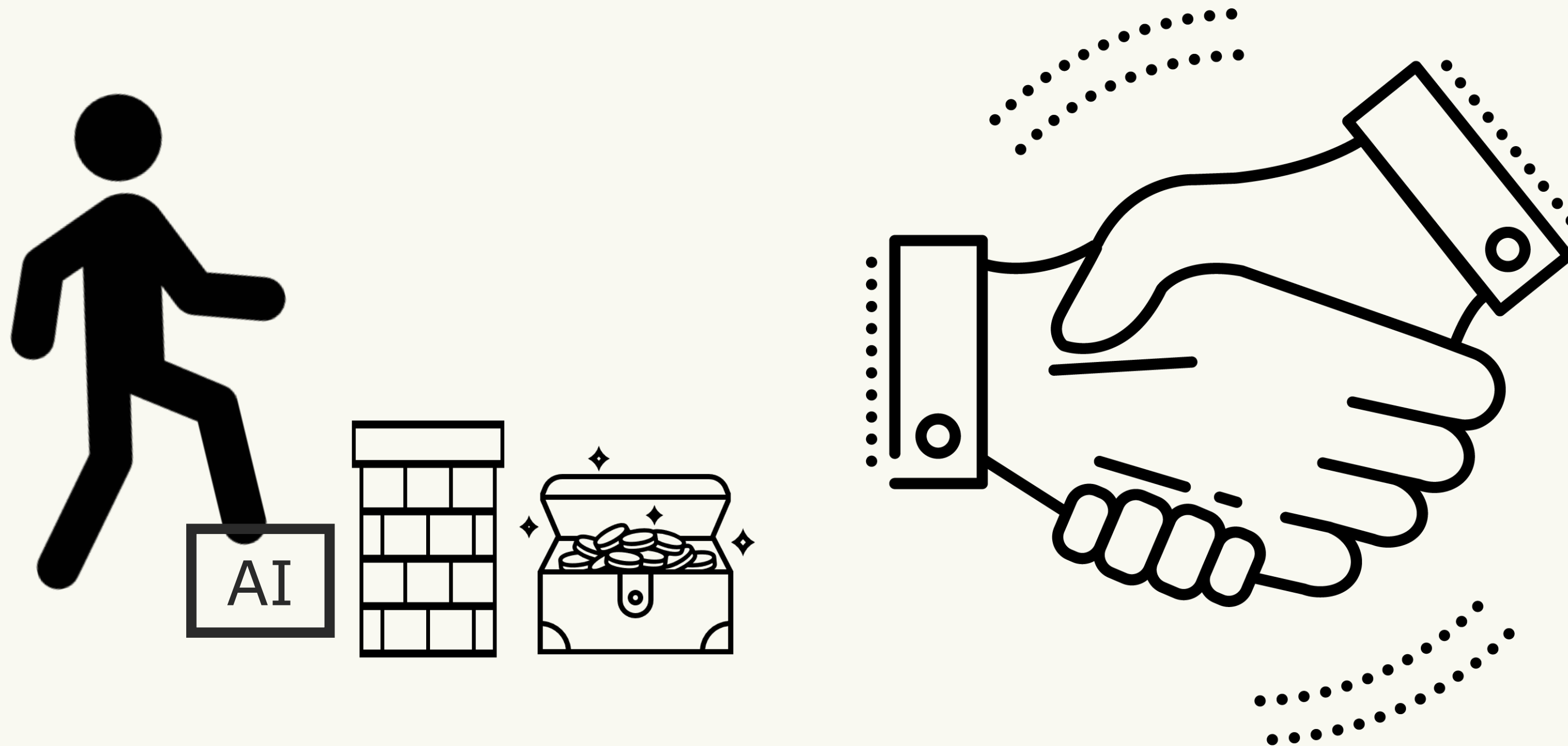
Pick new point  
after random interval

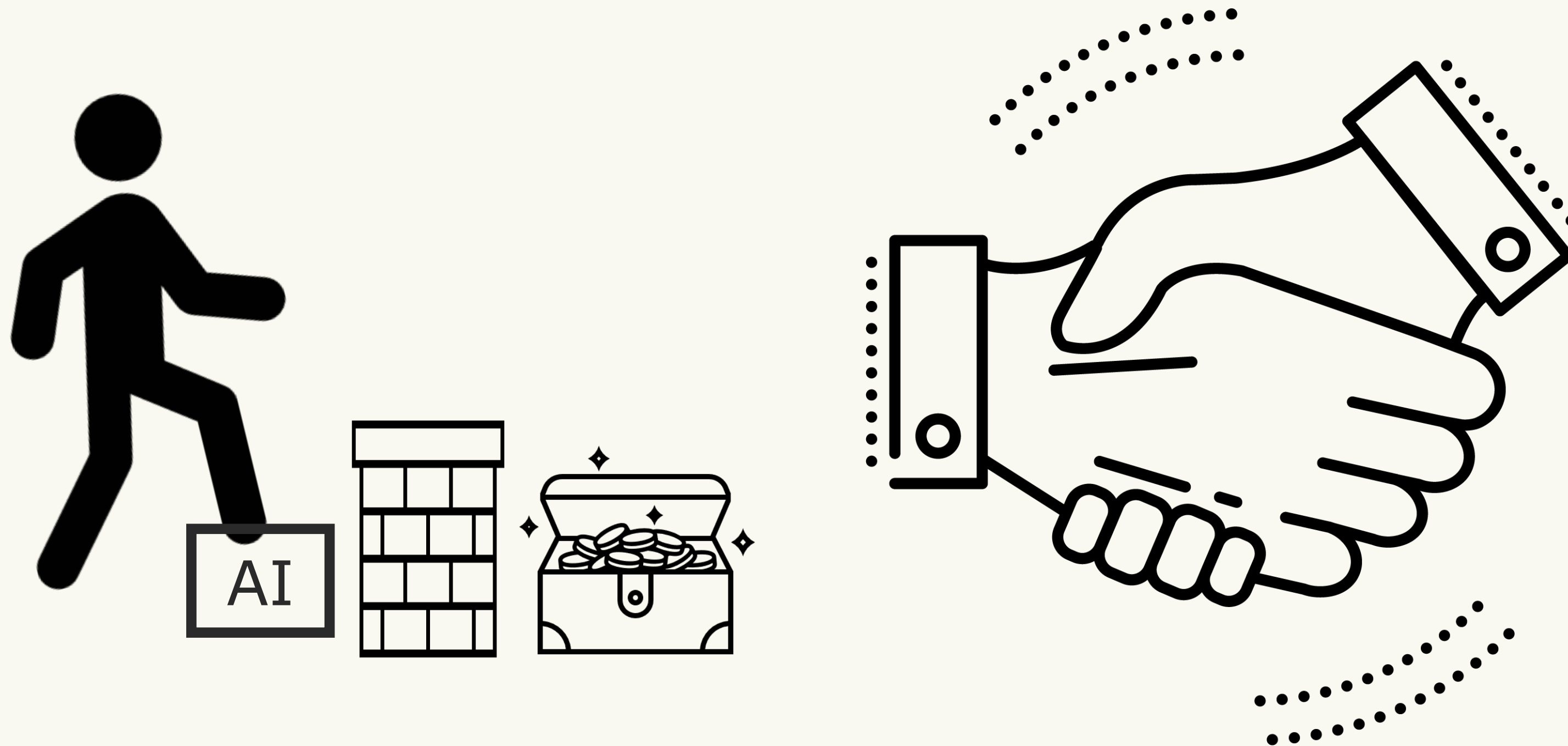
**ONE DOES NOT SIMPLY**

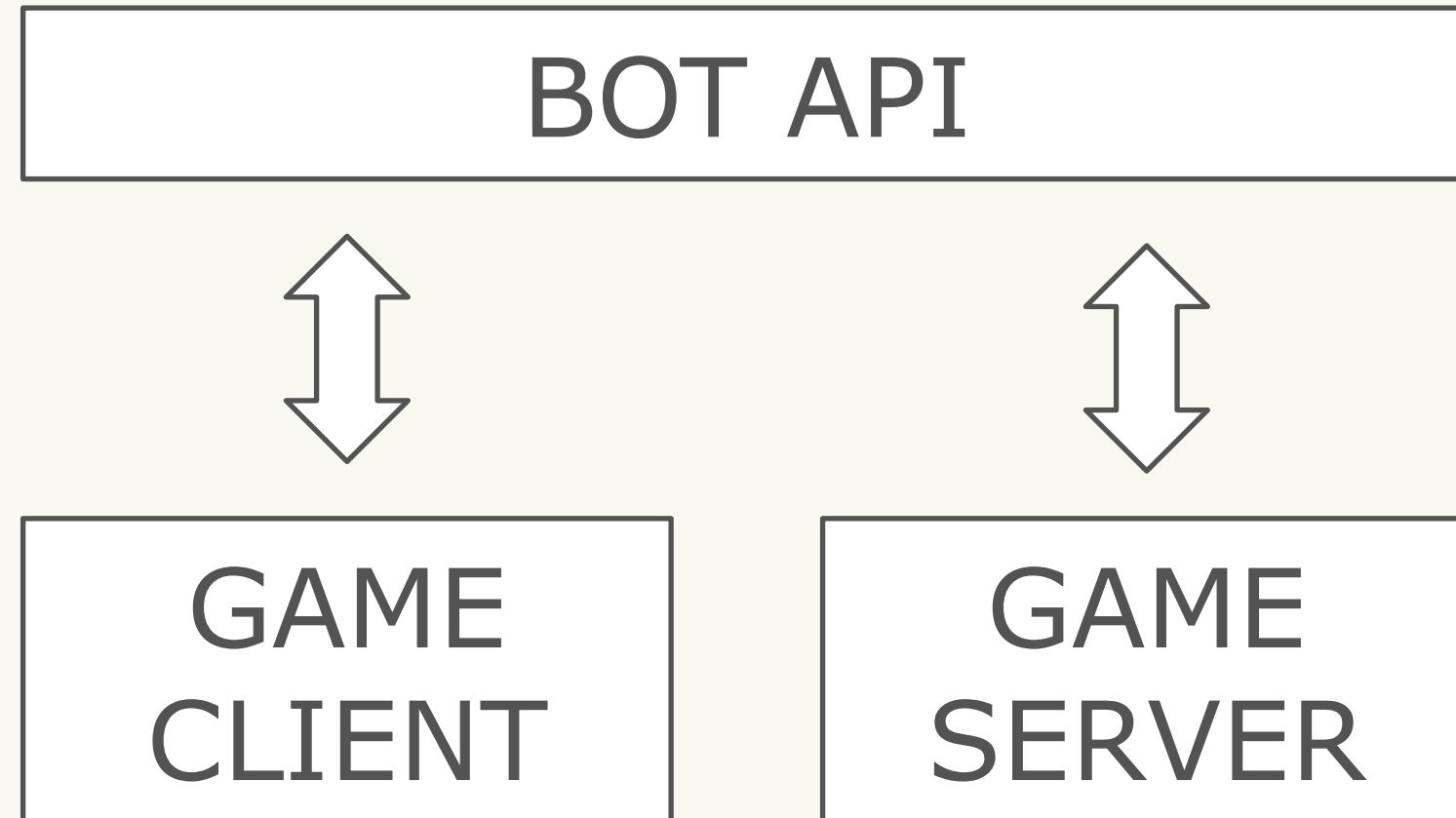
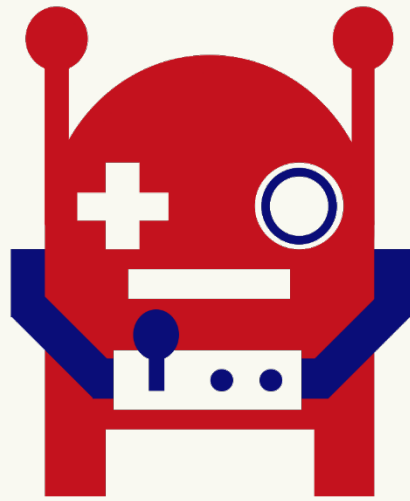


imgflip.com

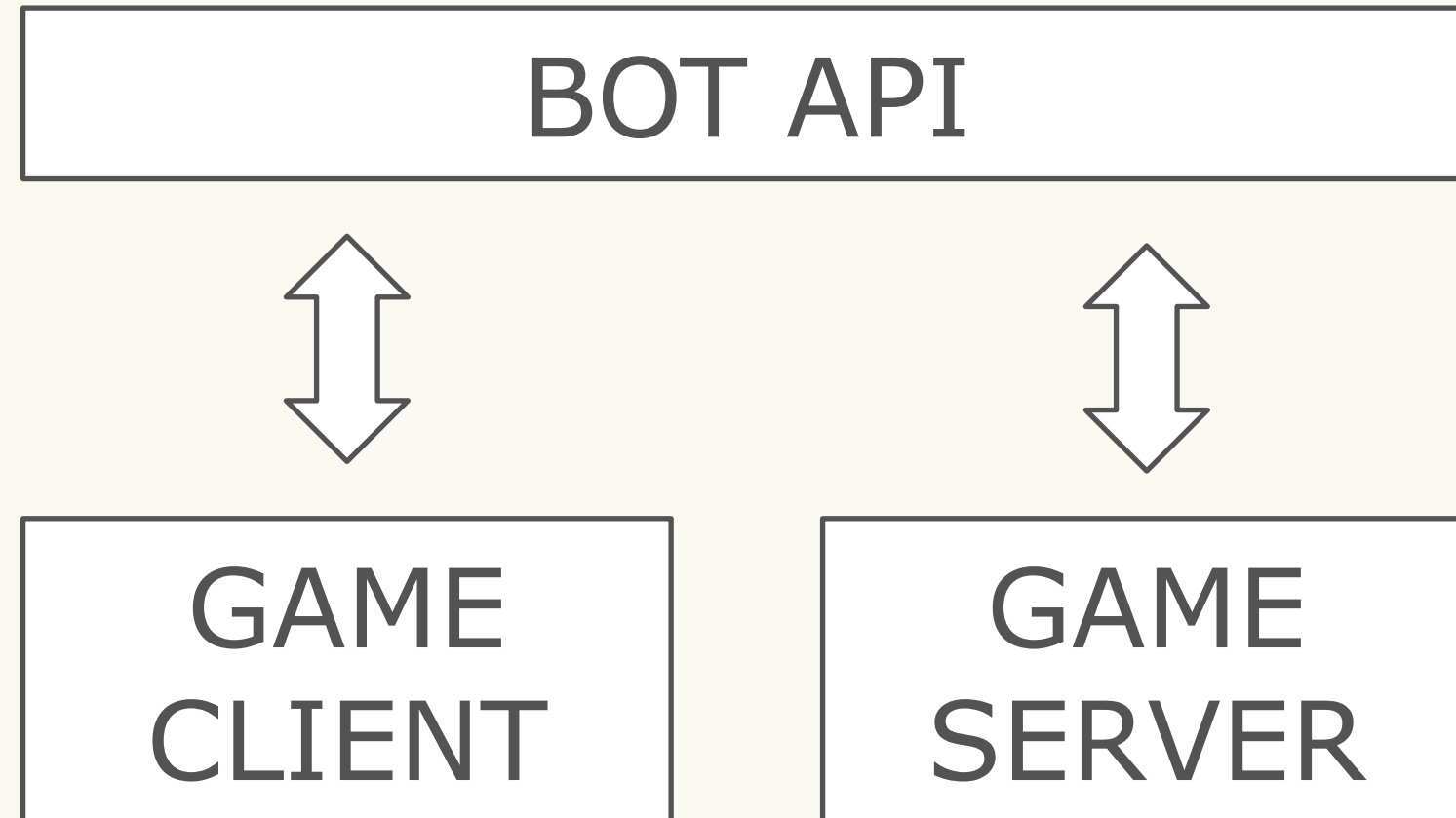
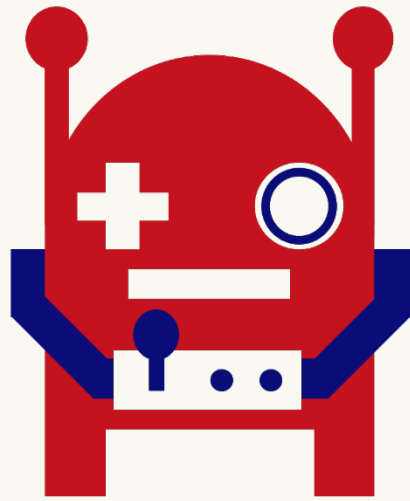














