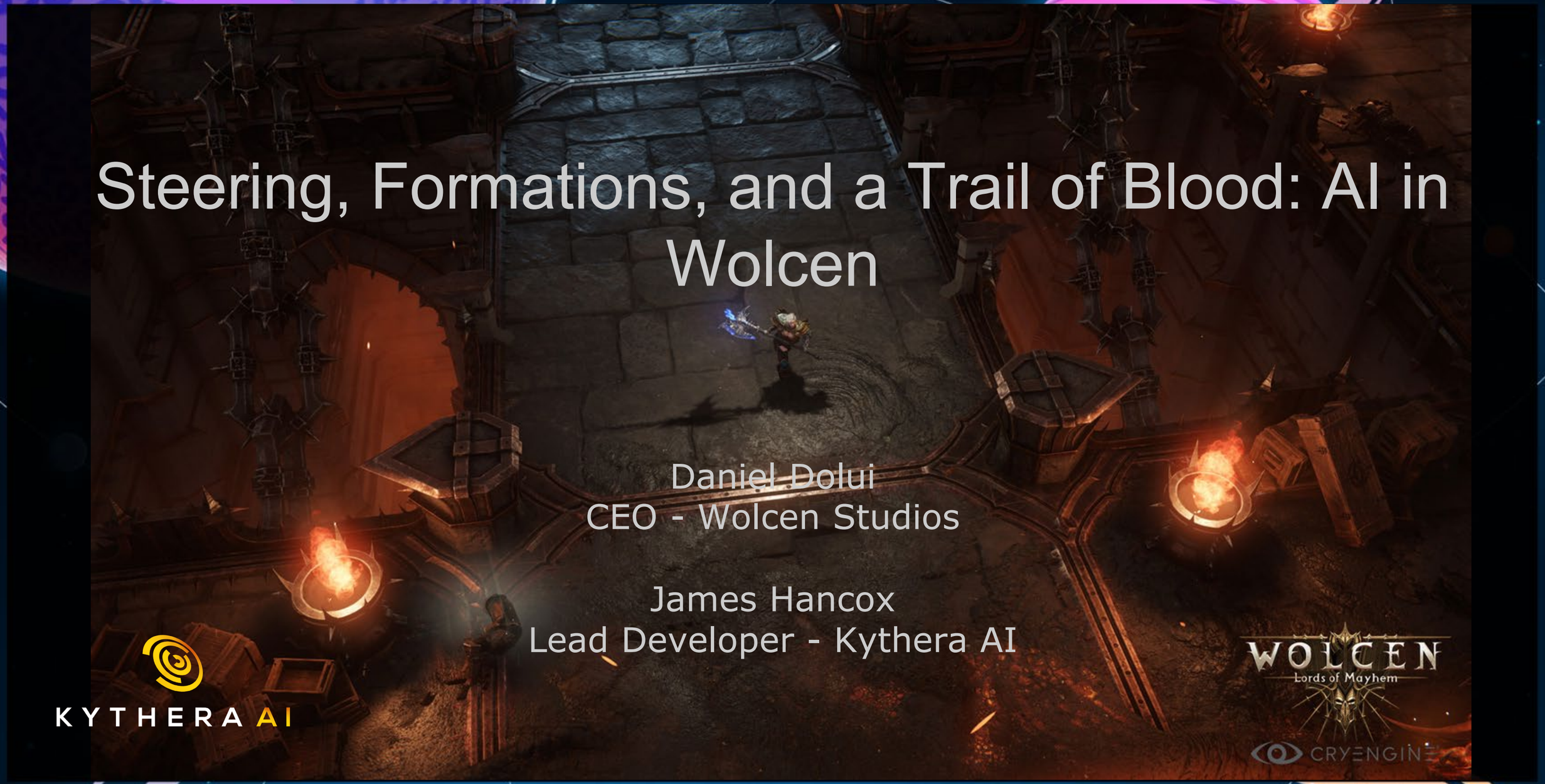
Steering, Formations, and a Trail of Blood: AI in Wolcen



Daniel Dolui
CEO - Wolcen Studios

James Hancox
Lead Developer - Kythera AI

KYTHERA AI

WOLCEN
Lords of Mayhem

CRYENGINE

- Daniel Dolui
- Co-founder and general Manager of Wolcen Studios
- Moved from development to VFX design to creative direction
- Started 2011

- James Hancox
- Lead developer at Kythera AI
- Joined 2018
- Worked on some systems described in this talk