# **Fan art & Positive Memes!**

## **”AutoBois”**

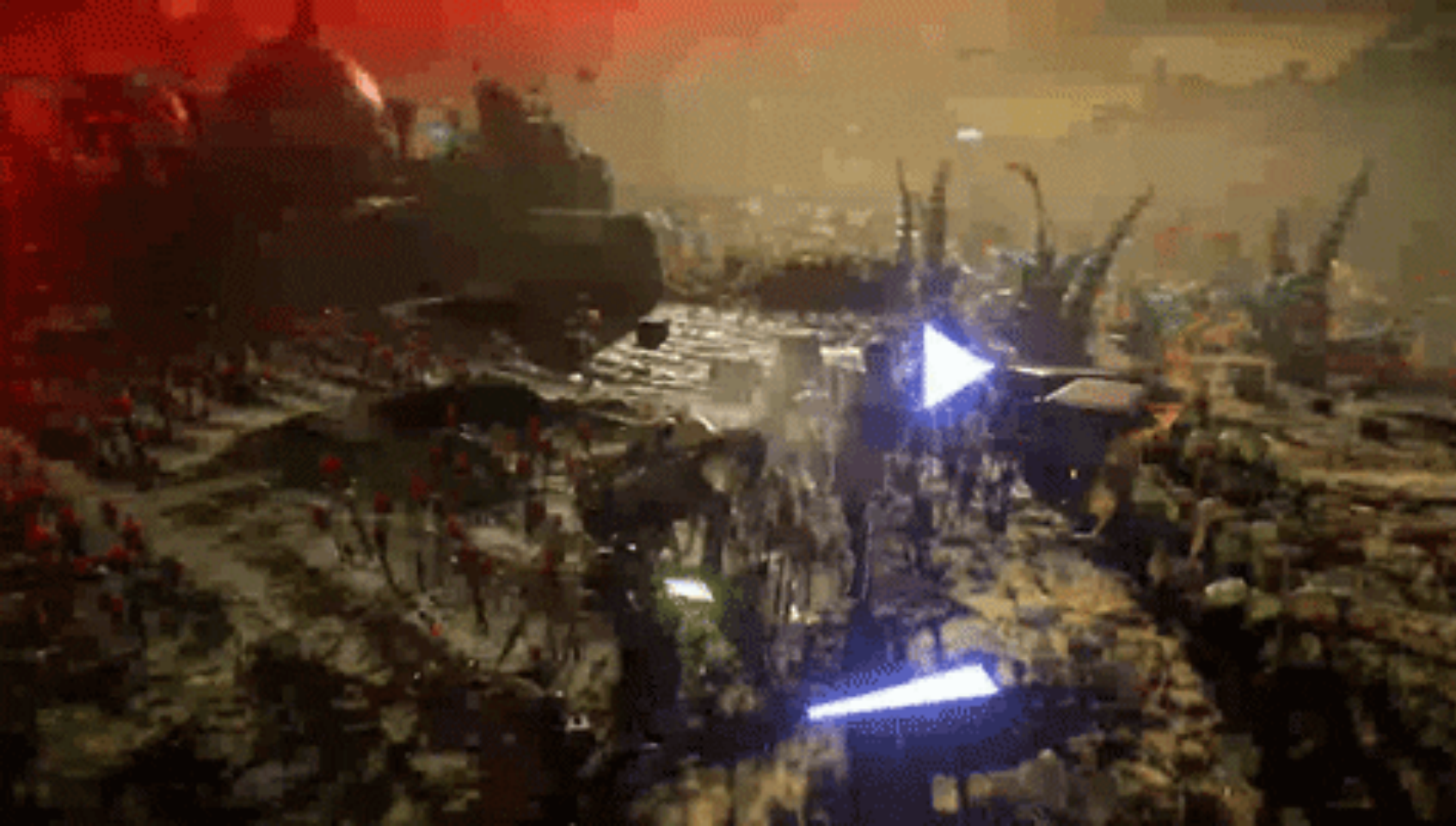






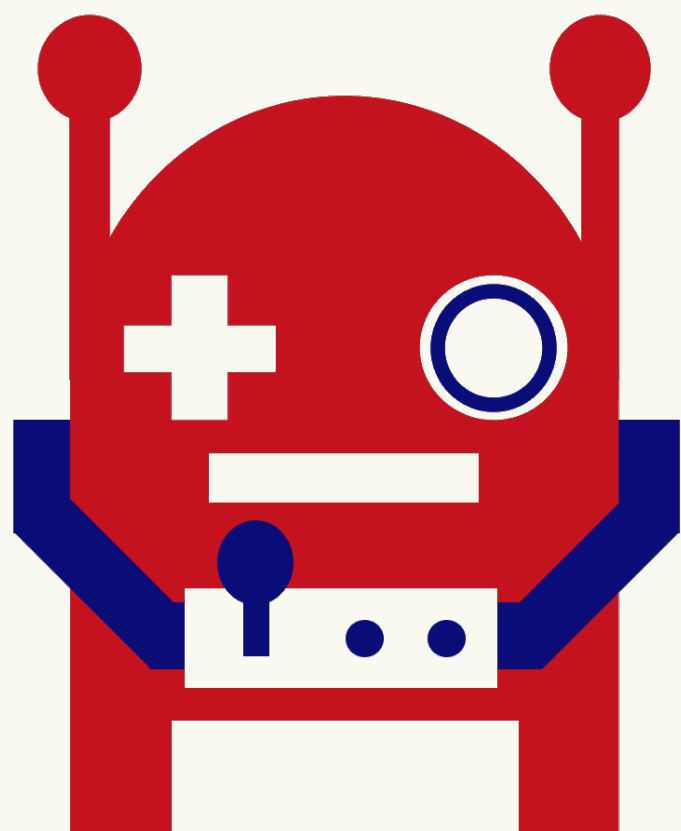
# Play The Objective

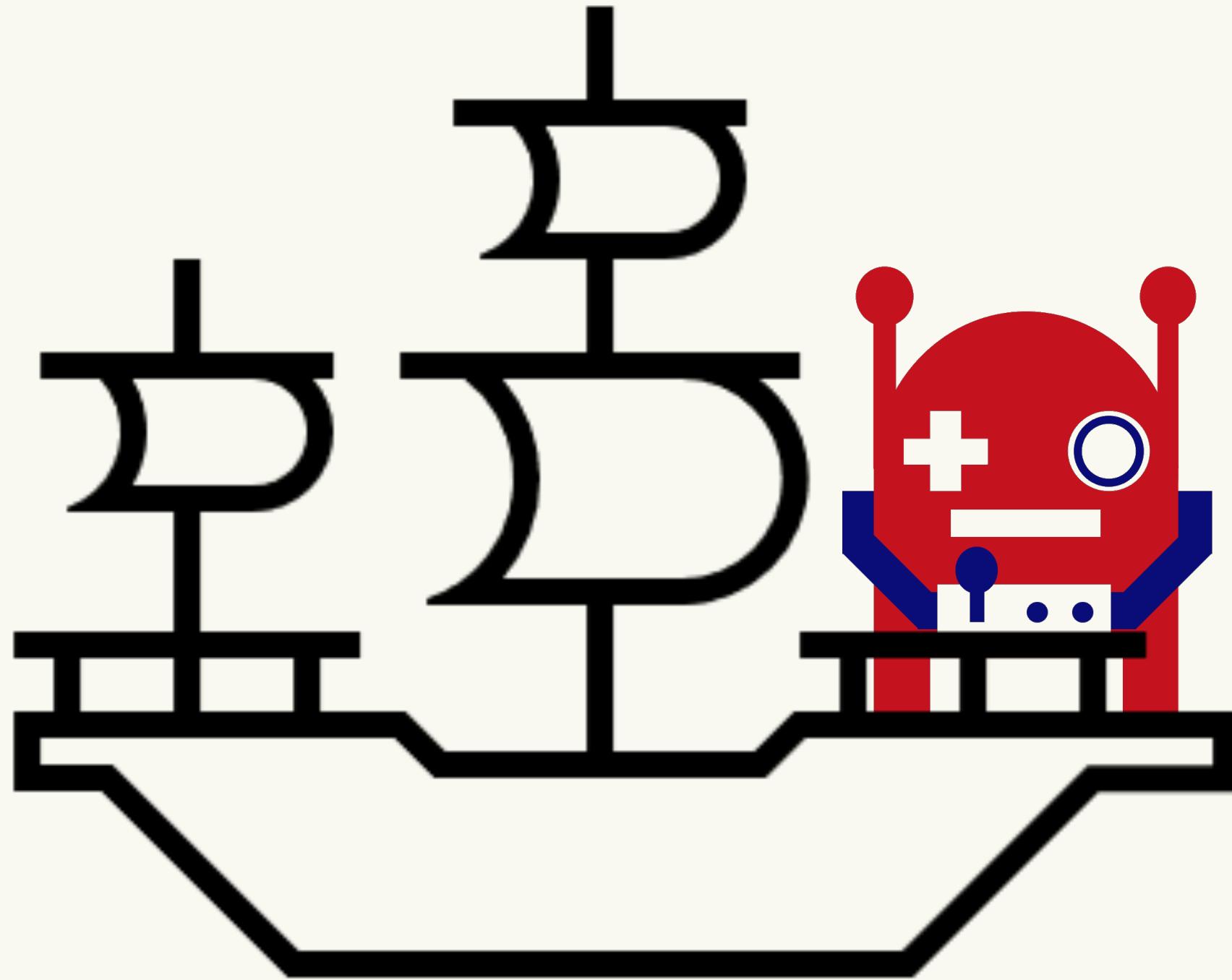




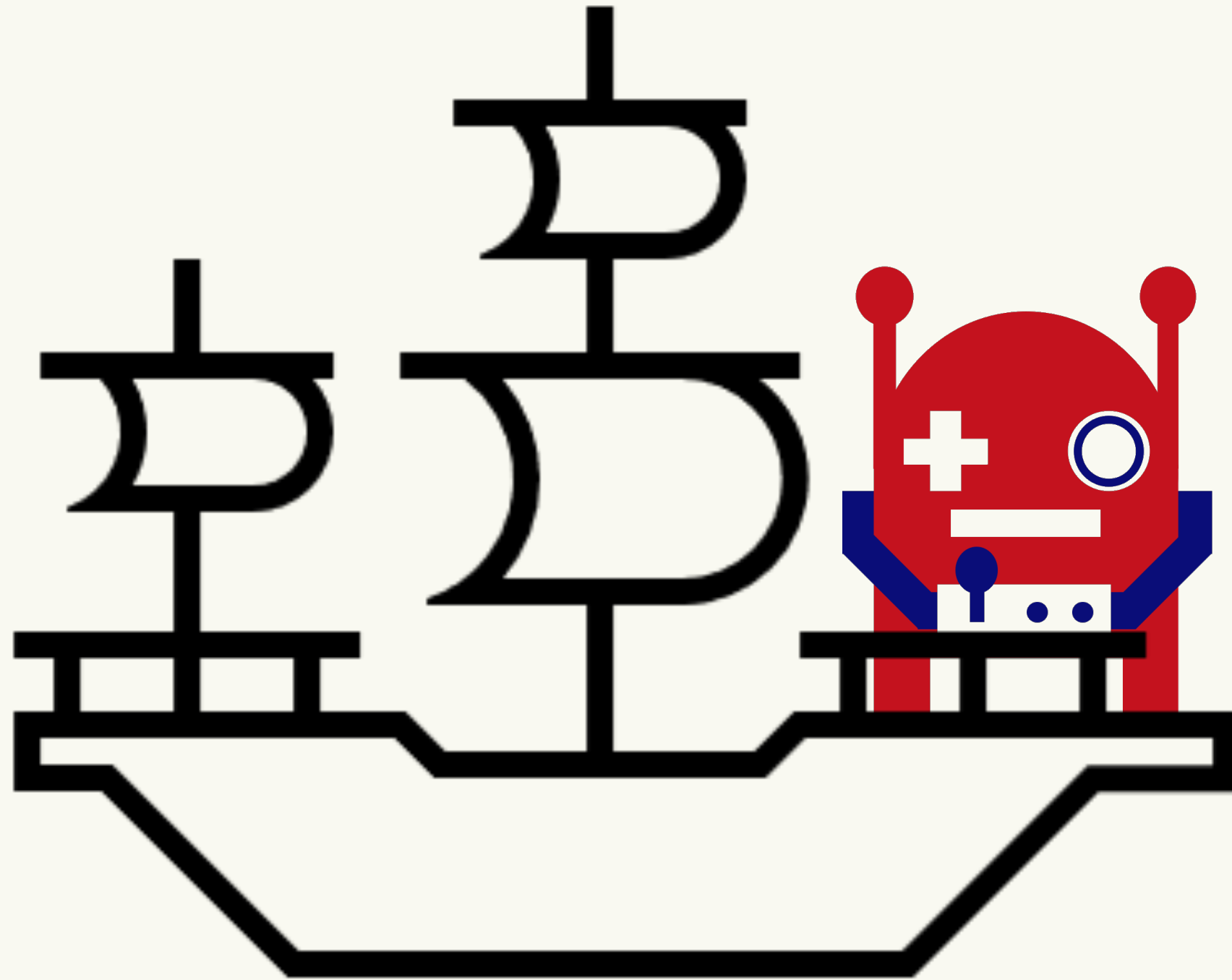






















**Pioneering**

*PopCap™*



**Teamwork**





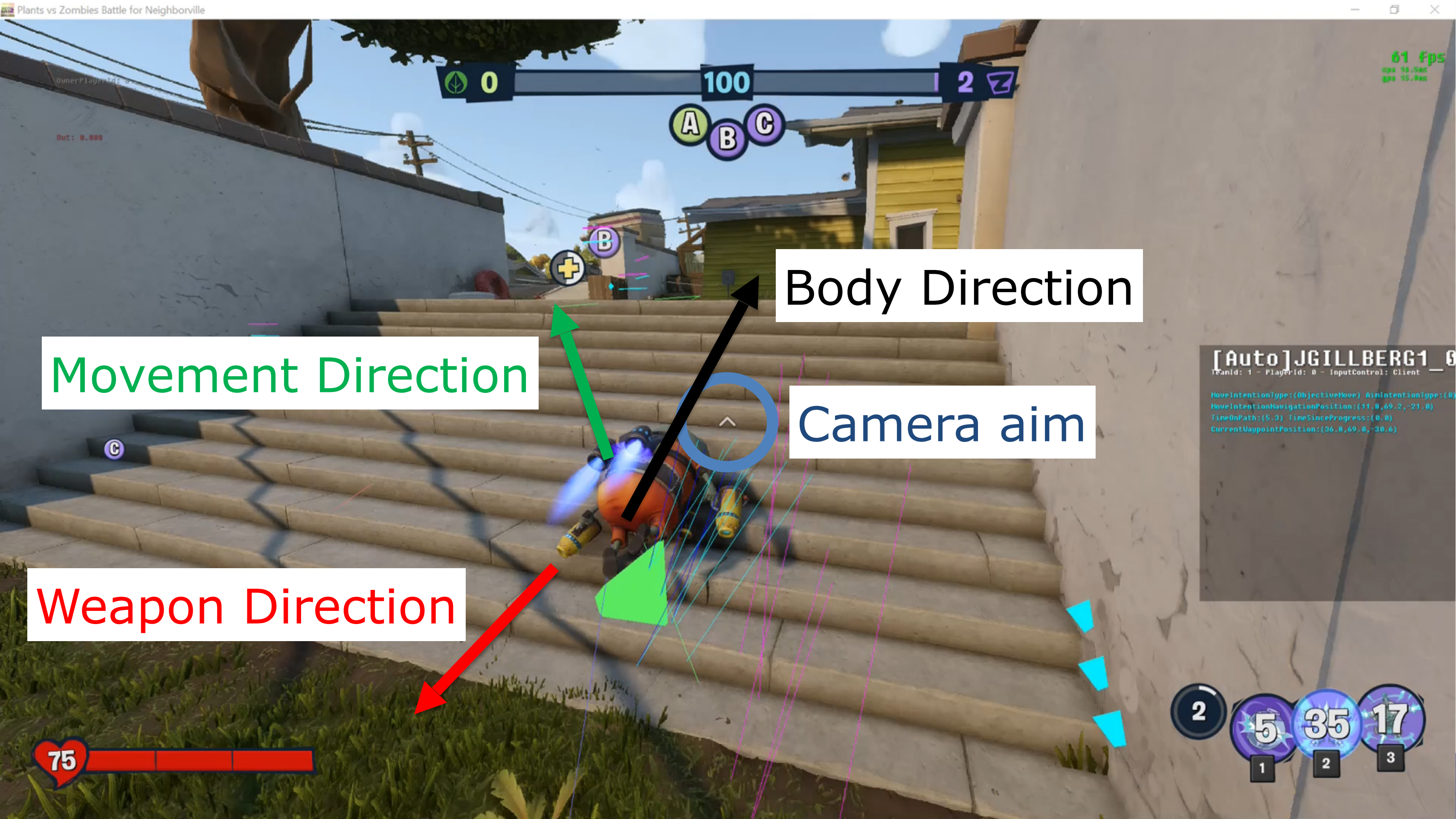
**Pioneering**

*PopCap™*



**Teamwork**





Movement Direction

Body Direction

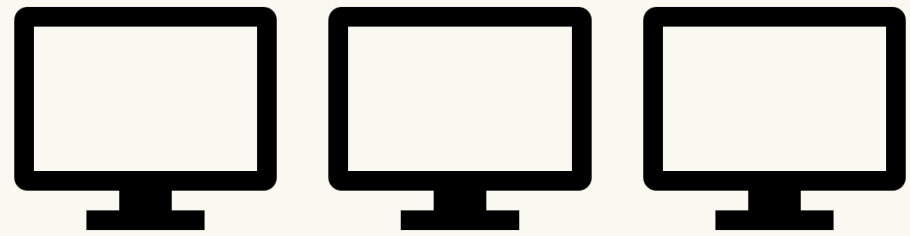
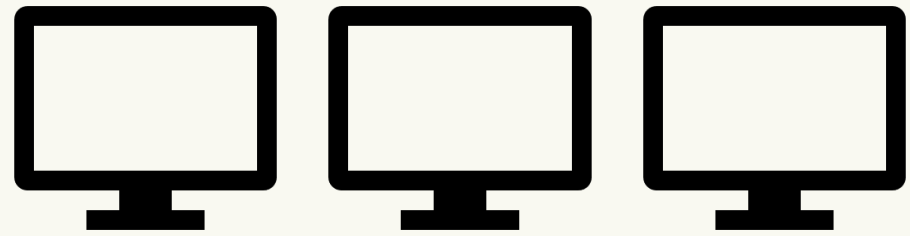
Camera aim

Weapon Direction









12 v 12





Fork



- **Big effort**
- **Lessons learned**
- **API takes shape**





Fork



- **Big effort**
- **Lessons learned**
- **API takes shape**



0 100 2

A B C

61 fps  
cpu 15.565  
gpu 15.945

OwnerPlayerId: 0

Out: 0.000

[Auto]JGILLBERG1\_0

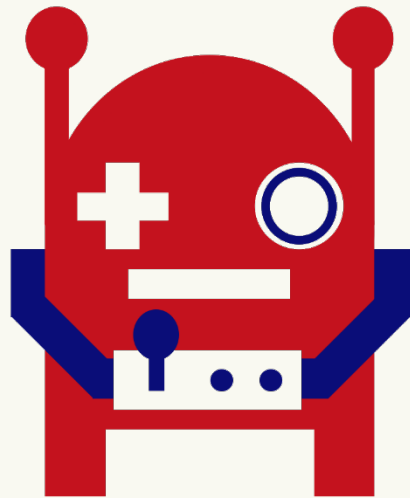
TeamId: 1 - PlayerId: 0 - InputControl: Client

MoveIntentionType:(ObjectiveMove) AimIntentionType:(0)  
MoveIntentionNavigationPosition:(11.8,69.2,-21.0)  
TimeOnPath:(5.3) TimeSinceProgress:(0.0)  
CurrentWaypointPosition:(36.8,69.0,-30.6)

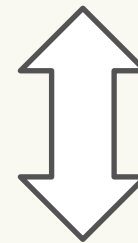
75

2 5 35 17  
1 2 3

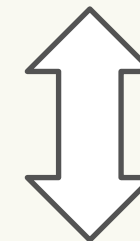




BOT API

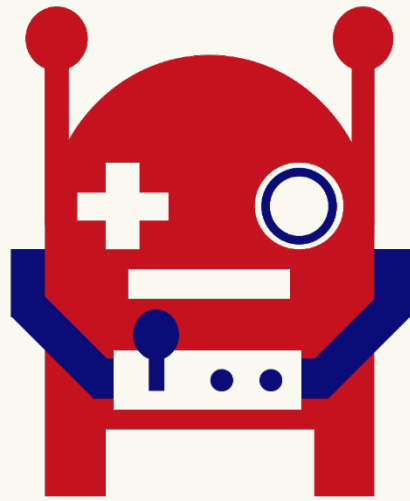


GAME  
CLIENT

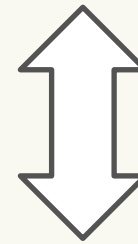


GAME  
SERVER

**Iteration Speed!**



BOT API



GAME  
CLIENT



GAME  
SERVER

**Iteration Speed!**



# PLANTS vs. ZOMBIES™

BATTLE FOR NEIGHBORVILLE

· COMPLETE EDITION ·









Electronic Arts

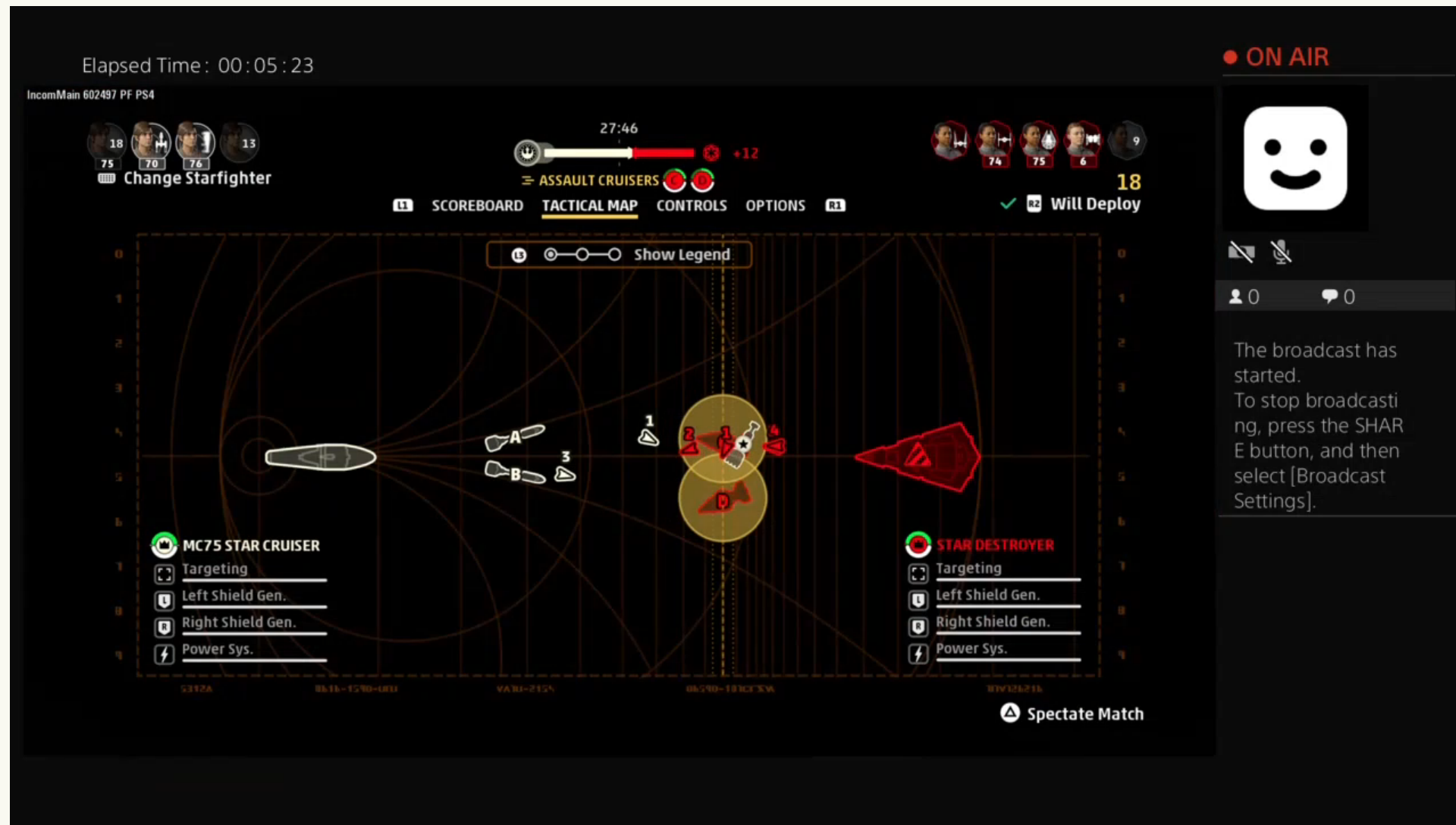
MOTIV<sup>Σ</sup>

***PERFORMANCE TESTING  
WITH AUTOPLAYERS***



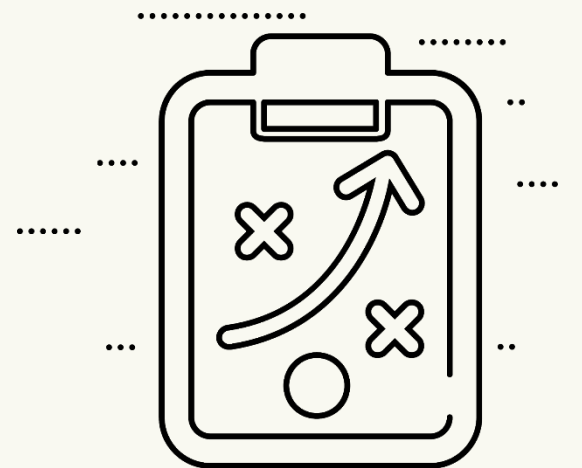


# Goals



■ Performance

■ 5 v 5



■ PS4 VR

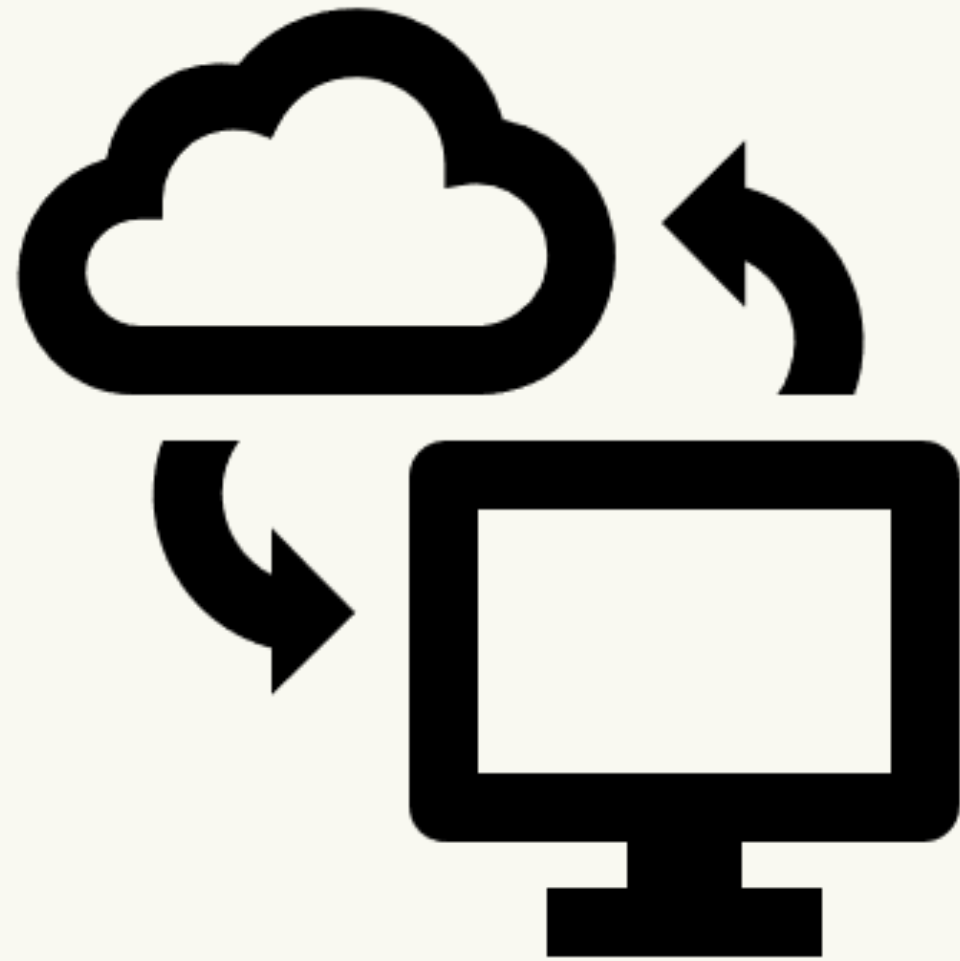


# Challenges

- **Space flight**
- **Player Flow**
- **Game mode**



# Farm Setup, 10 kits

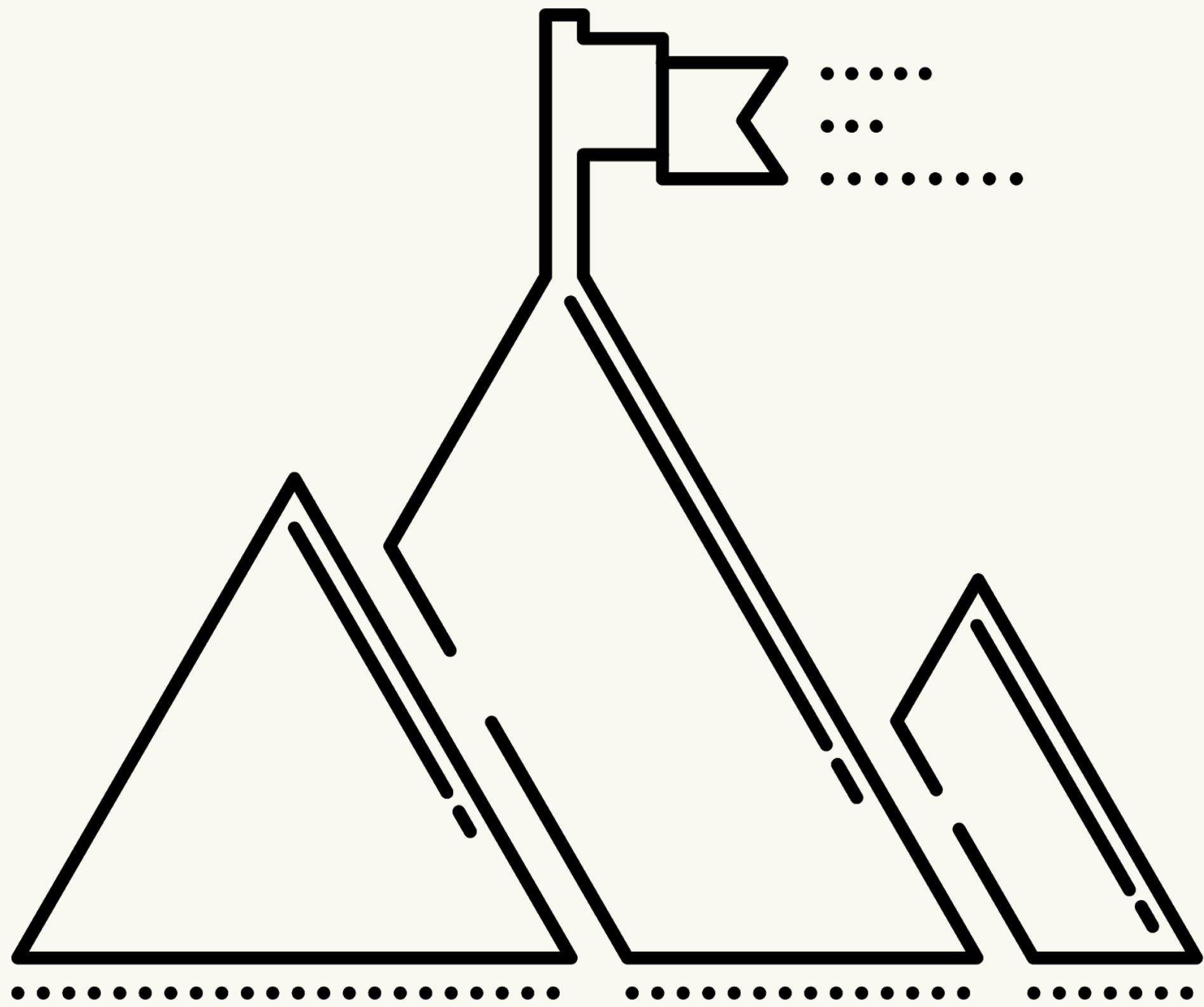




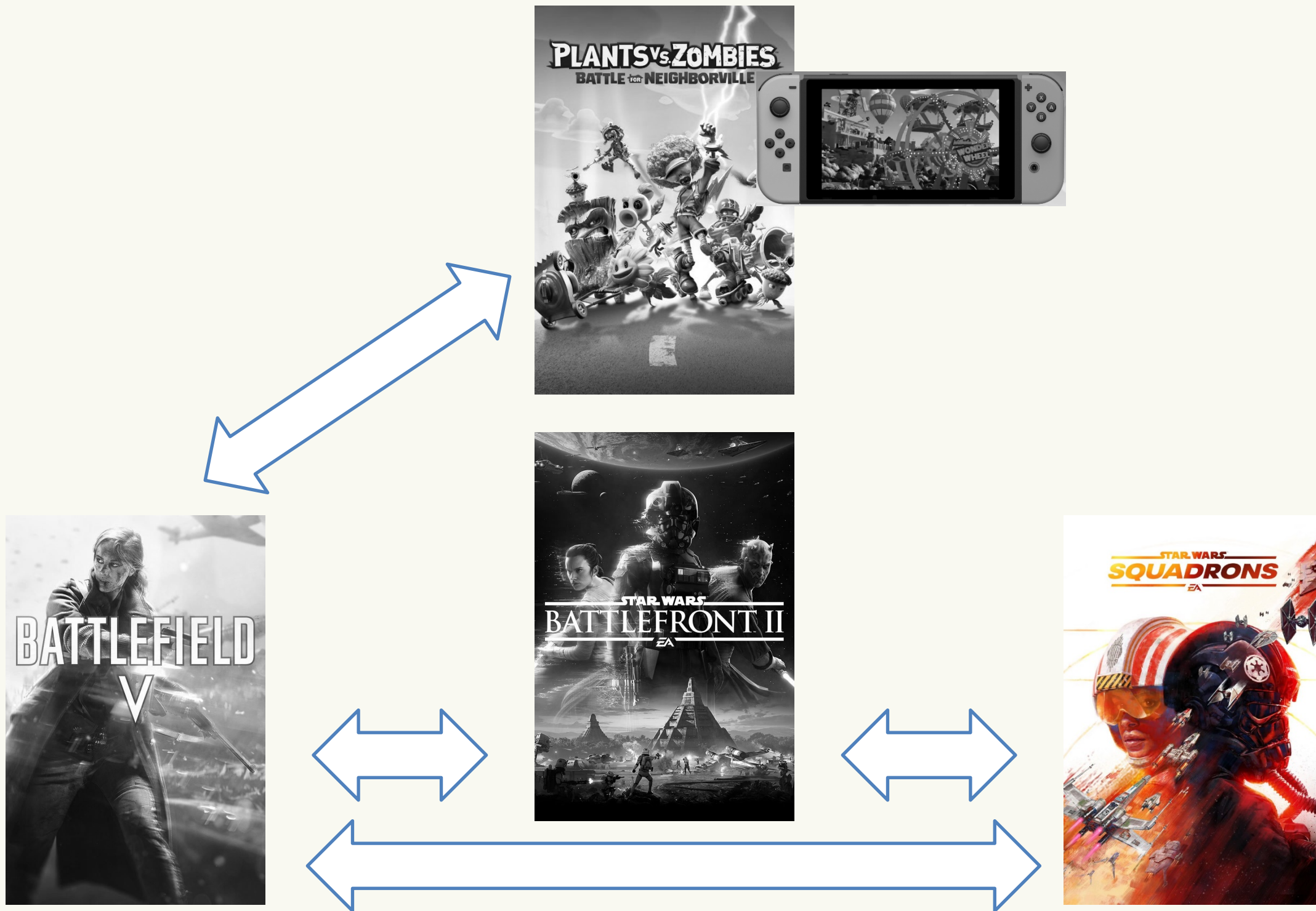
# VR

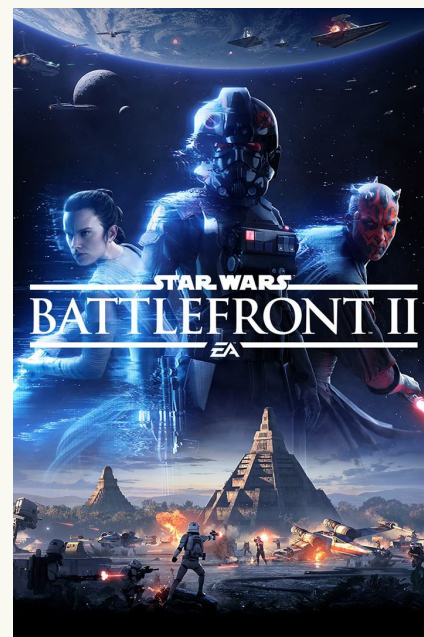
# Regular











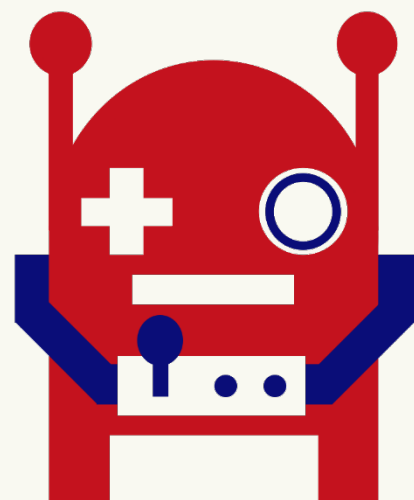
BOT API



GAME  
CLIENT

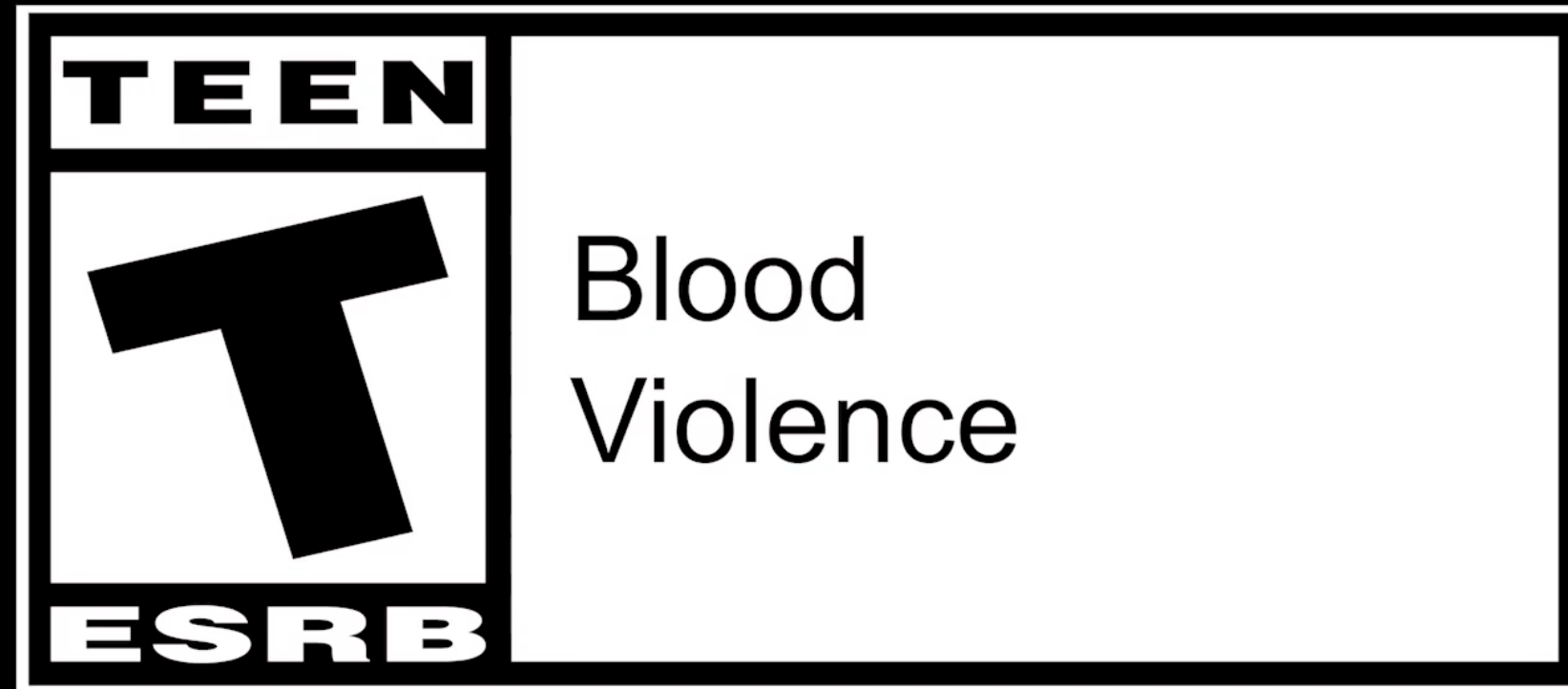


GAME  
SERVER









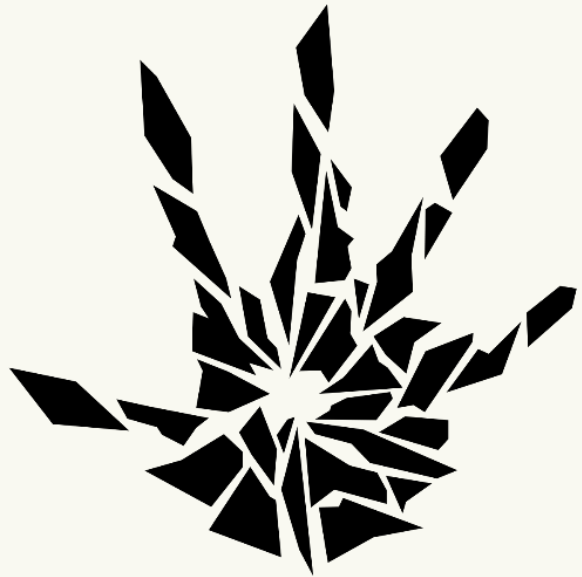
# Goal: Faster QV Matchmaking



# APEX

— LEGENDS™ —

Fork



FROSTBITE™



**ONE DOES NOT SIMPLY**





[243.450] #GLADCARDS CC 16436:still:character\_bloodhound:character\_skin\_bloodhound\_common\_01:geard\_frame\_bloodhound\_legendary\_01:gcared\_stance\_bloodhound\_rare\_08: Done  
[243.550] ClientPakFile Unload: geard\_frame\_bloodhound\_legendary\_01.rpak  
[243.550] Requesting unload of pak "geard\_frame\_bloodhound\_legendary\_01.rpak"



1 00:37

75 E 105 120 SE 150 165 S 195 210 SW 240 255 W  
147

29 SQUADS LEFT 29

KryptonKingfisher RhodiumRat  
AntimonyAsp [Boxing Gloves Melee] HafniumHummingbird



unnamed

2

4

Q

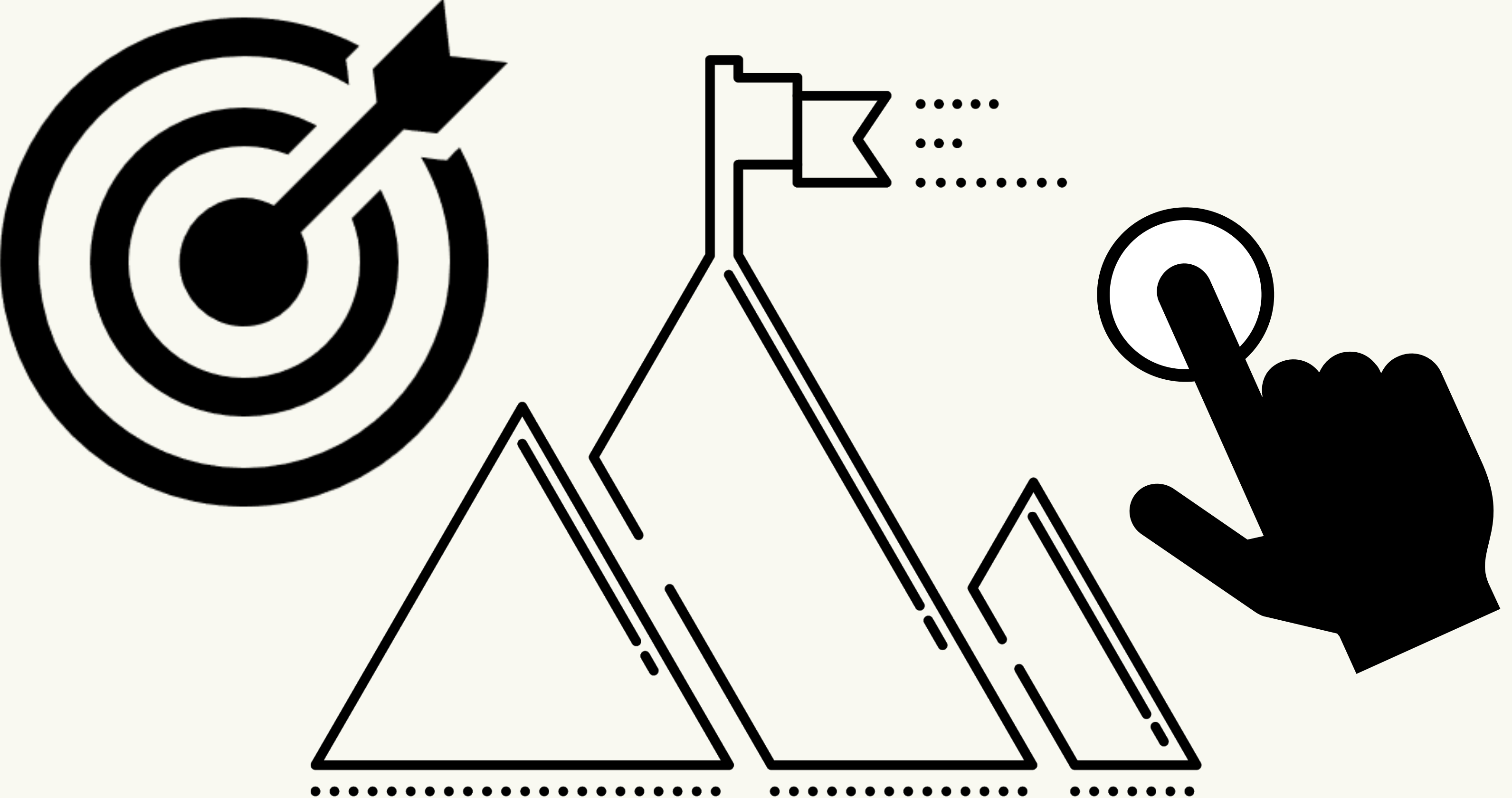
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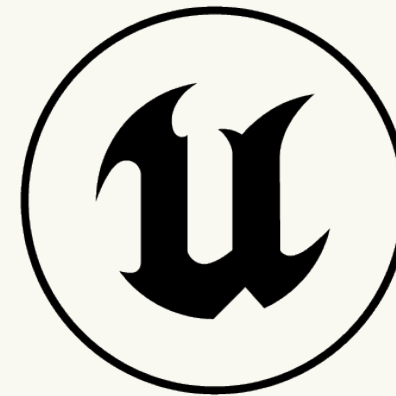
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217