Wolcen

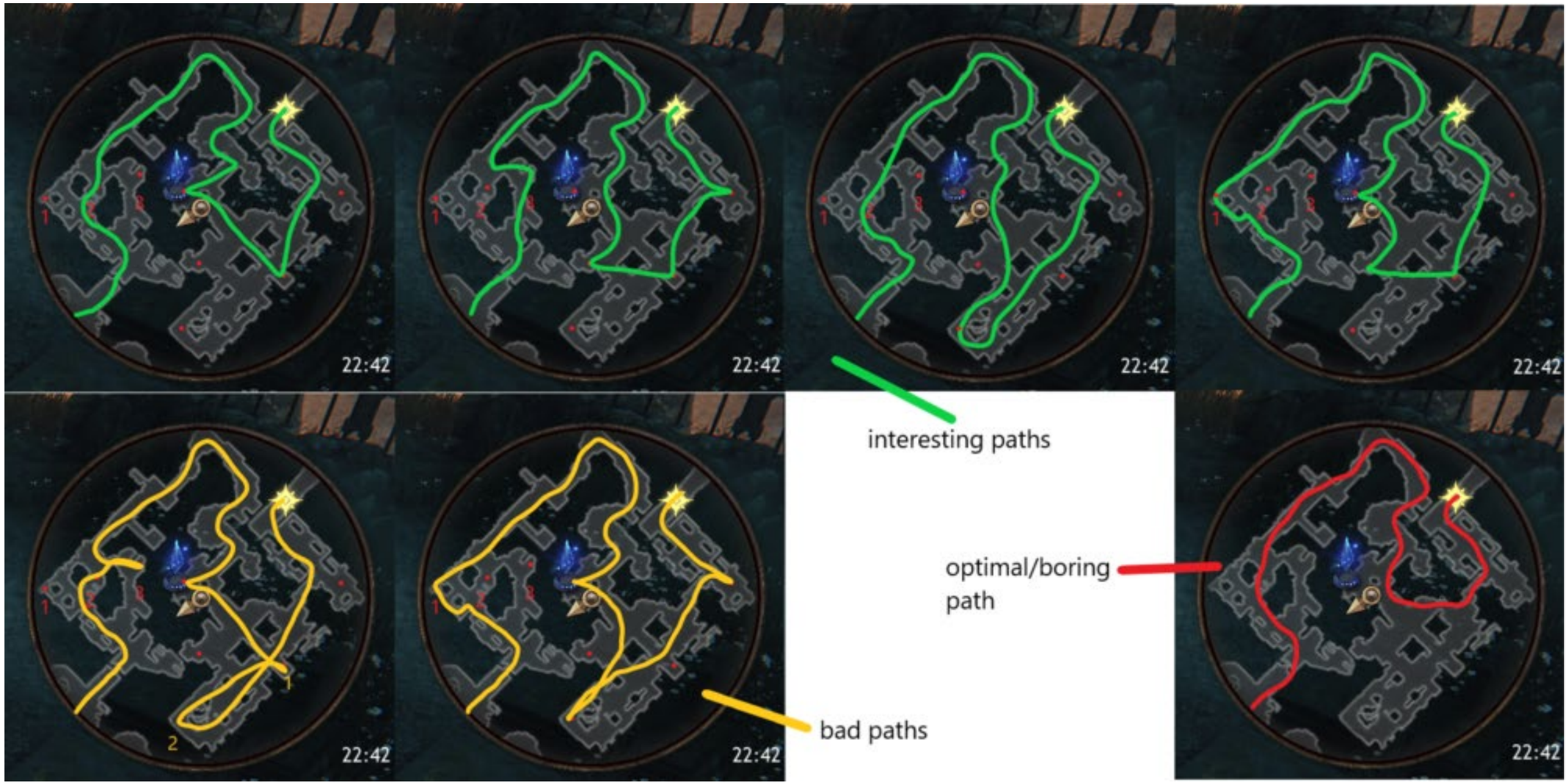
- Fast paced Action-RPG
- CryEngine - PC
- Take the genre to new places
- Free Character Building
- Strong storyline
- More Action than RPG
- Kickstarter in 2015, launched Feb 2020
- Close partnership with Kythera AI

Bloodtrails

Give a purpose, an objective in endgame

- Pre-Bloodtrail state: Lack of meaning in endgame maps
- Short term objective and storyline
- Tell the player where to go
- A “scent trail” to guide the player
- Lead them to points of interest

Bloodtrails

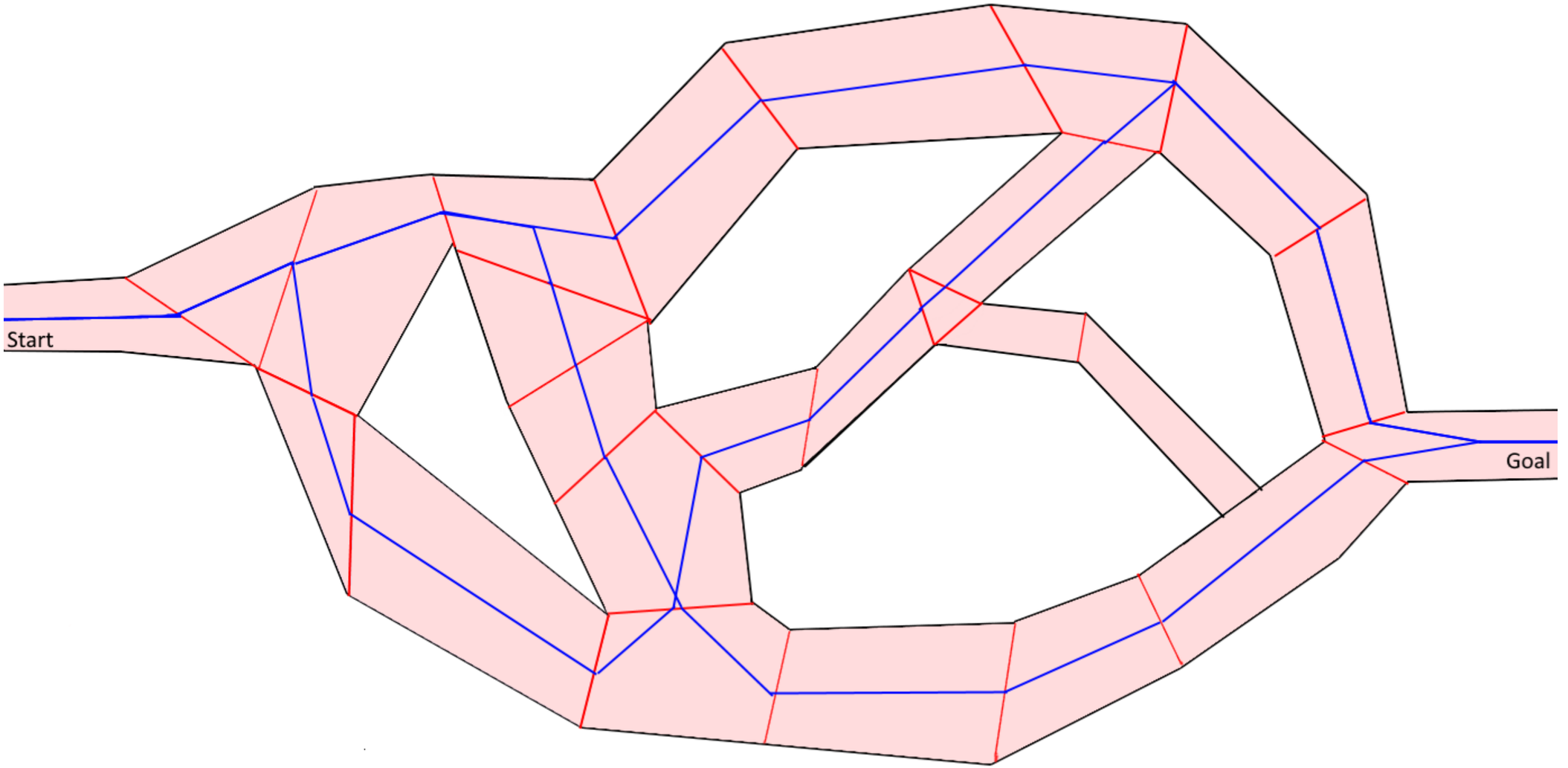


Bloodtrails

1. Path Discovery
2. Path Selection
3. Path Smoothing

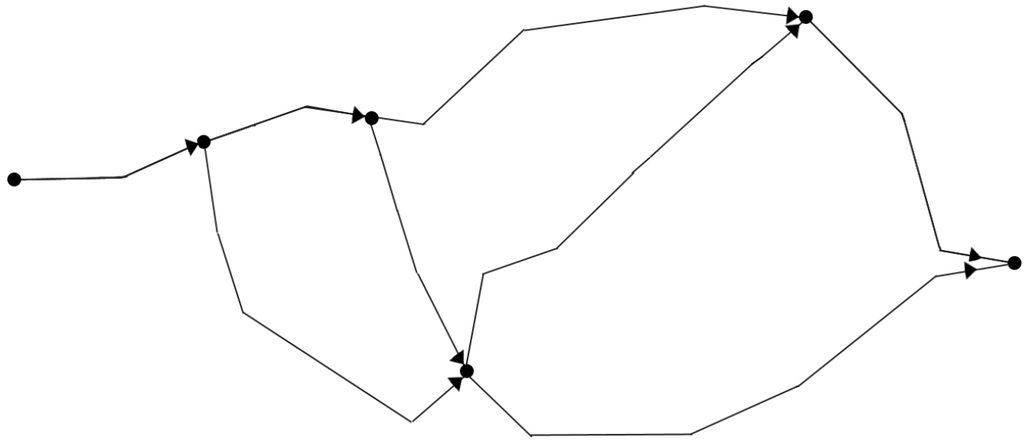
Path Discovery

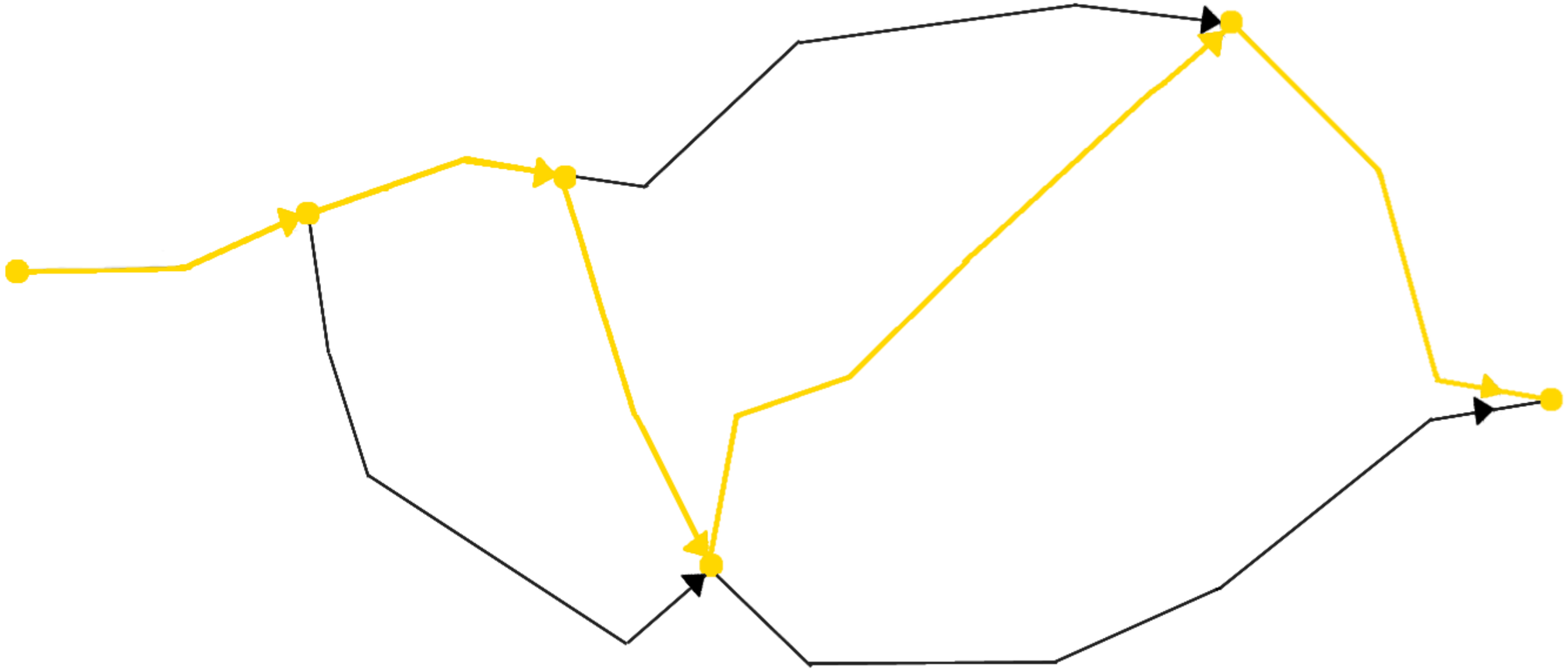
- Repeated A* searches
- Increase cost of polys in found paths
- Higher cost incentivises A* to find alternative routes
- We’re exploring the space- not necessarily using these paths!