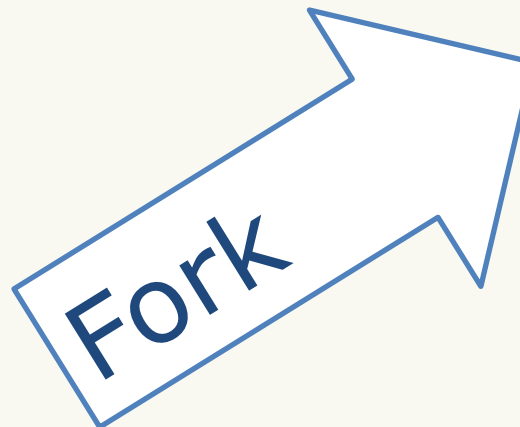
1 G7 SCOUT 2 P2020



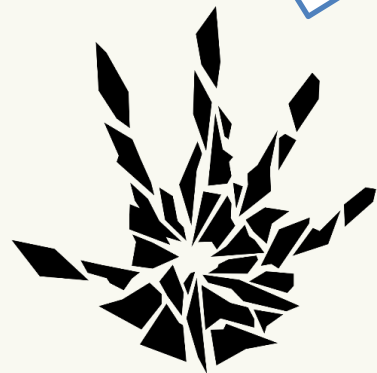




**UNREAL  
ENGINE**

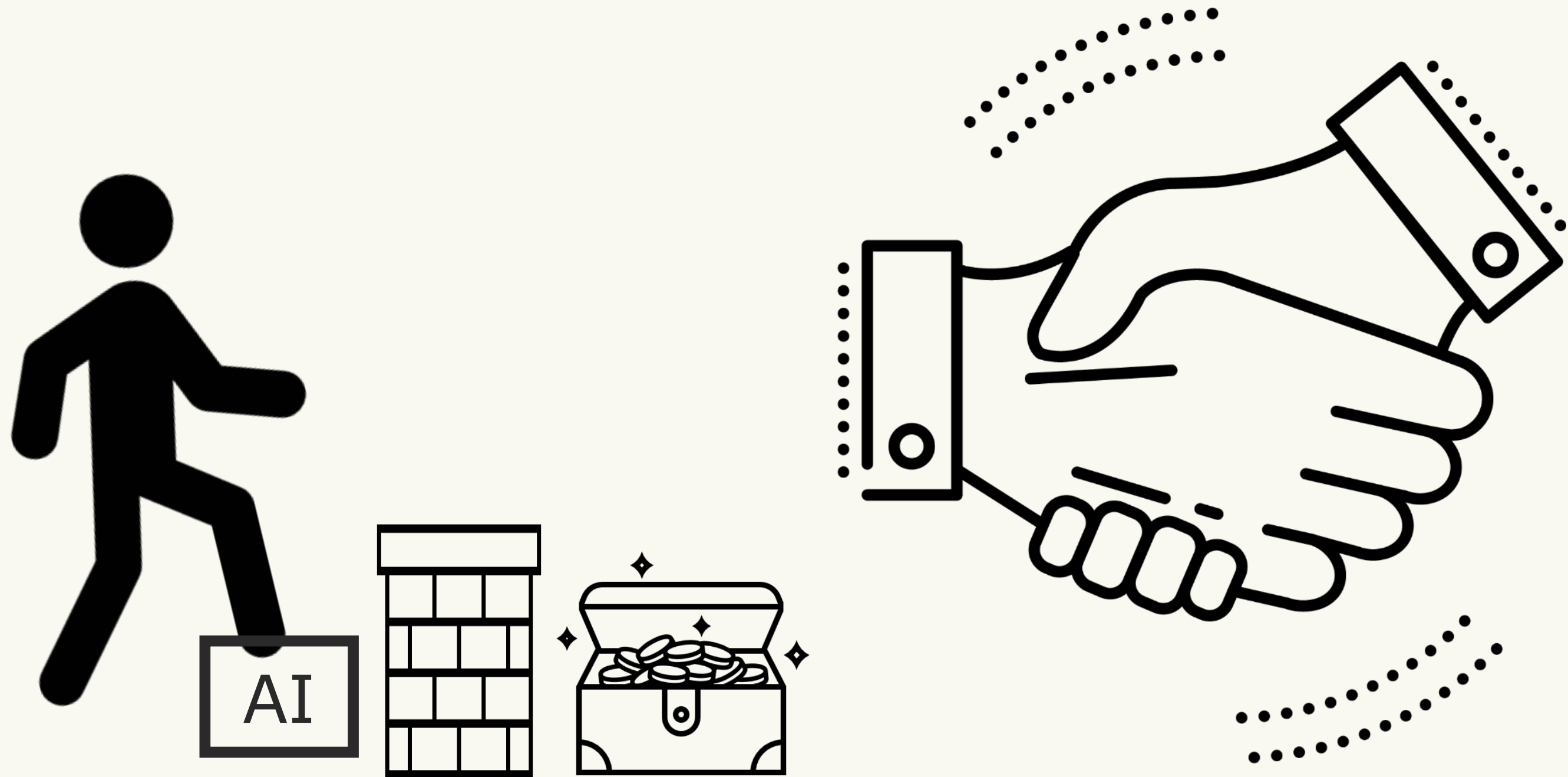


**APEX**  
— LEGENDS™ —



**FROSTBITE™**

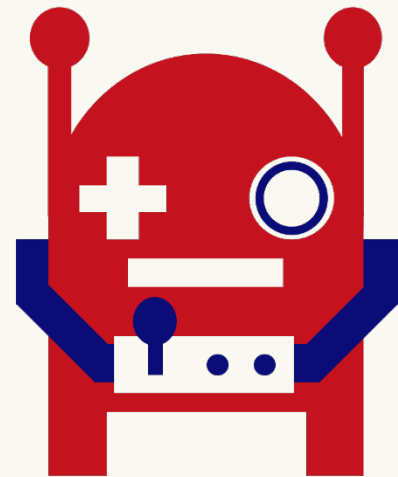
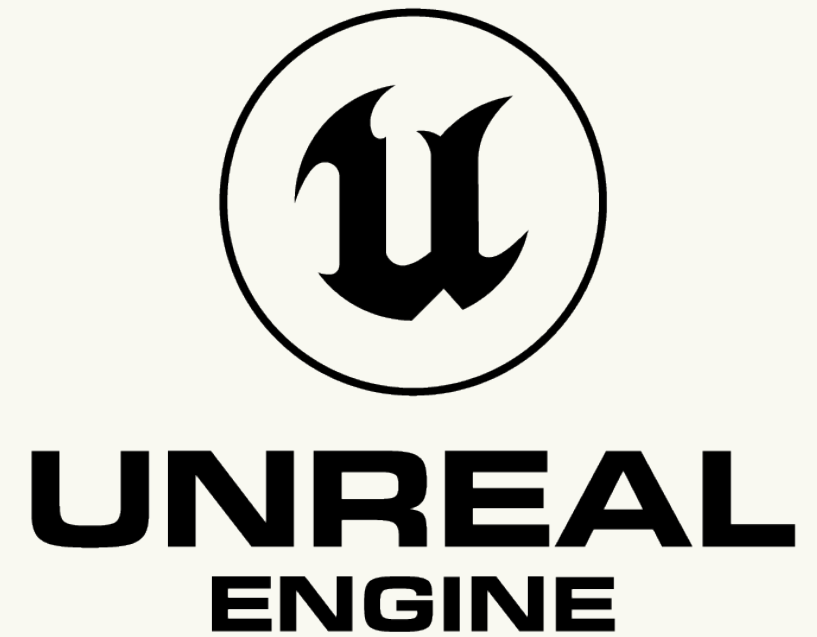




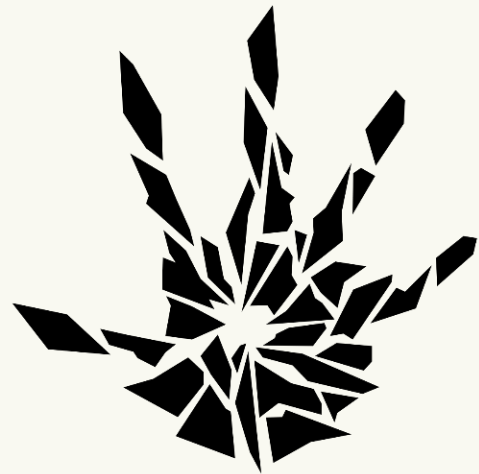
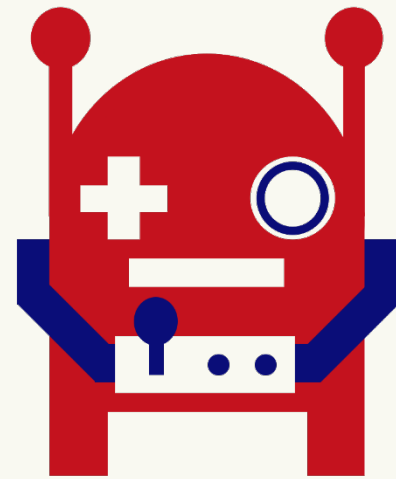


**ONE DOES NOT SIMPLY**

imgflip.com





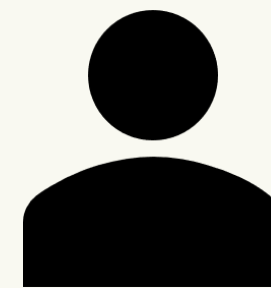
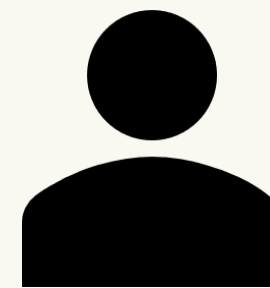
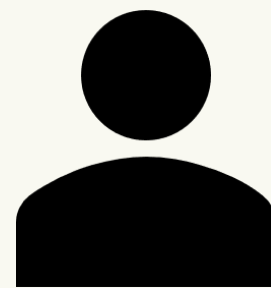
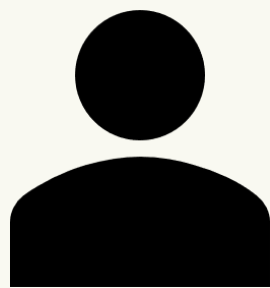
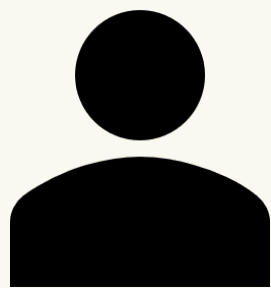
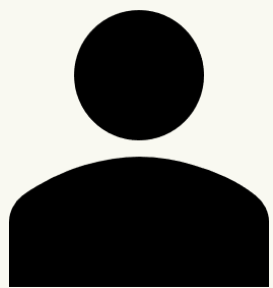


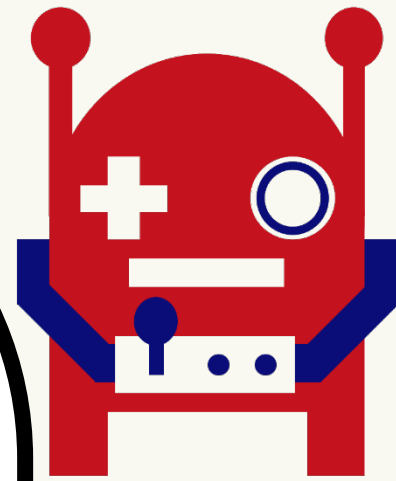
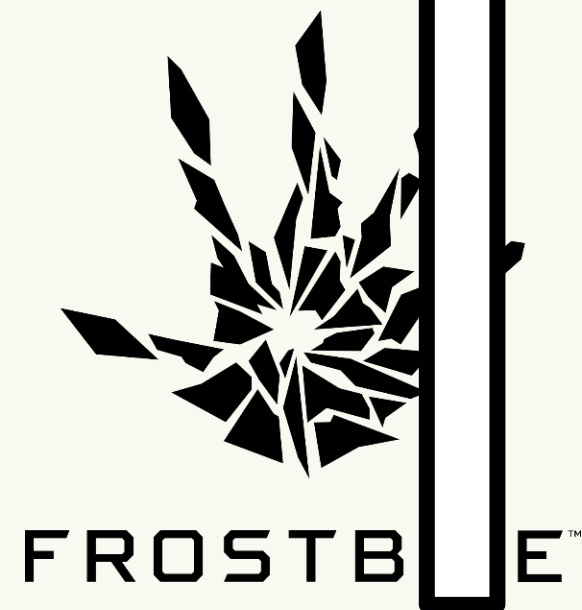
FROSTBITE™

**APEX**  
— LEGENDS™ —

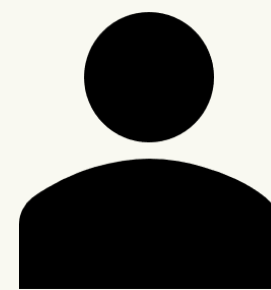
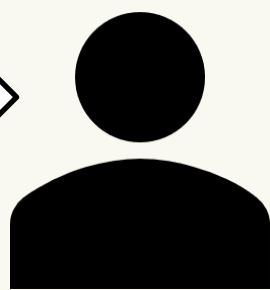
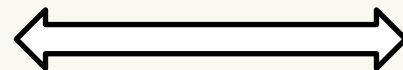
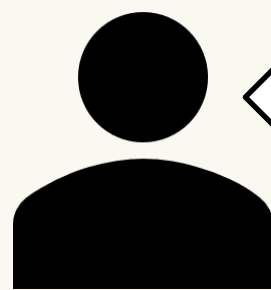
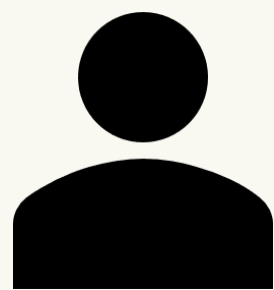


**UNREAL**  
**ENGINE**





**UNREAL  
ENGINE**











- **Reinforcement Learning**
- **Trial n Error**
- **Rewards**
- **Millions of iterations**







## ■ Explore RL





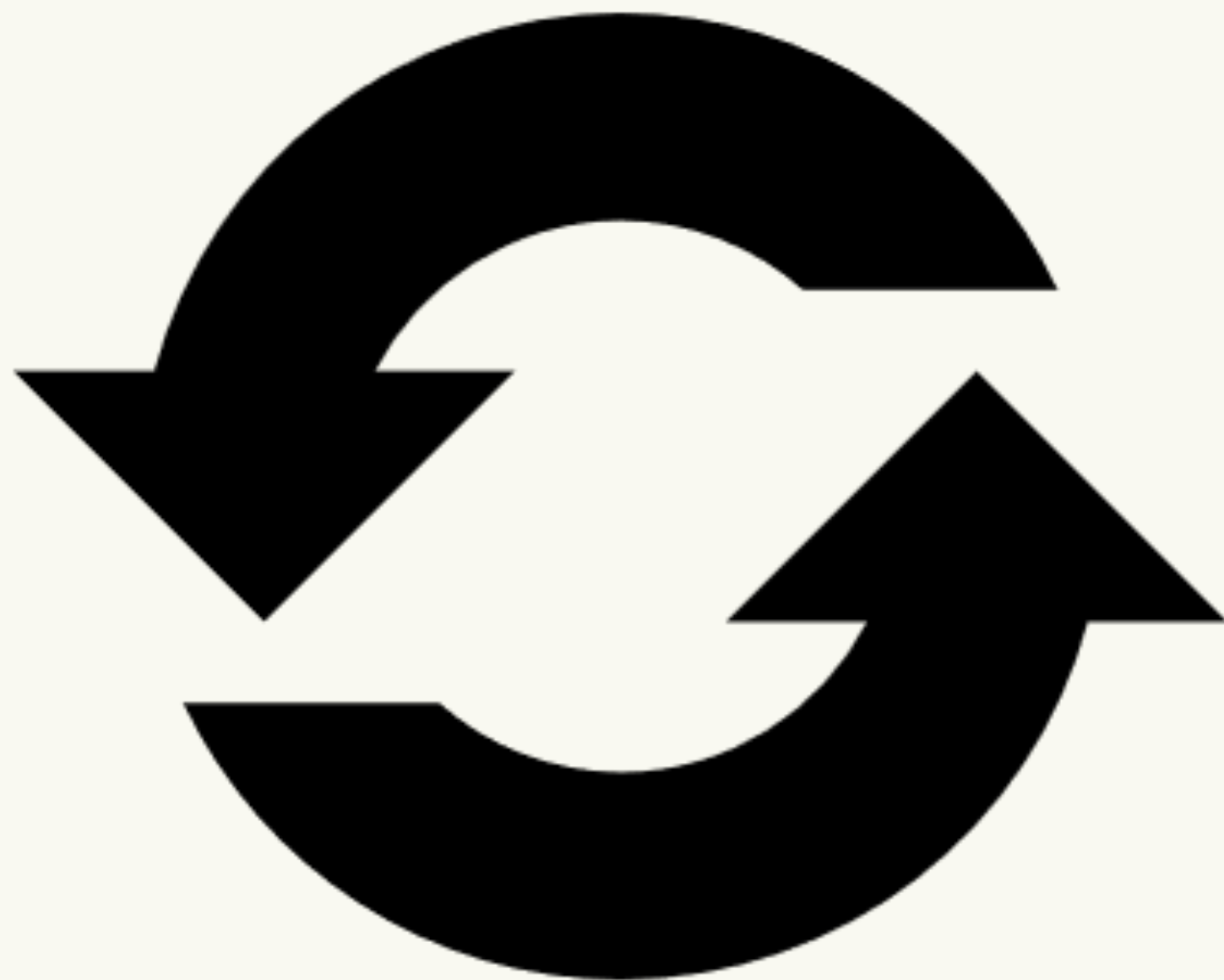
- Explore RL
- Real Problem



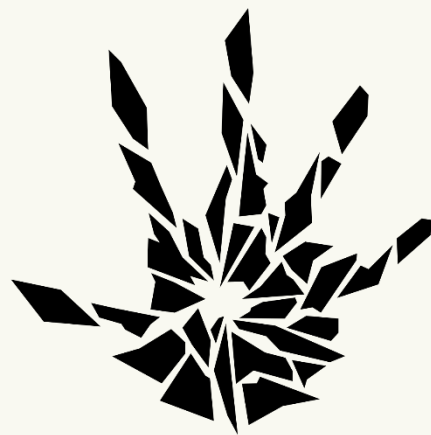
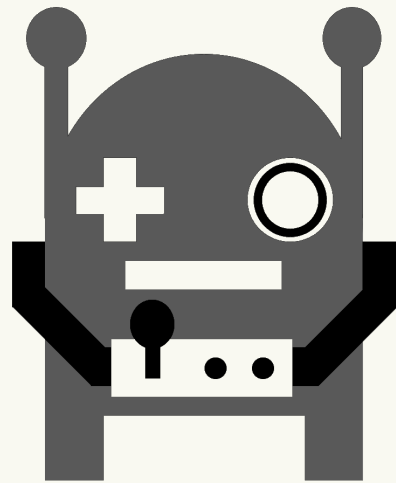
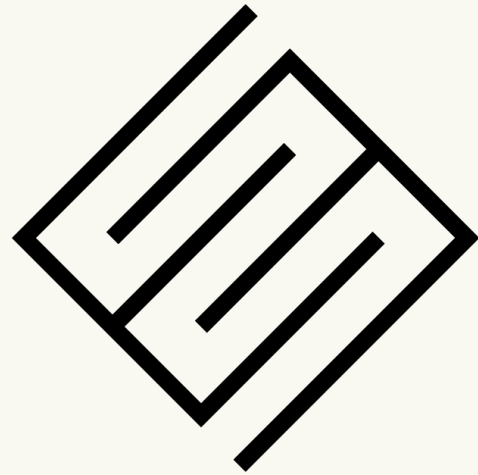
- Explore RL
- Real Problem
- Major Changes





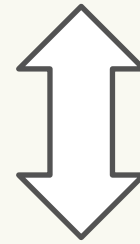




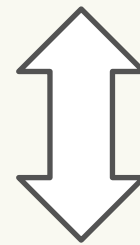


FROSTBITE™

ML



BOT API



GAME  
CLIENT

GAME  
SERVER











- **Single Machine**
- **250 Helicopters**
- **5 Game Servers**
- **10M Steps/Hour**
- **~5 Hours training**

fps/ms  
cpu 82/19.8  
sim 28/30.9  
gpu0 118/ 0.6  
mp/s 186.6

Score: 0.899 Ori: 1.283  
Ori: -0.014, -0.034, -0.027 -0.037  
Waypoint: 0.166  
Waypoint: 0.166  
Line: 0.157 Ori: 1.436, 0.118 -0.481  
Height: 0.000 Waypoint: 0.166  
Ground: 0.187 Height: -0.427  
Throttle: 0.000 Height: -0.401  
Height: -0.141  
Ground: 0.021  
Throttle: 0.028  
Ground: 0.181  
Throttle: 0.672

Score: 1.723  
Ori: -0.014, -0.034 -0.073  
Waypoint: 0.166  
Line: 0.075  
Height: 0.008  
Ground: 0.187  
Throttle: -1.000

Score: 0.773  
Ori: 0.075, -0.002, -0.058  
Waypoint: 0.166  
Line: 0.030  
Height: 0.078  
Ground: 0.252  
Throttle: 0.000

Score: 5.069  
Ori: 0.075, -0.002, -0.058  
Waypoint: 0.166  
Line: 0.030  
Height: 0.078  
Ground: 0.252  
Throttle: 0.000















# Original



# Mimic1



# Mimic2



# Mimic3













PS5

XboxSeriesX

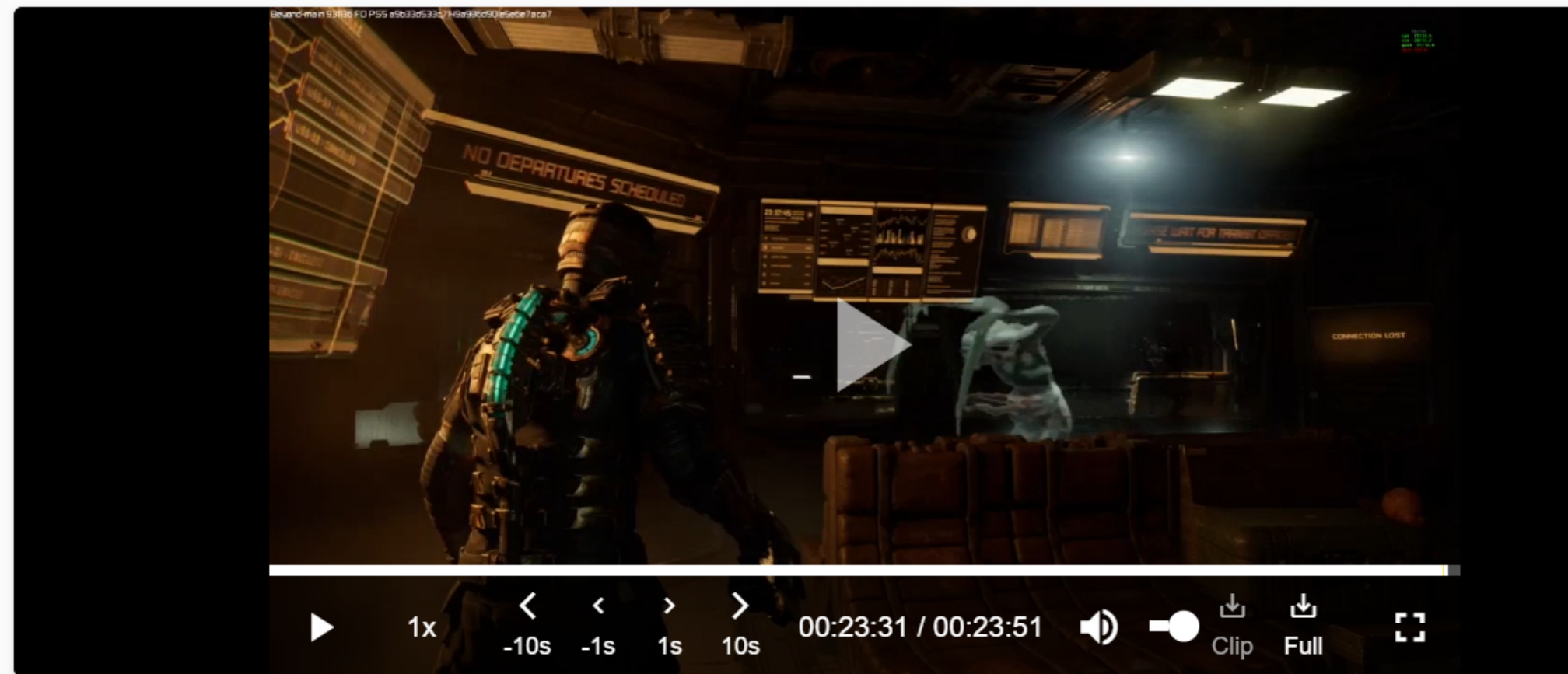
XboxSeriesX

XboxSeriesX

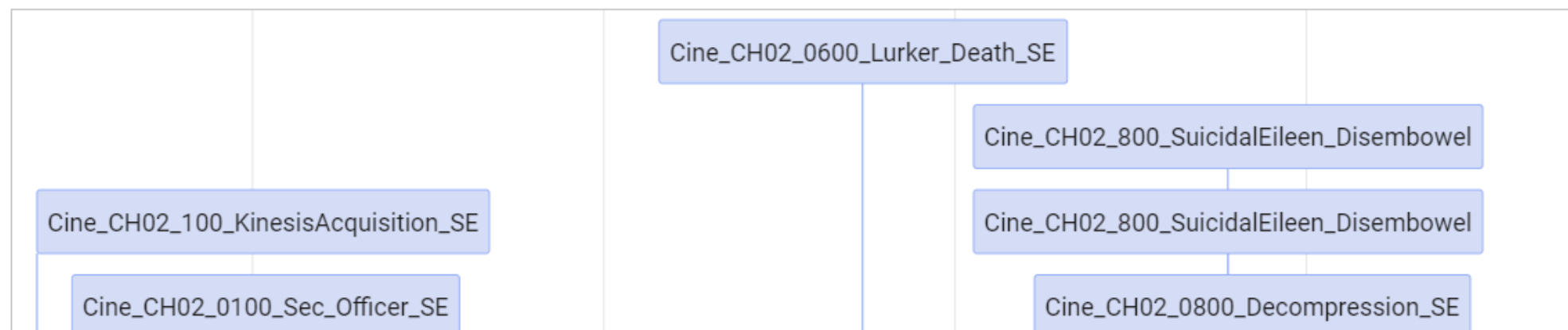
PS5

XboxSeriesX

|< < > >|



### Timeline



PS5

XboxSeriesX

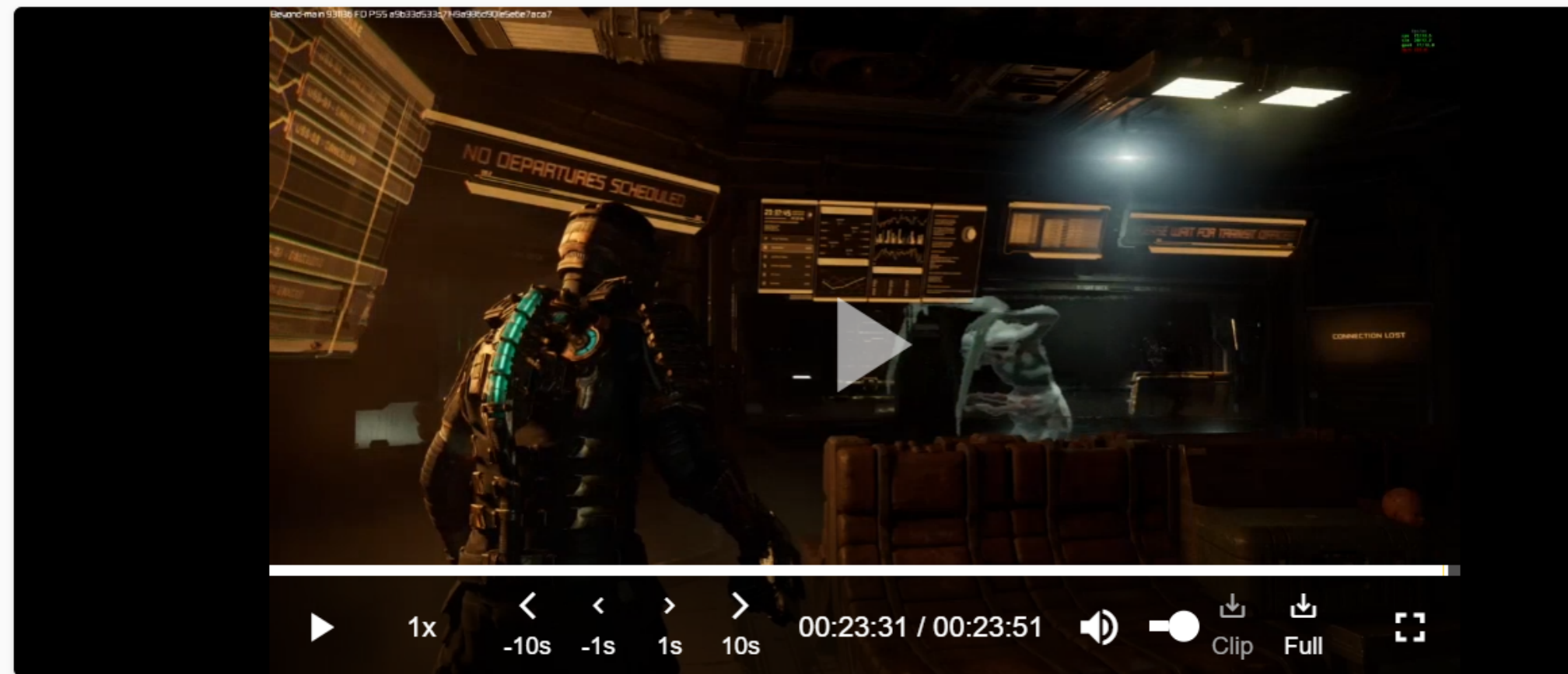
XboxSeriesX

XboxSeriesX

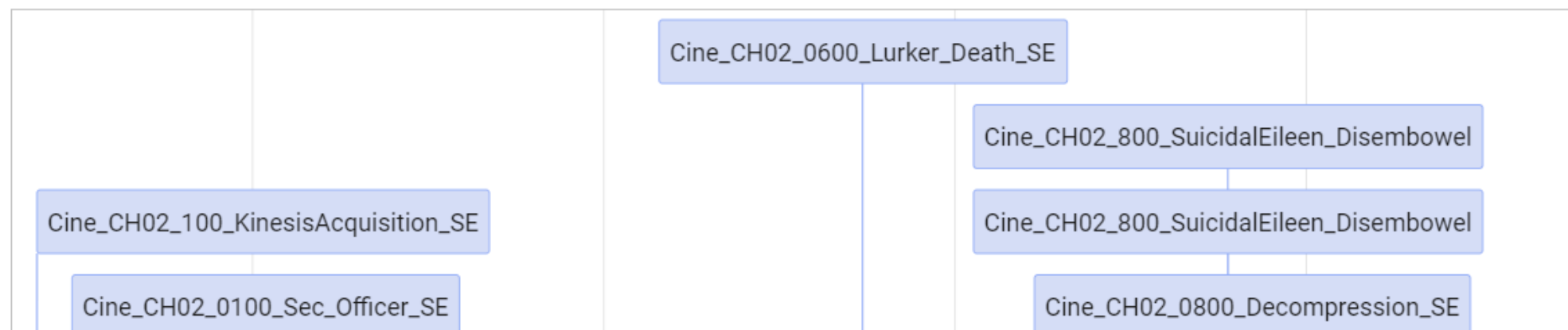
PS5

XboxSeriesX

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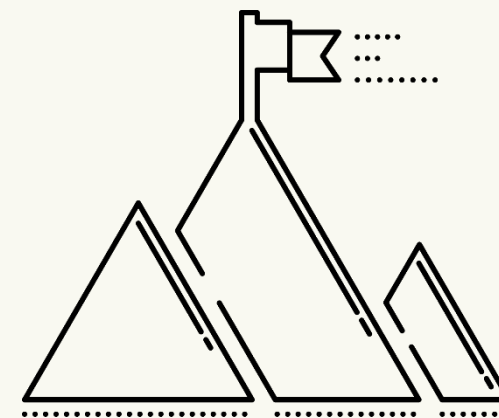
### Timeline





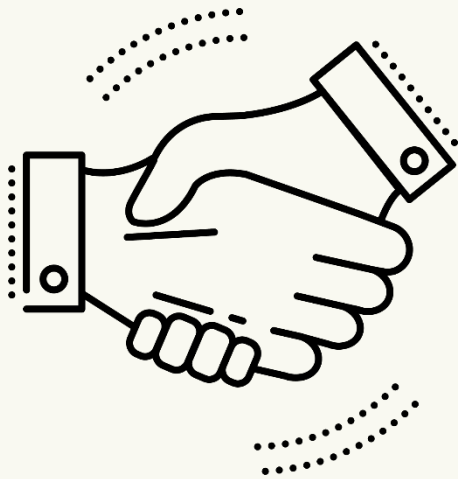


Single Player  
Worth it ?

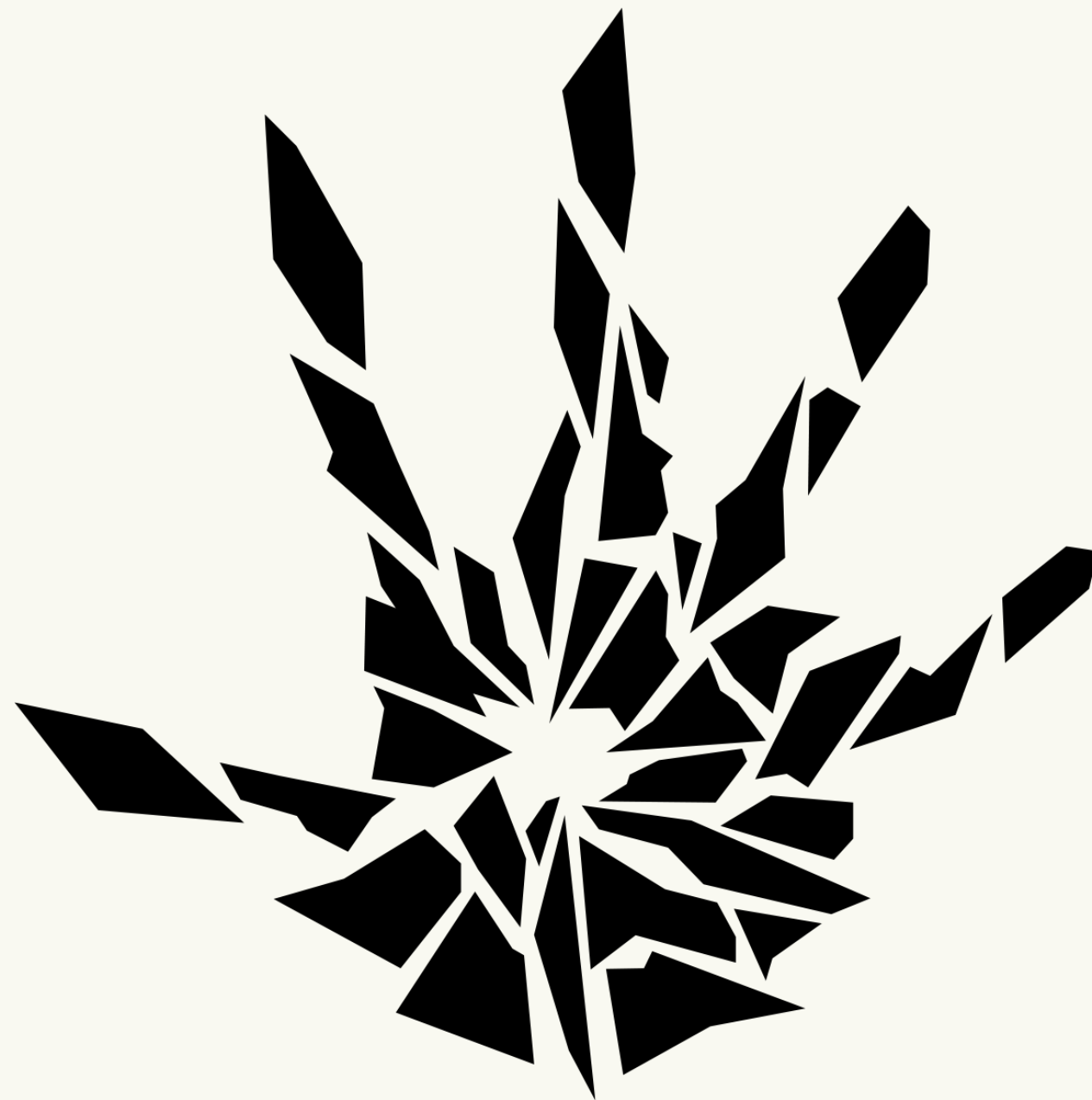
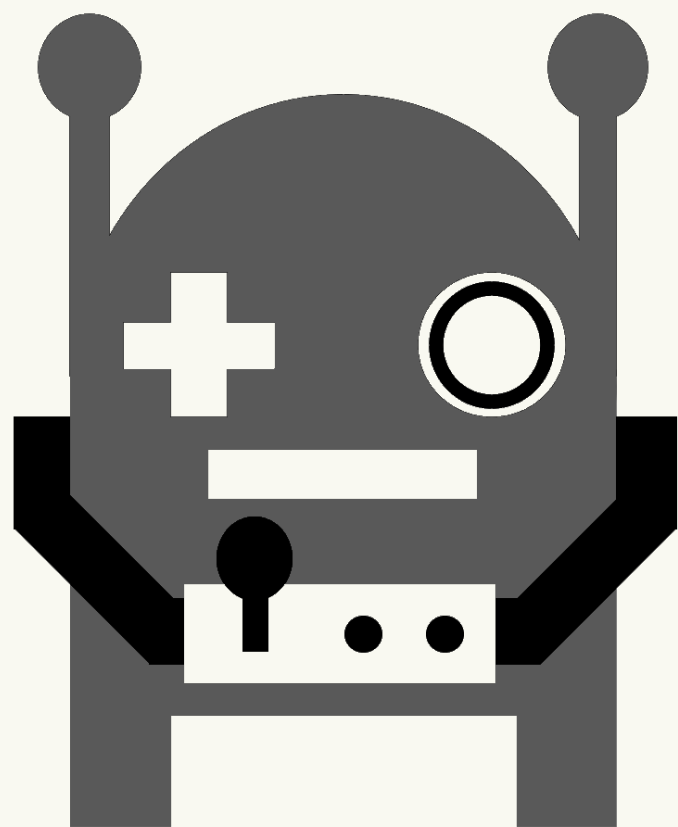


5 v 5 VR - Worth it





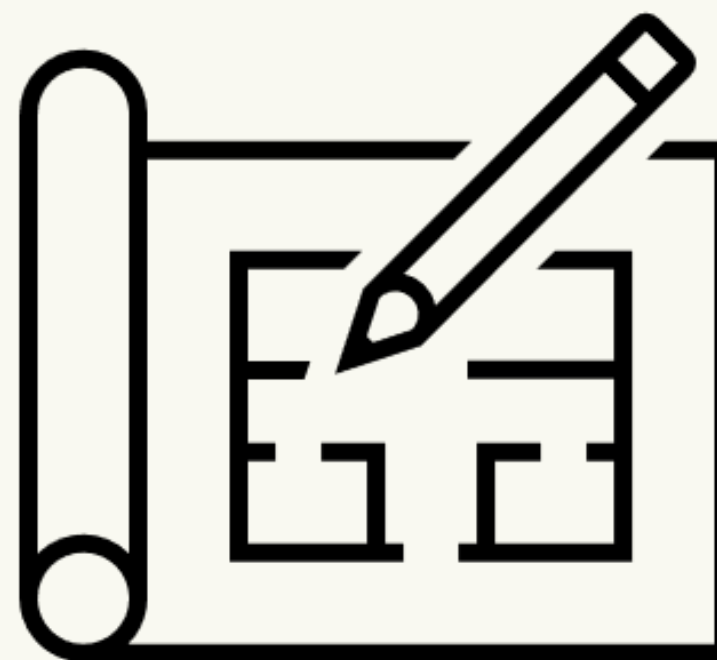
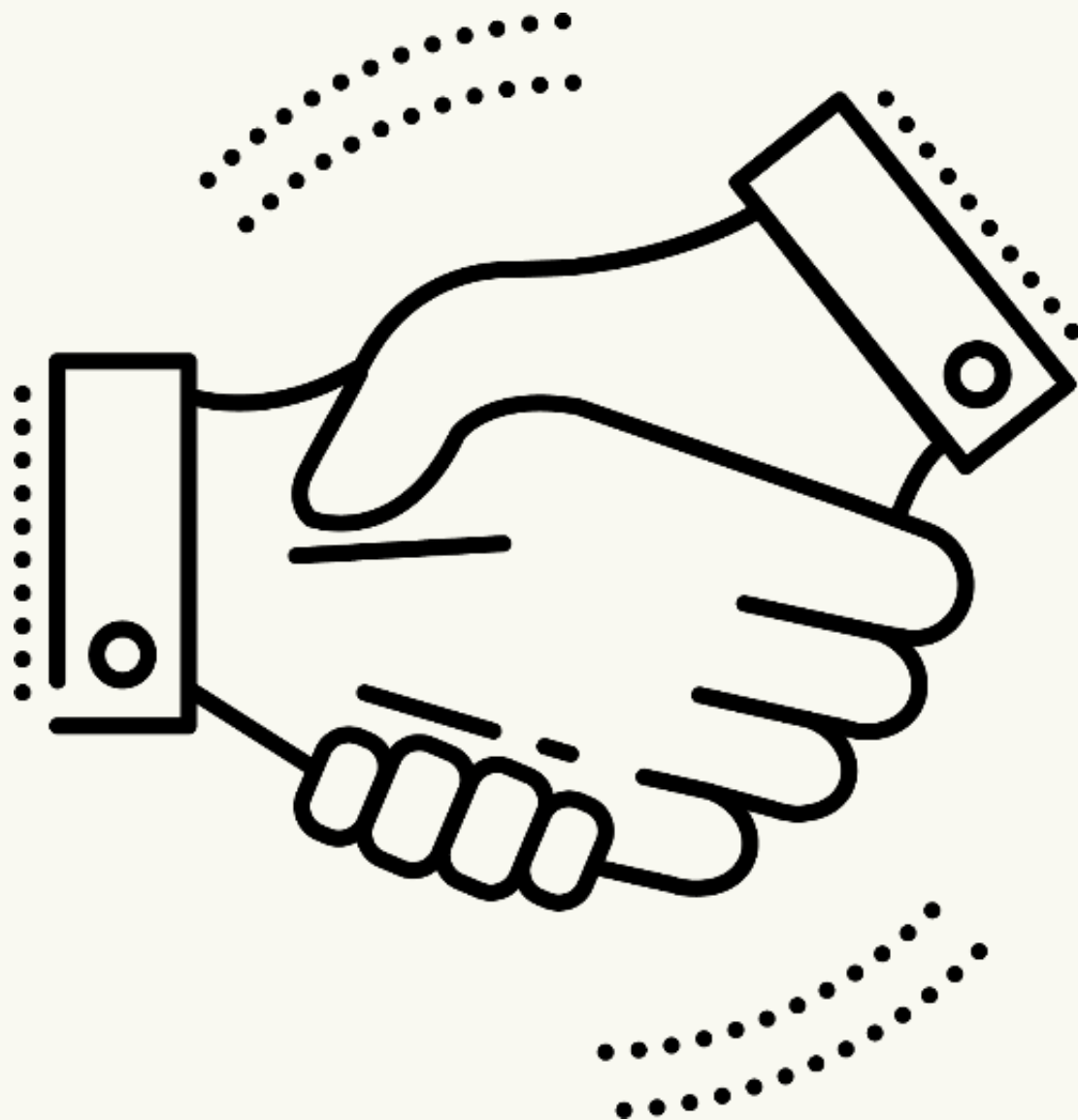
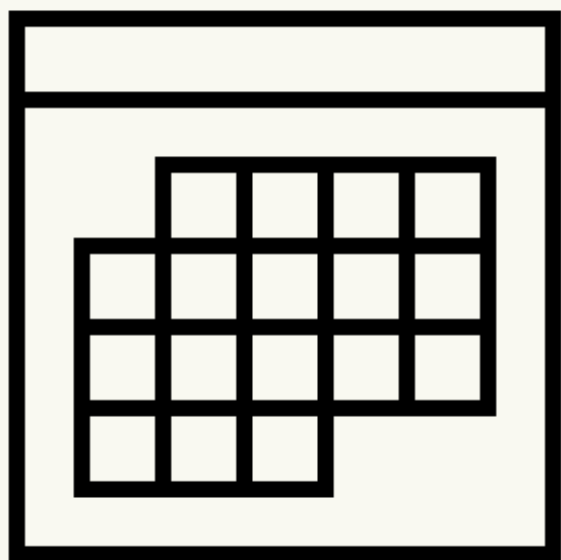




# FROSTBITE™

Very early dev version - AutoPlayers integration spike





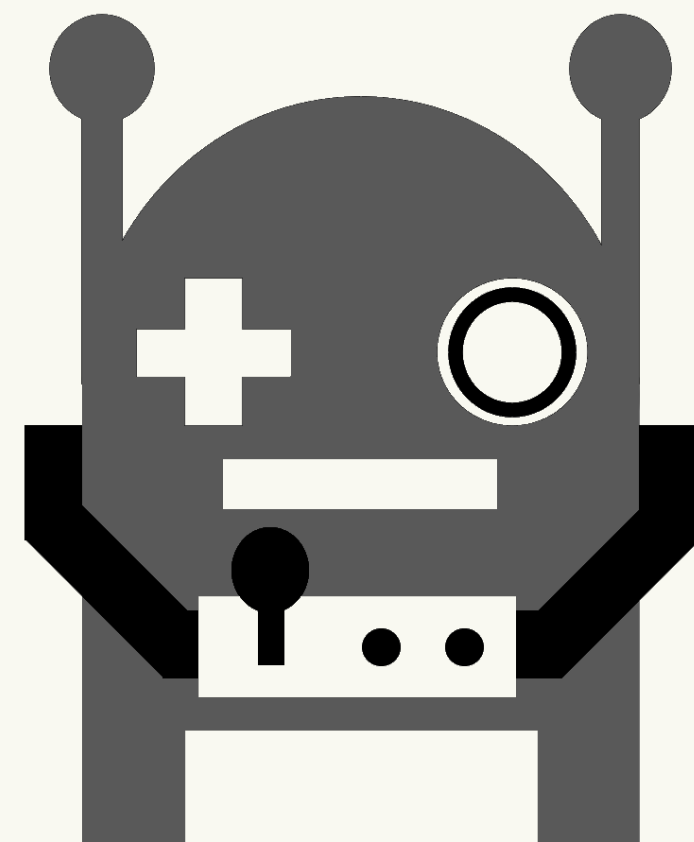
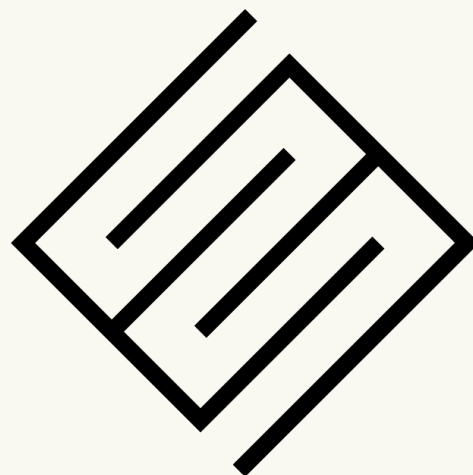
Fps/ms  
cpu 30/14.0  
sim 30/ 7.1  
gpu0 226/ 4.4  
mp/s 208.0







ZeroG ?