Start
Goal

Path Selection

- Build Directed Acyclic Graph from discovered paths
  - Nodes = polys in paths
  - Edges = connections between polys **in path**
- Random walk graph from start to end
- Creates a path that may not exist in any discovery path





Path Smoothing

Now to make the path prettier!

- Push path out from corners by random radius
- Smooth path with polynomial curve
- Add Perlin noise along path
- Clamp final height of points to navmesh
- Apply VFX on top of the path

1.1.2.2
FPS 64 - 15.7ms
KYTHERA
62
10:58
Choice that Matters
Expedition: +0% Magic Find and Enemies are level 40
The Gifts of Ashtaroth
Hunt Down Enemies
Bloodtrail
Find the next trace
24613
3876
Willpower 34
Rage 966

Bloodtrails - Conclusions

- Issue with spawning stuff along the trail
- Trail worked nicely gameplay-wise
  - Objective feeling is good
  - It is almost hypnotic to follow

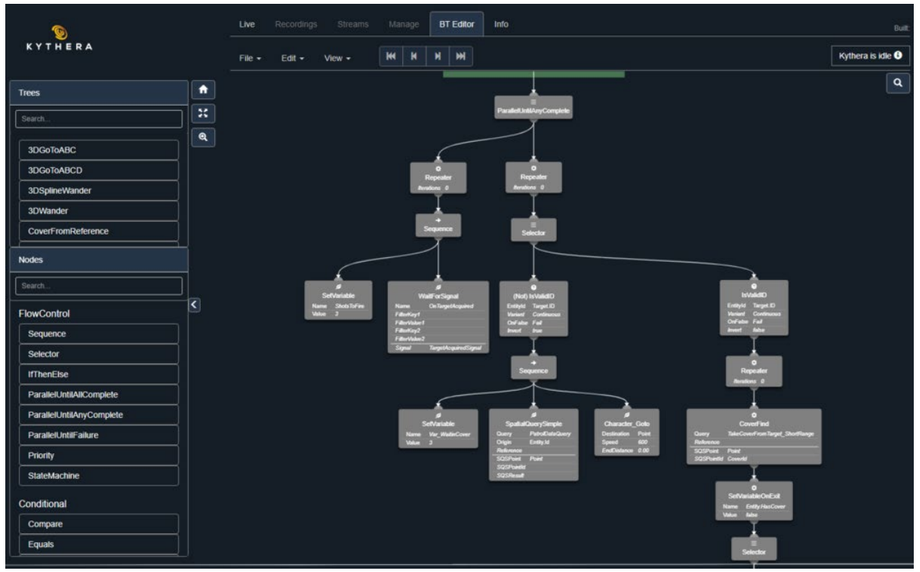
Formations

Give identity to a military Factions:

- The Republic
- “Byzantine legion”
- Contrast with other enemy types
- Fun to fight, fun to crush
- Needs to work everywhere