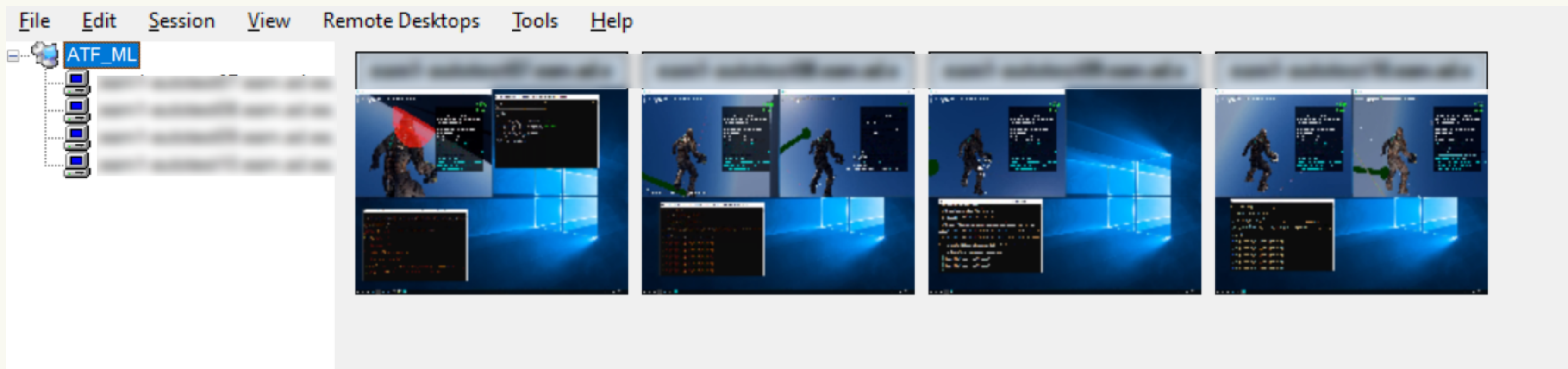




**Yes, but**







Very early dev build - AutoPlayers ZeroG ML

```
a: No value
B: No value
```

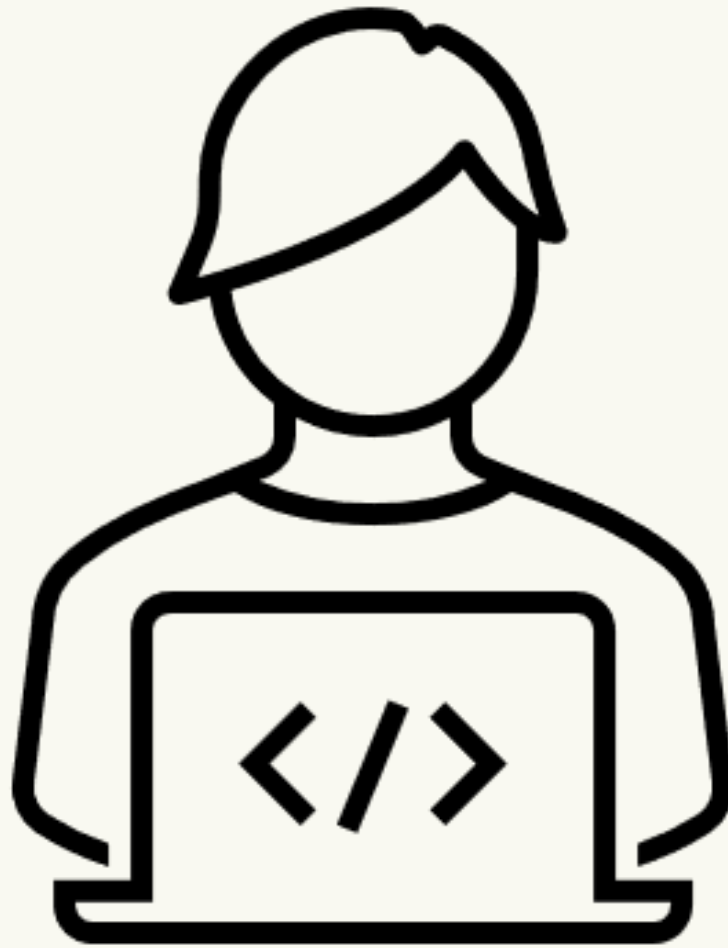
```

      fps/ms
cpu    56/18.8
sin    30/10.6
gpu0   115/ 8.7
mp/s   106.0

```













# Very early dev build - AutoPlayers ZeroG ML

h:\csc\code\ml\csc\code\autocsc\q\autocsc\_autoplayer\3\30n\_inet\autocsc

a: No value  
B: No value

[Realm\_Client]OBJ (298-MLTraining-[1]-2, Area(D:0.0,R:30.0) VT:0.0)

fps/ms  
cpu 56/18.0  
sin 30/10.6  
gpu0 115/ 8.7  
mp/s 106.0





# Results

- **Portable ML**
- **ML Guidelines**
- **ML Training**

# Playthrough Scripting

- Unique Events



# Playthrough Scripting



- Unique Events
- Repeatability

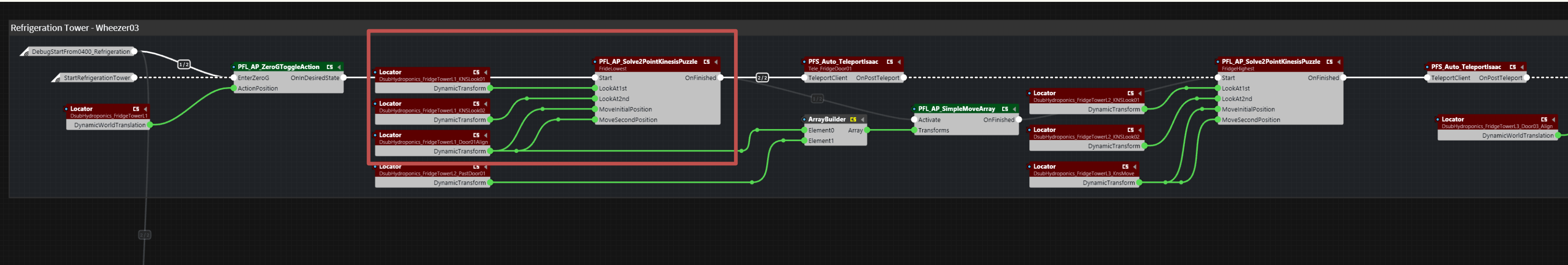
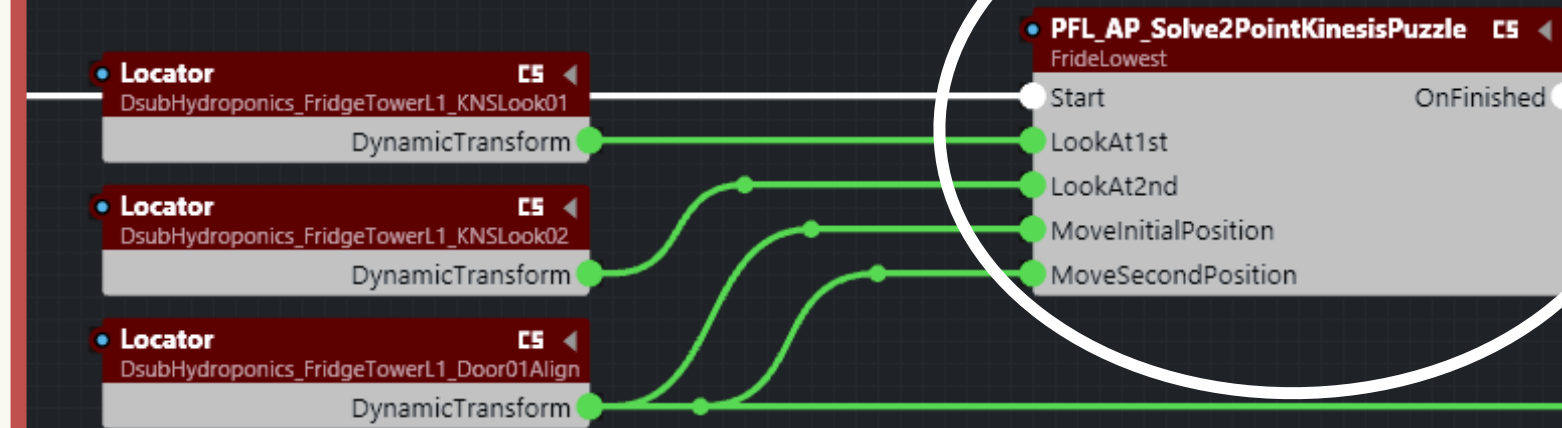


# Playthrough Scripting



- Unique Events
- Repeatability
- No Exploration

# Solve Puzzle



Tram start to sapling room



CineCapture\_CrossAR



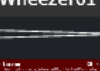
Enzyme Creation and Wheezer01



CineCapture\_ForceGunAcquisition



Wheezer01



West Grow Chamber - Wheezer 02



Refrigeration Tower - Wheezer03



East Grow Chamber - Wheezer 04 and 05



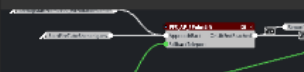
East Grow Chamber - Wheezer 06



Tentacle and Air Filtration



FireTube - Wheezer 07 and 08



Backtrack to WestGrowChamber



Ch06 End to Ch07



DEBUG SKIP TENTACLE - Return fr...



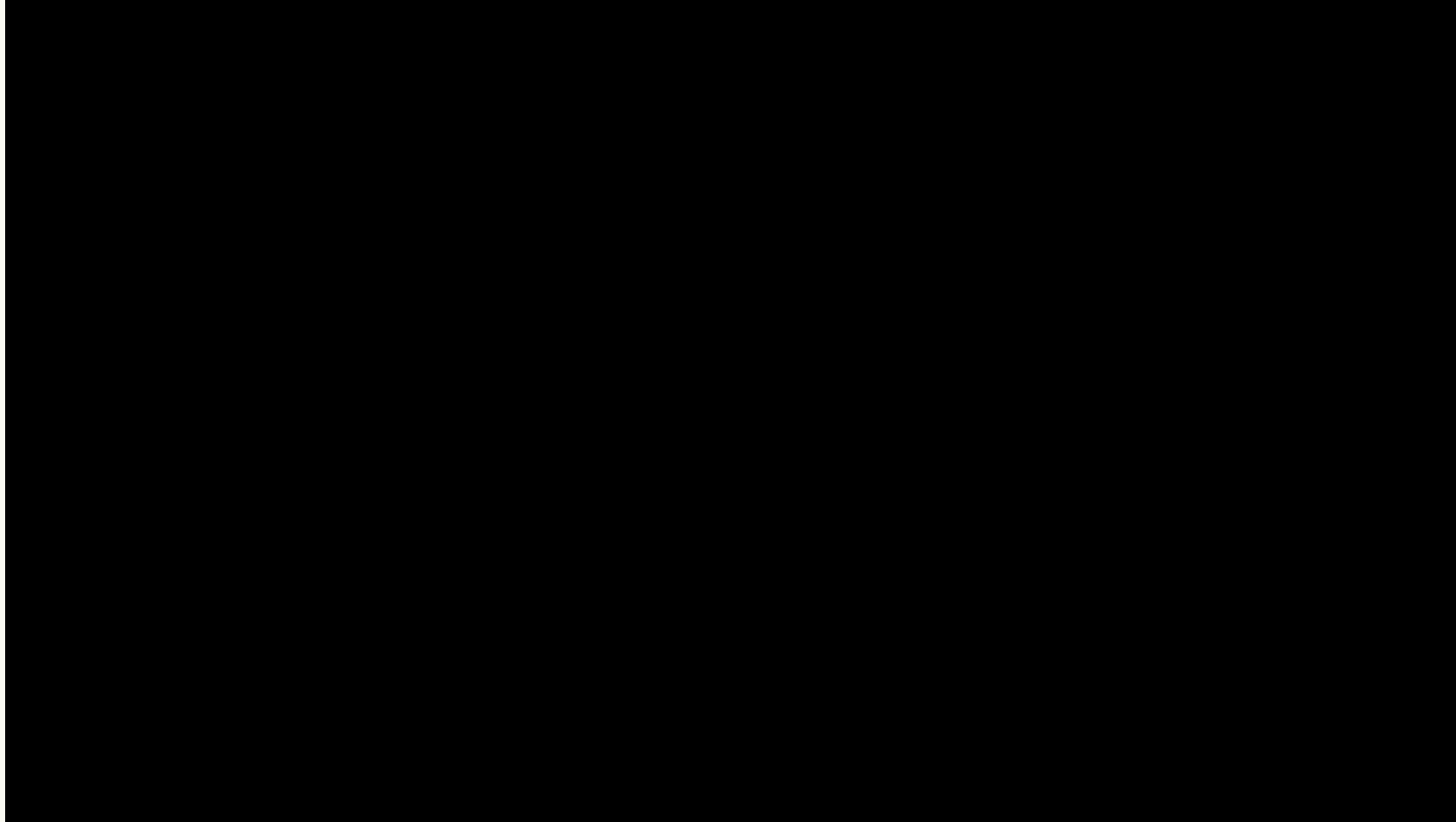
Backtrack to Food storage panel





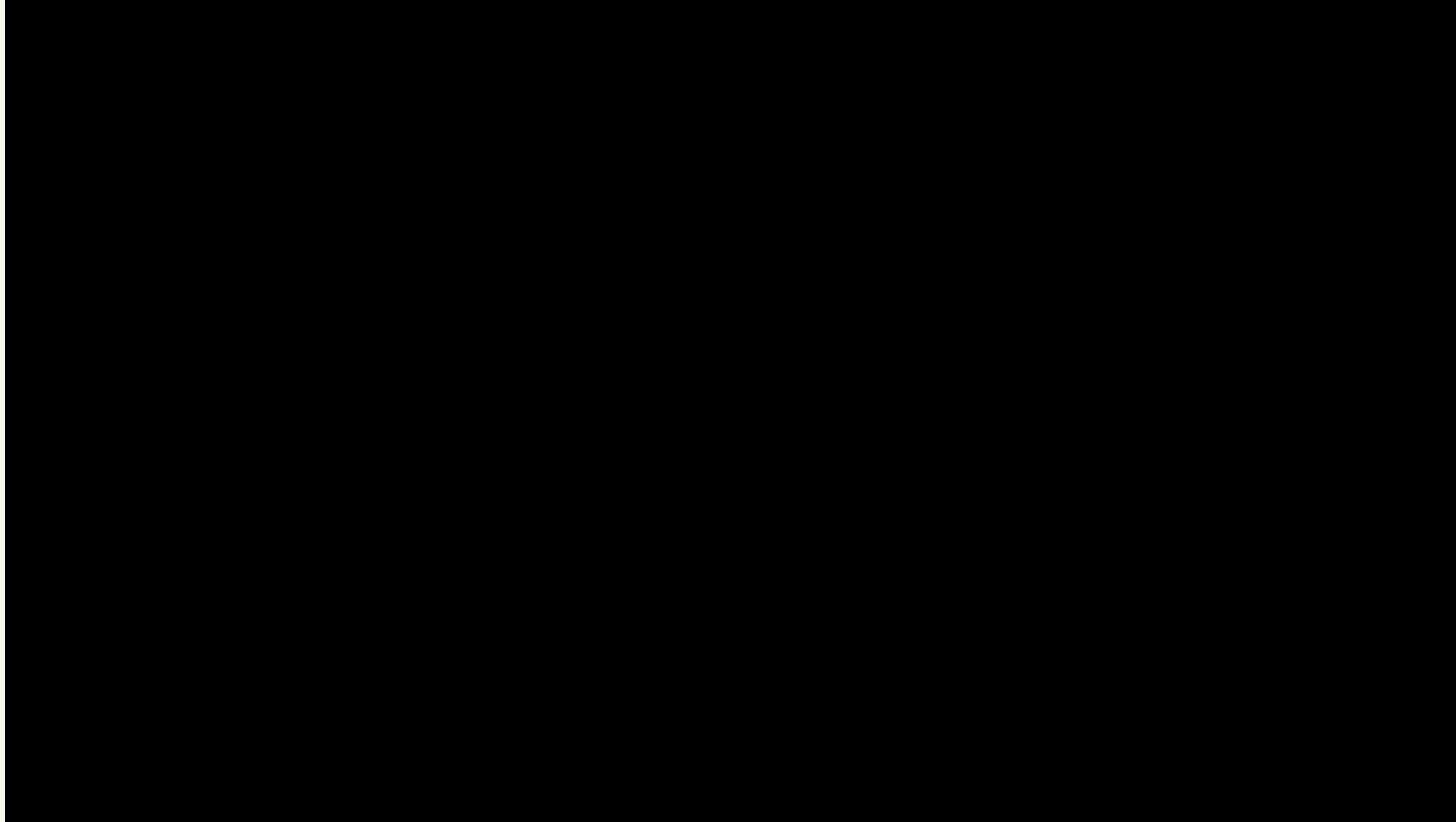


# Panel Scripting



- UI
- Stateful

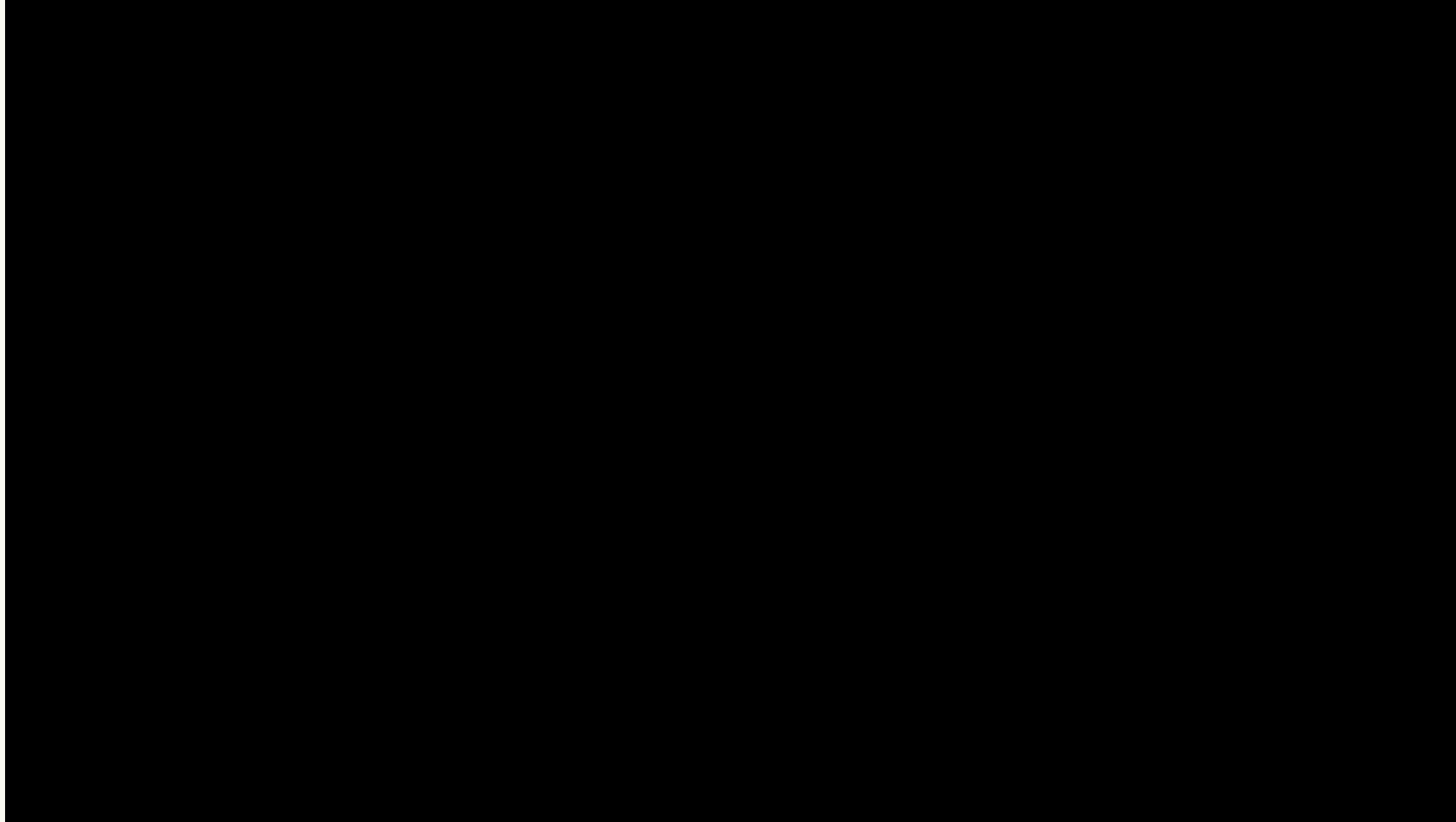
# Script + Objective



- **Script Where**
- **AI Carry**

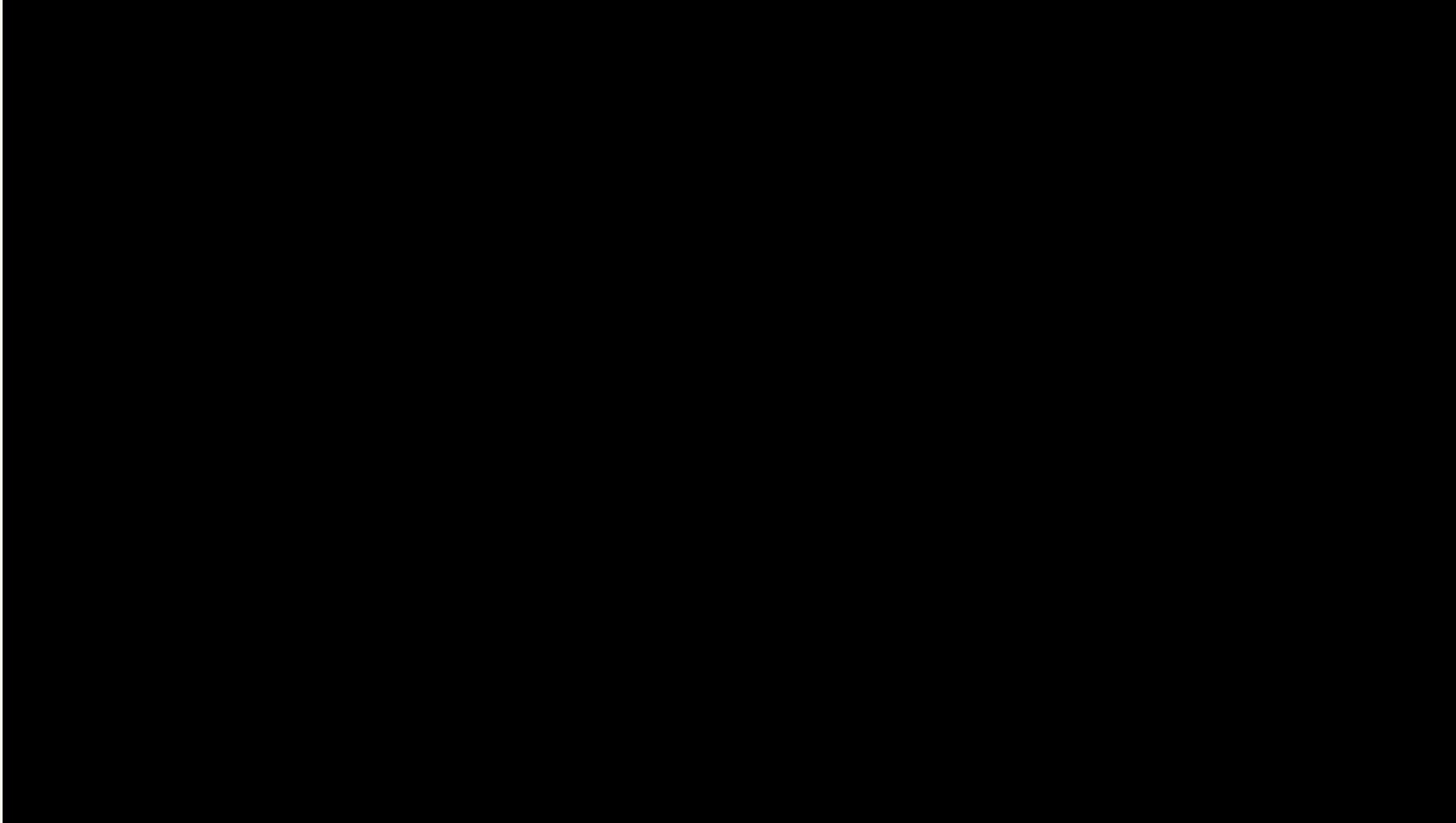


# Combat



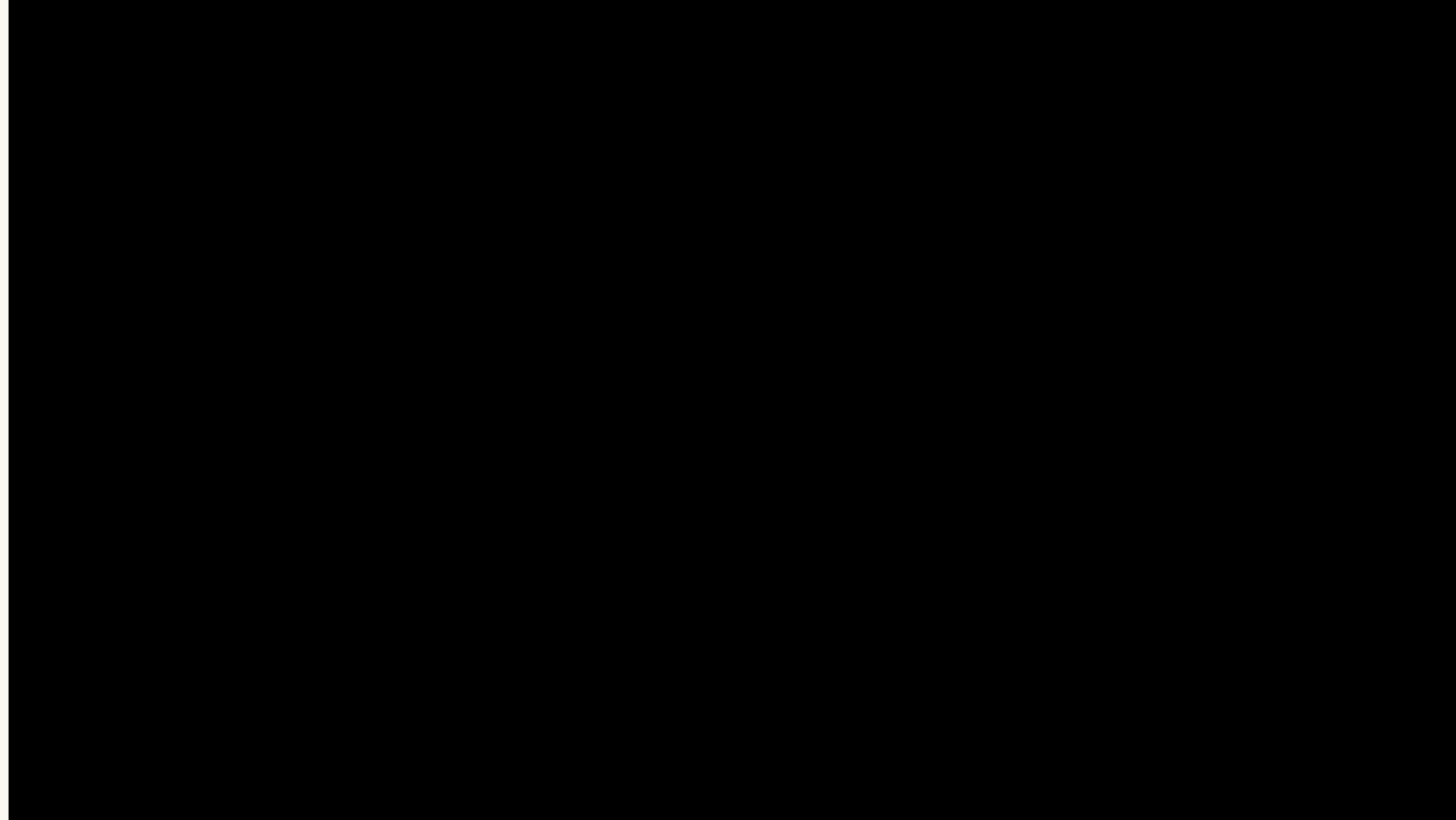
- **Defend Area**
- **Godmode**

# Stuck

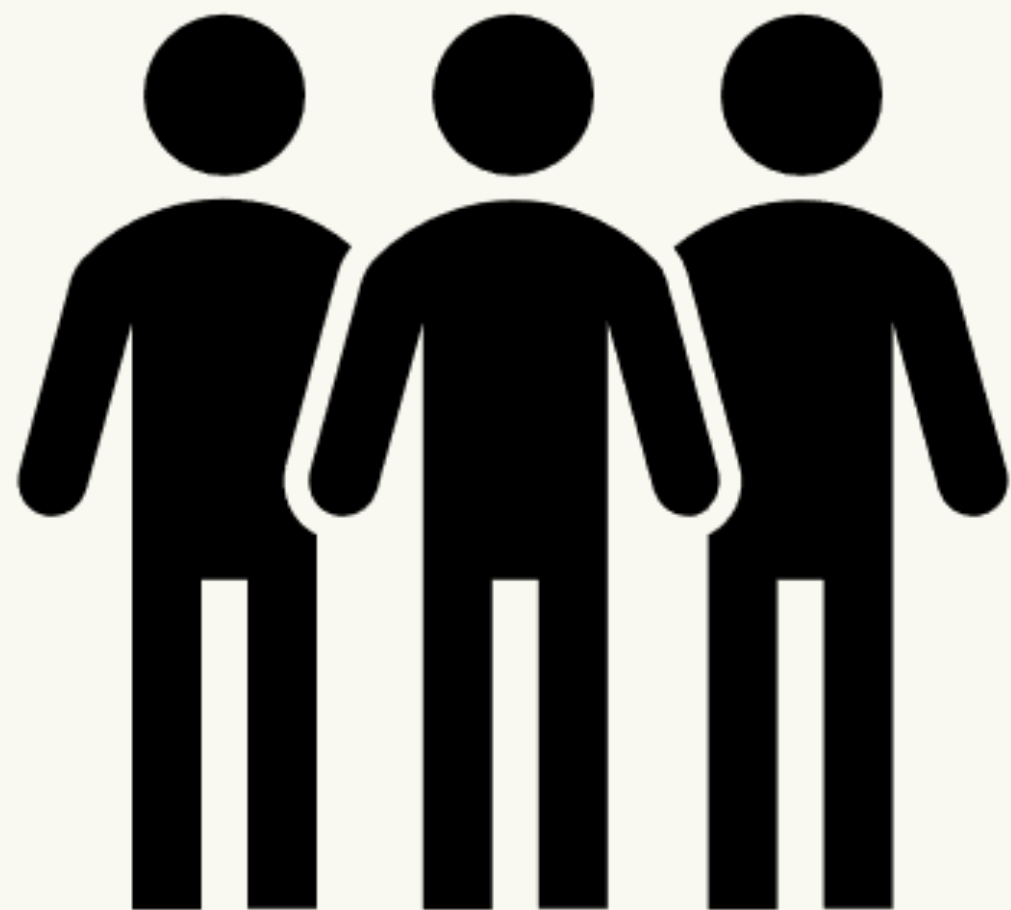


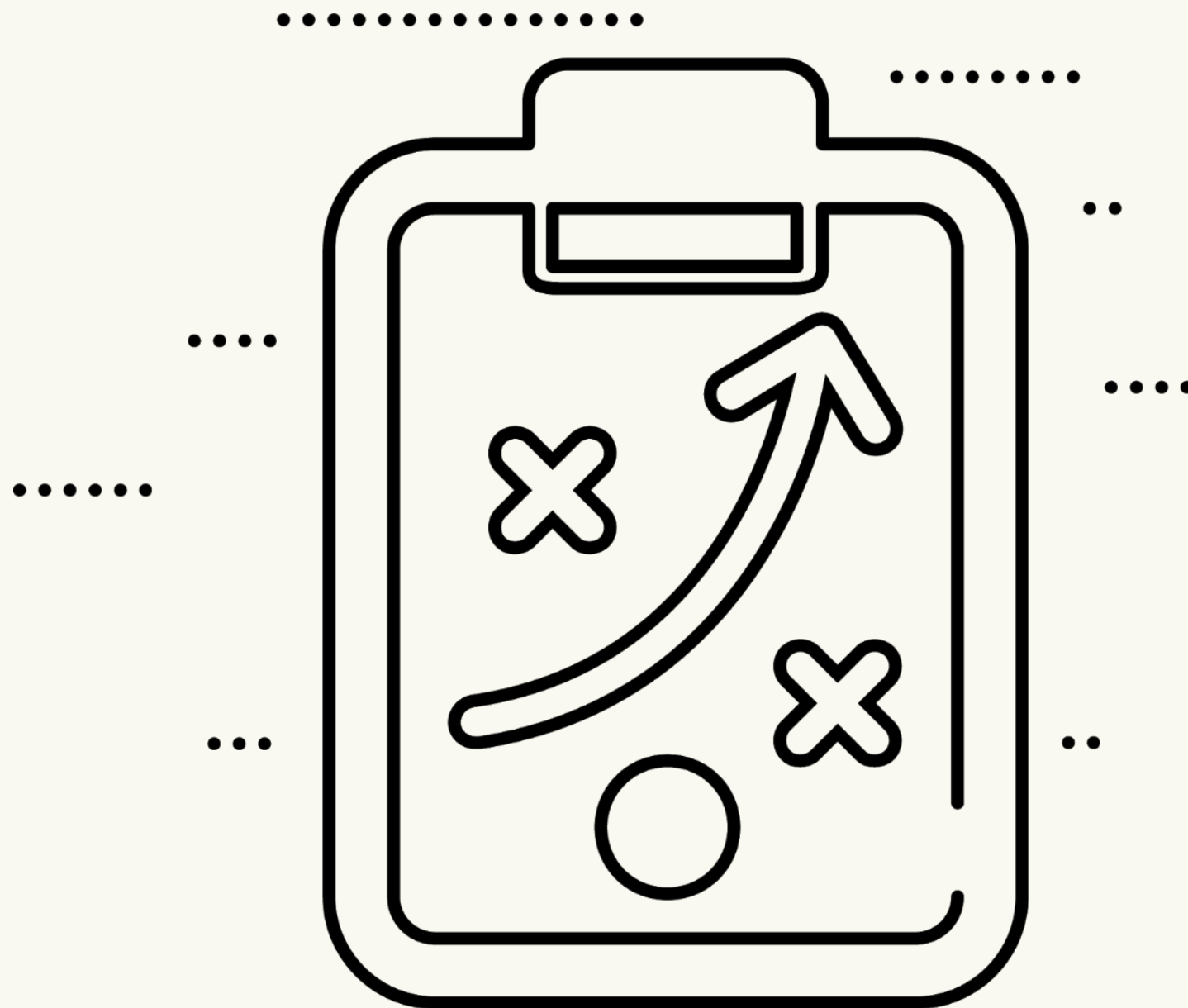
- **Input spam**

# Aimbot...

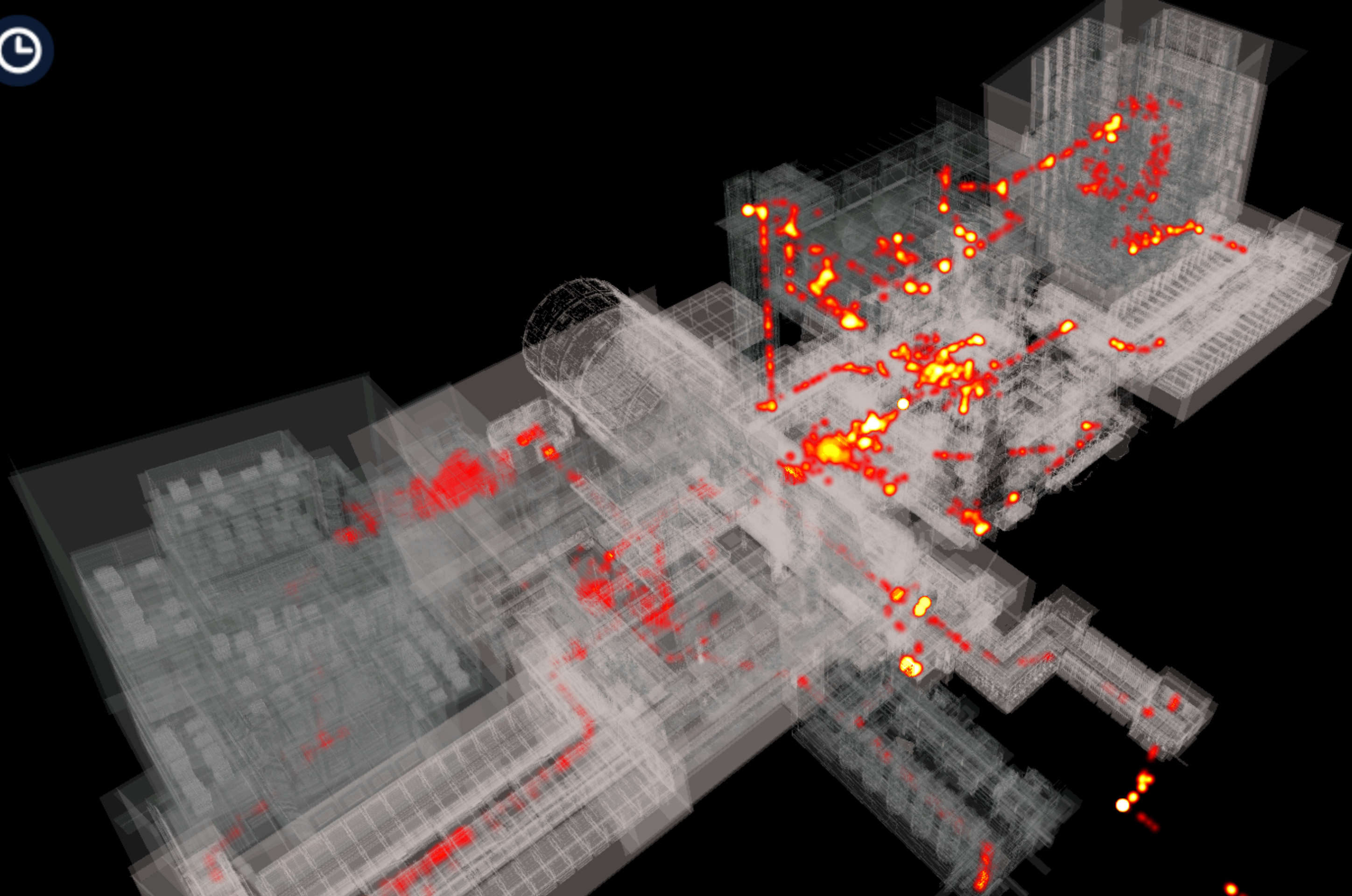














# Human

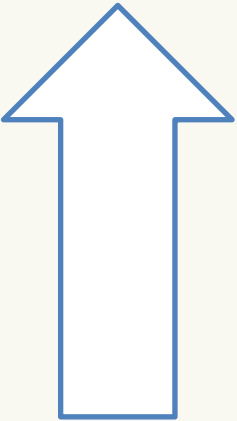
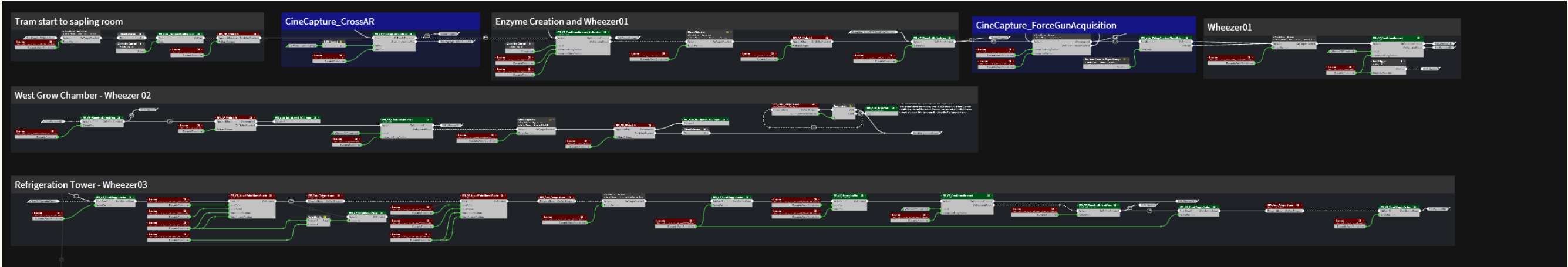


# AutoPlayer

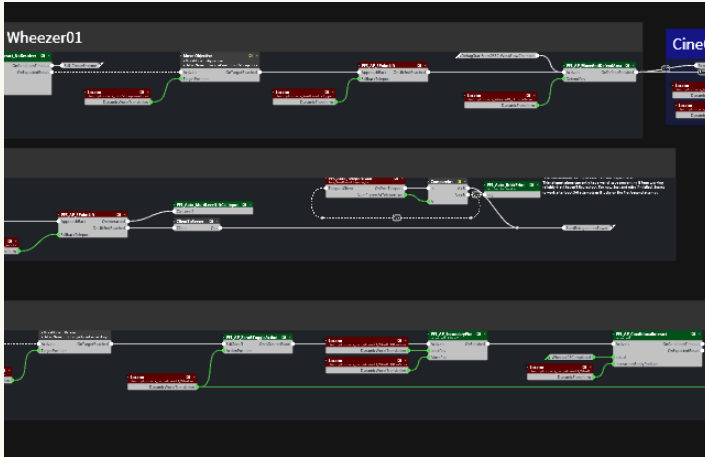




Before



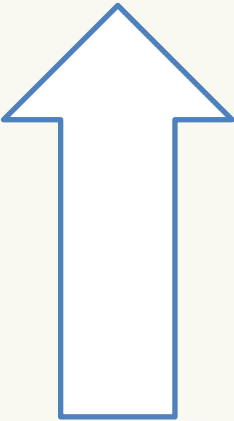
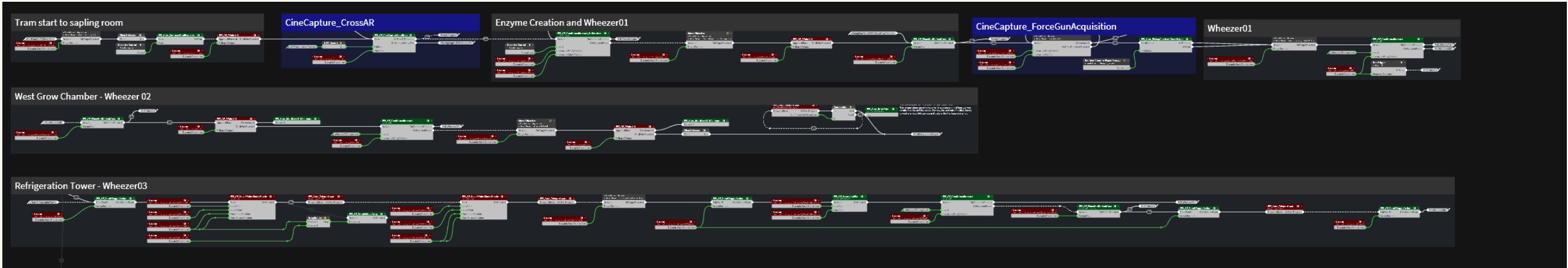
After



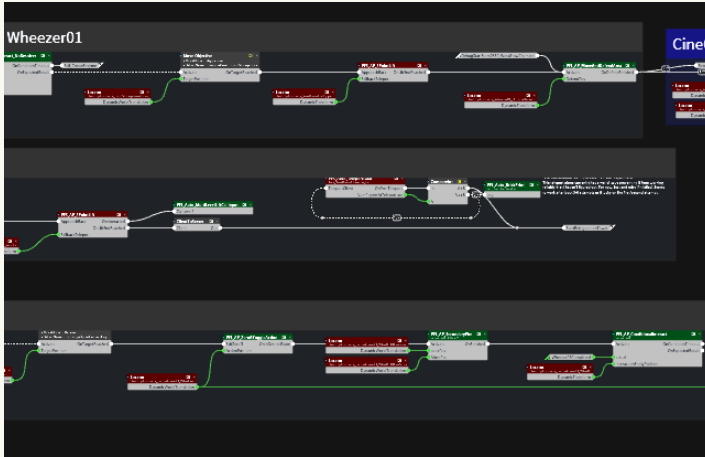
4x Work



Before



After



4x Work

Very early dev version - AutoPlayers integration spike



Behind DPF PC  
Client: Schematic (9560F08B) -----

Trained RL model, loaded and running with FB ML  
Traveltime ~14s  
(very few iterations on training setup/rewards)

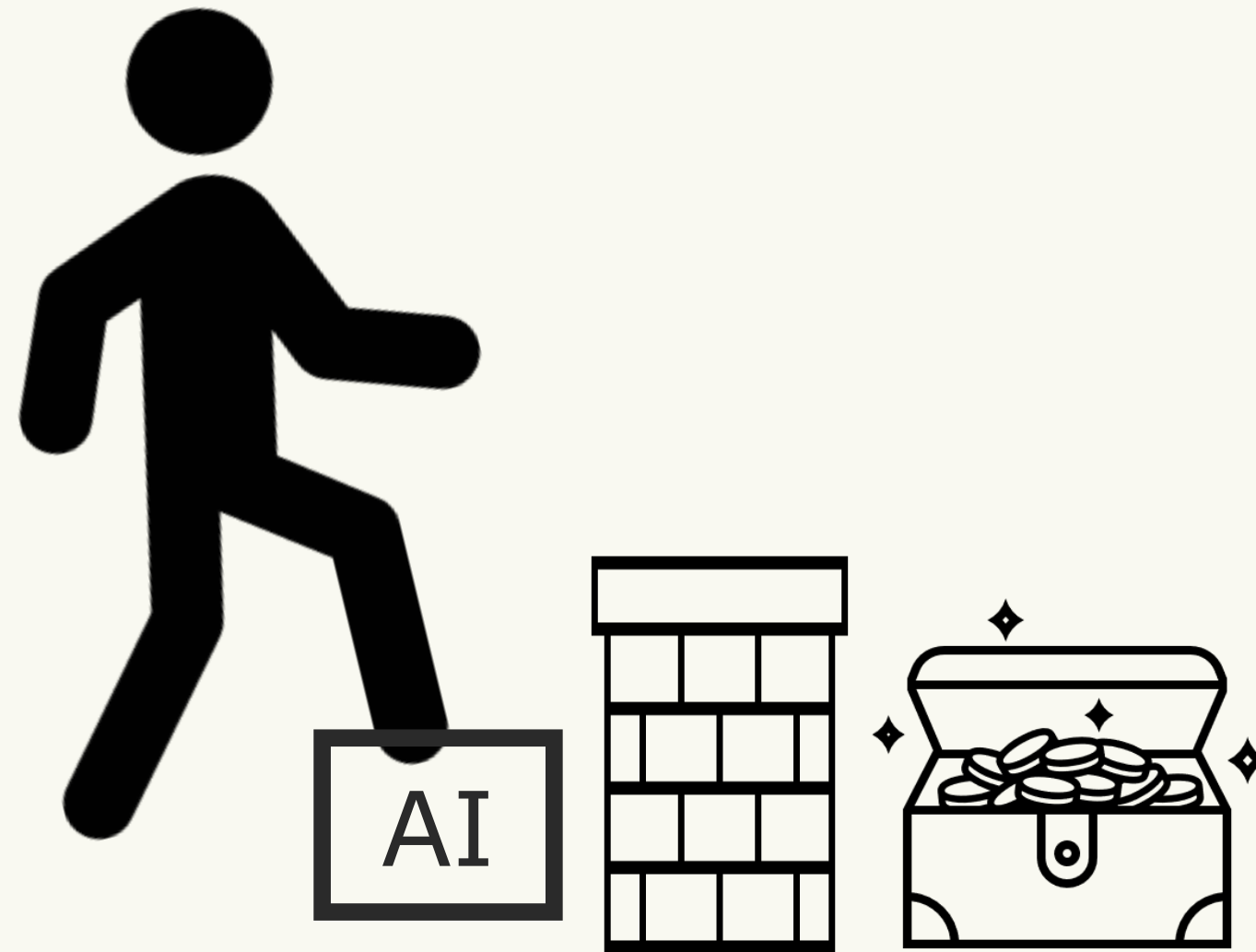


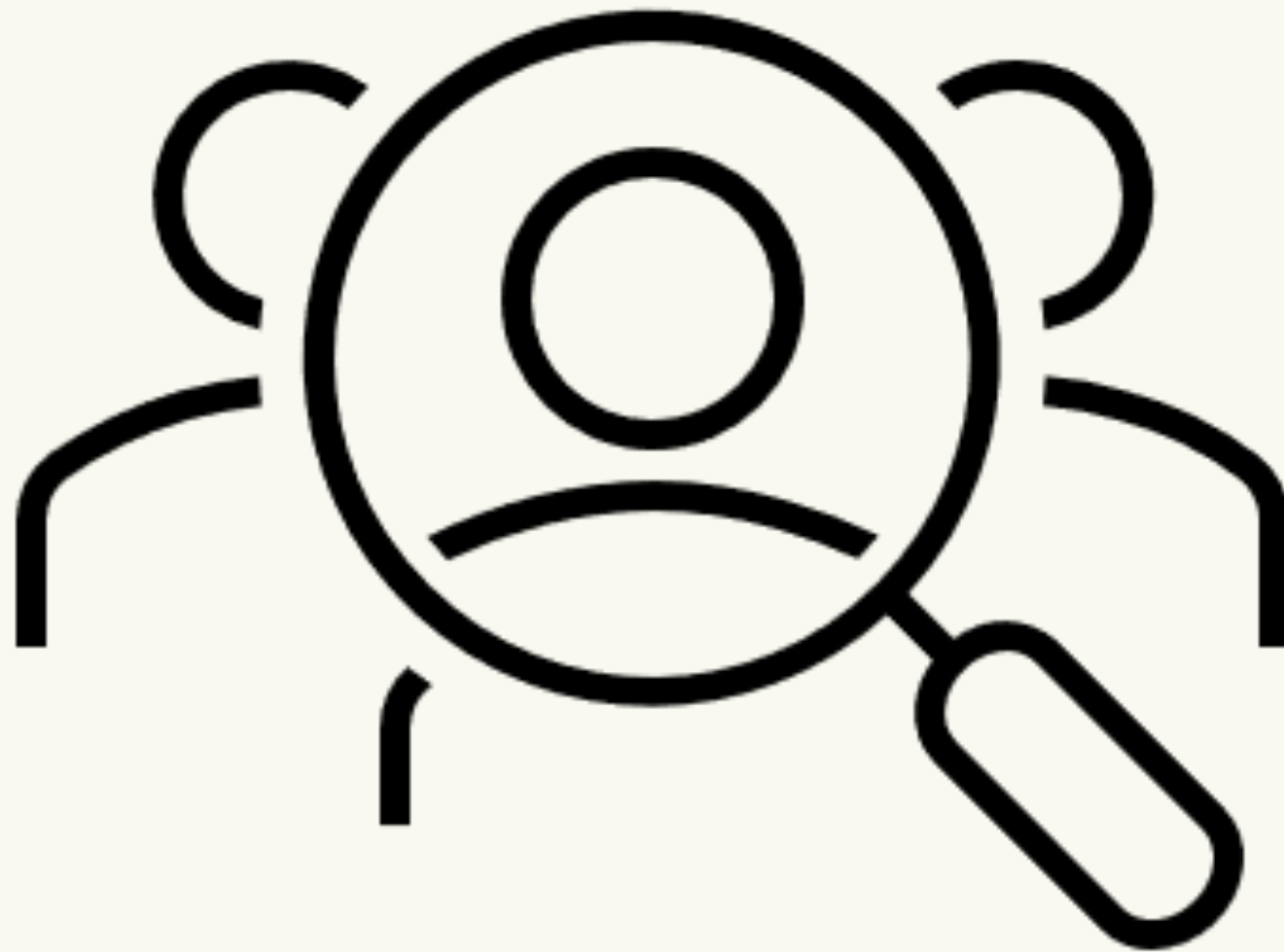




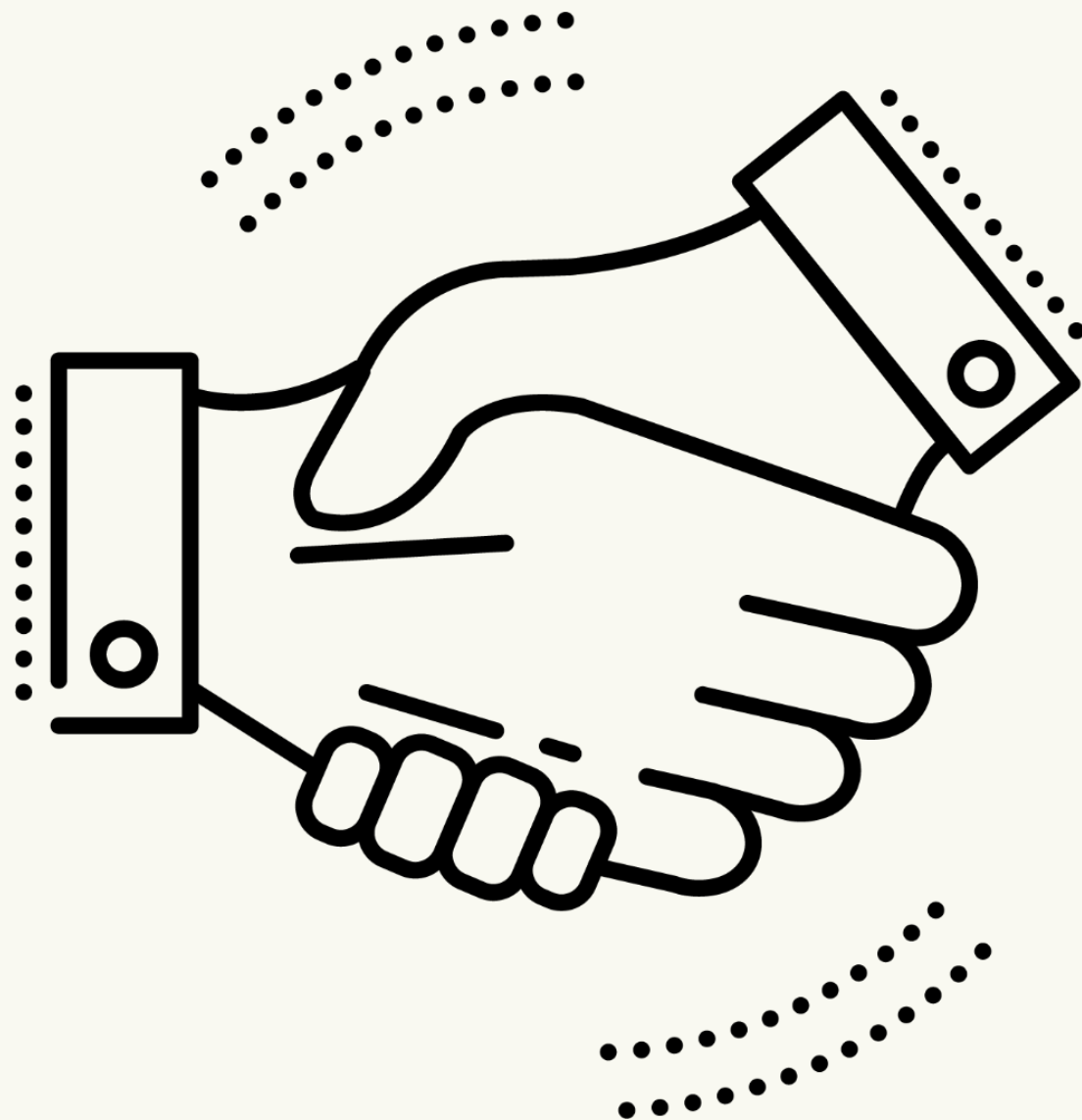


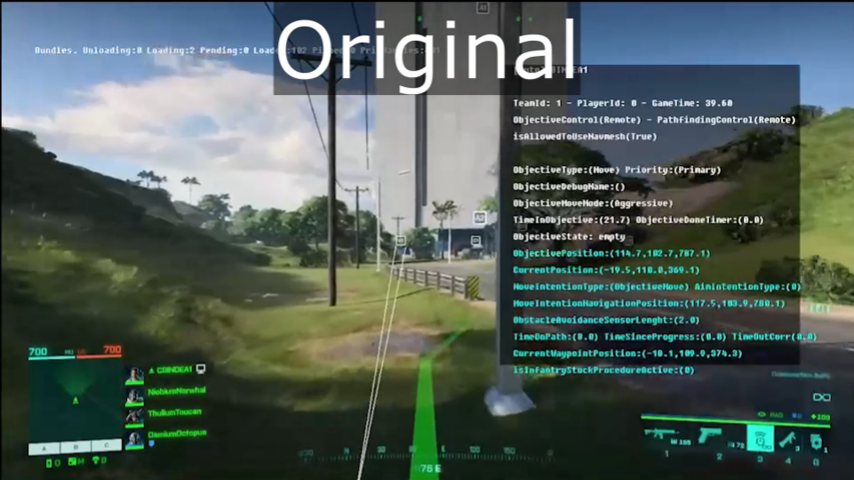
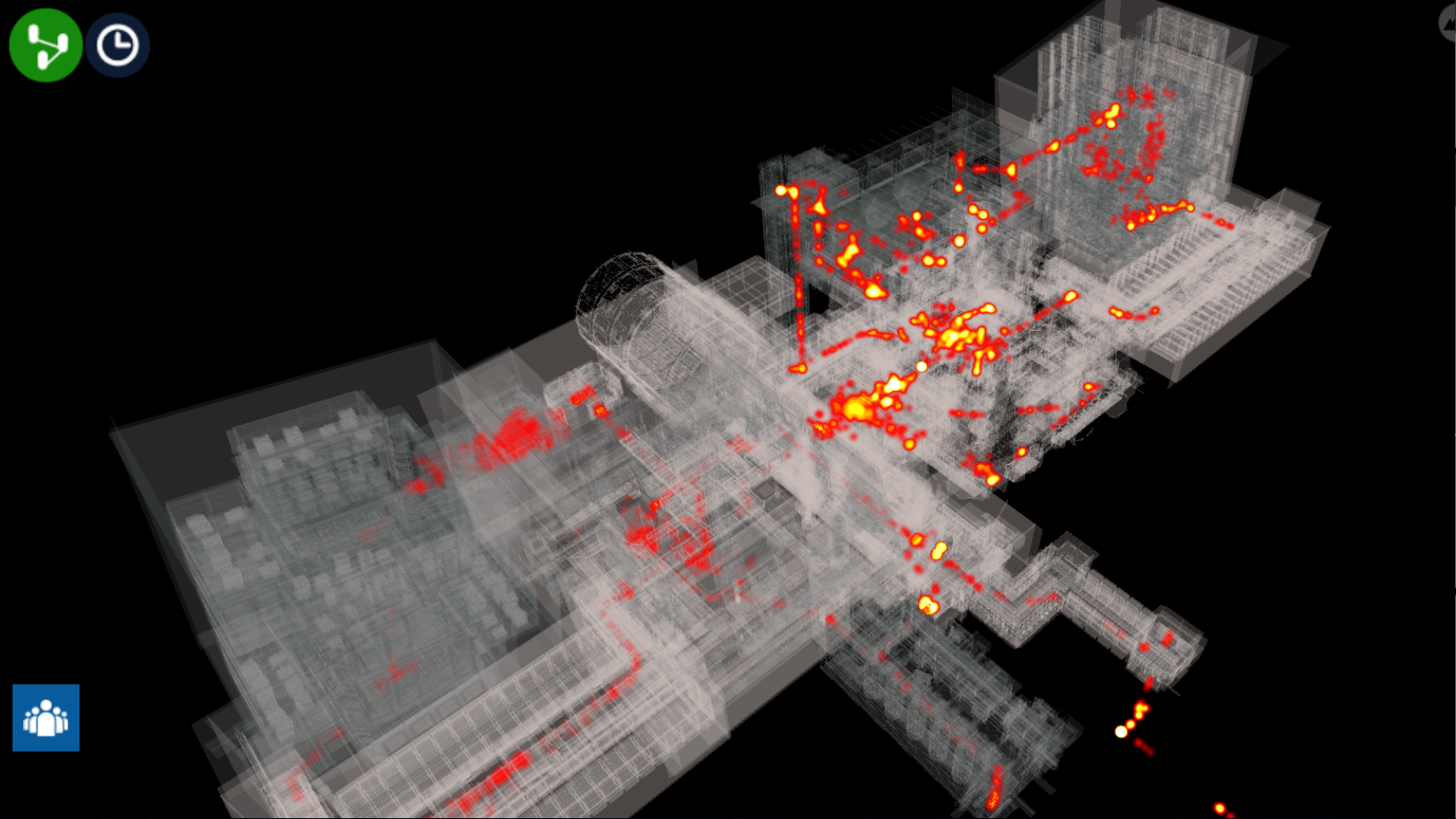




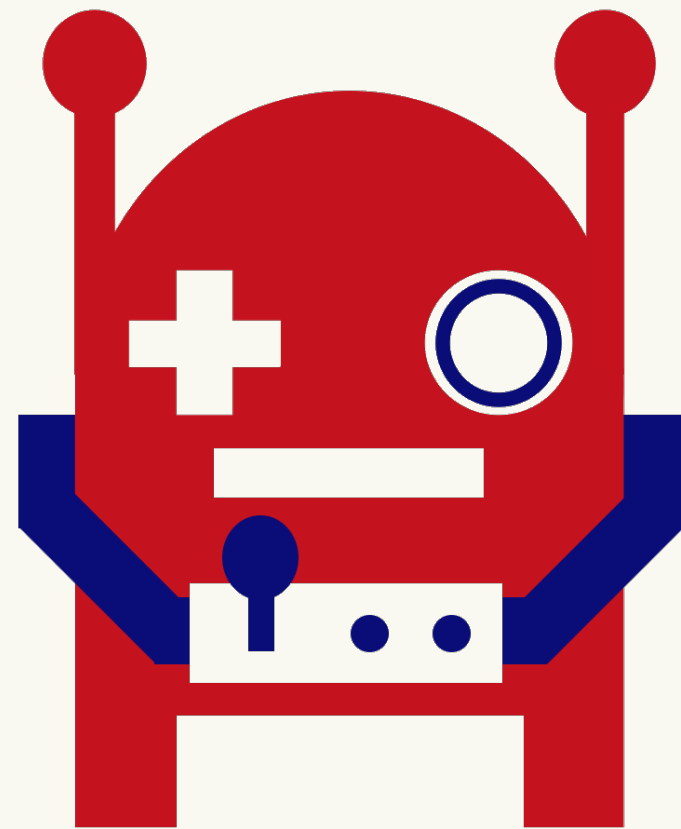












**jonas.gillberg@dice.se**



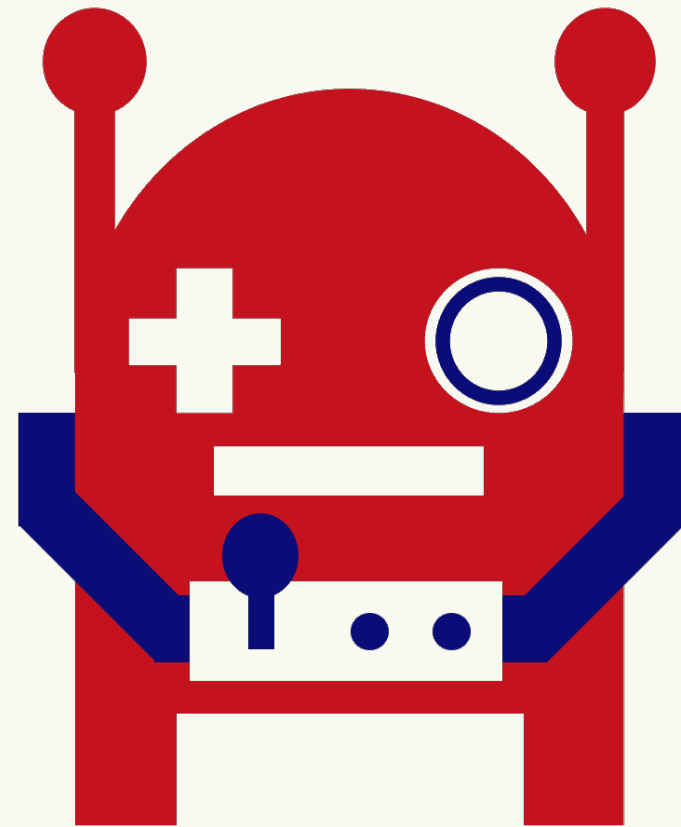








**5/5 – ”want to see more”**



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