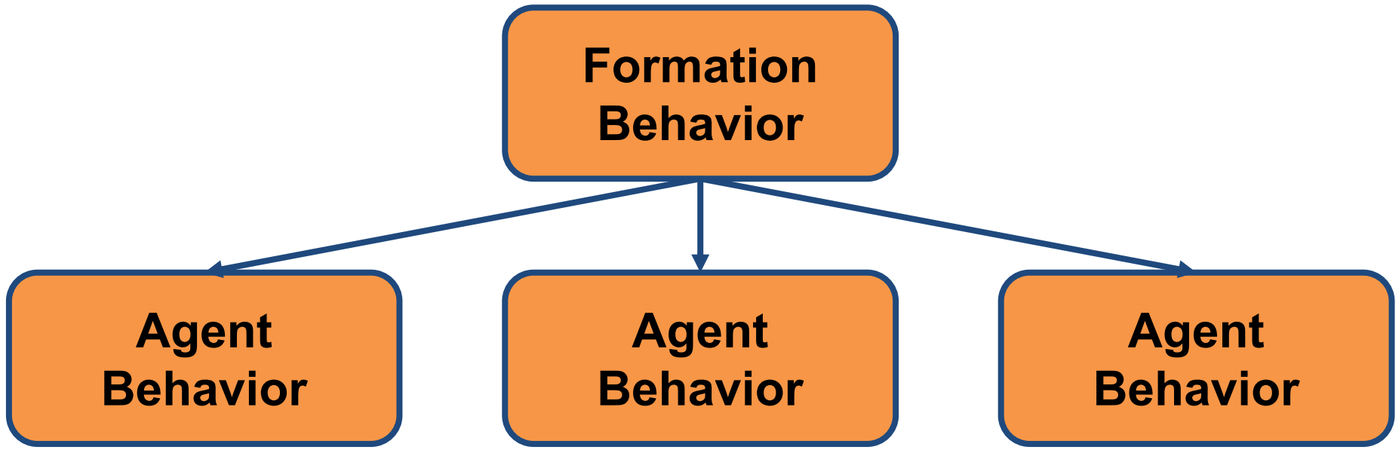
Formations

- Couldn’t achieve this with existing tools
- Needed new AI systems…
- ...while building on what we had already
  - AI Groups
  - Navigation (Detour/Recast)
  - Behavior Trees

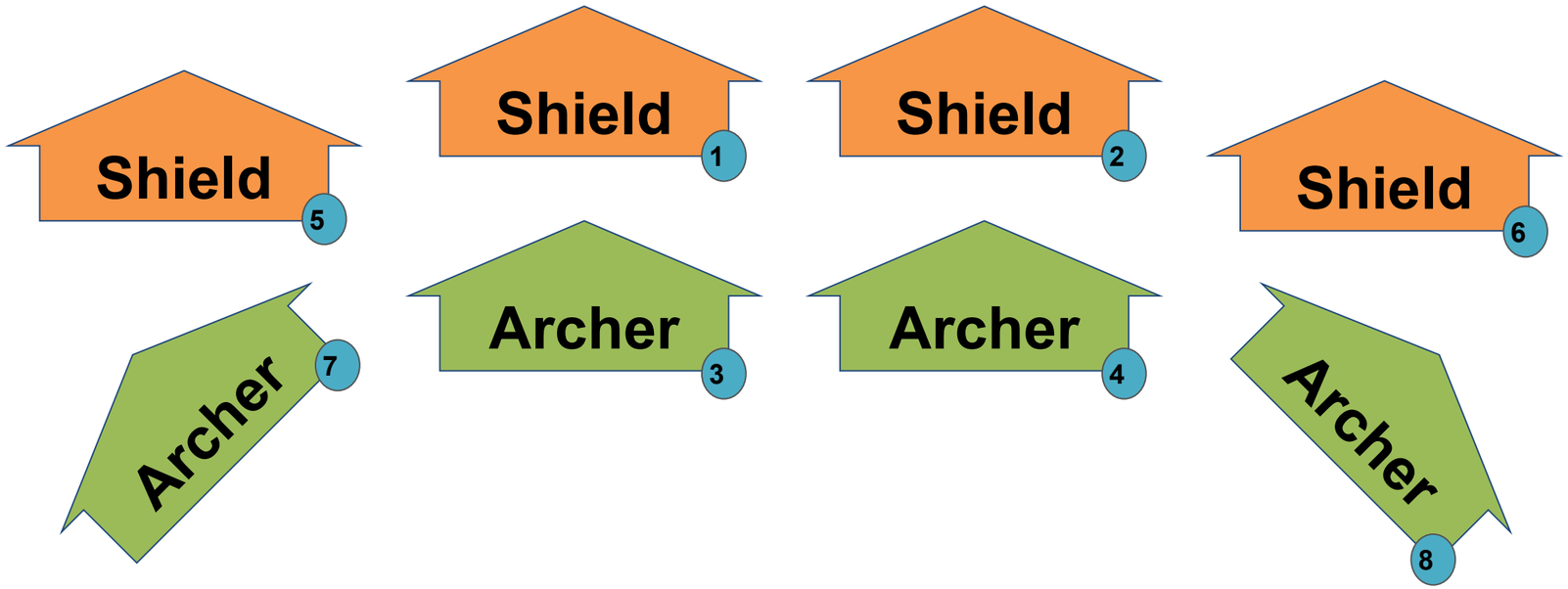


Formations - overall AI design

- Each member a full AI
- Virtual AI representing the Formation
- Formation AI can issue orders

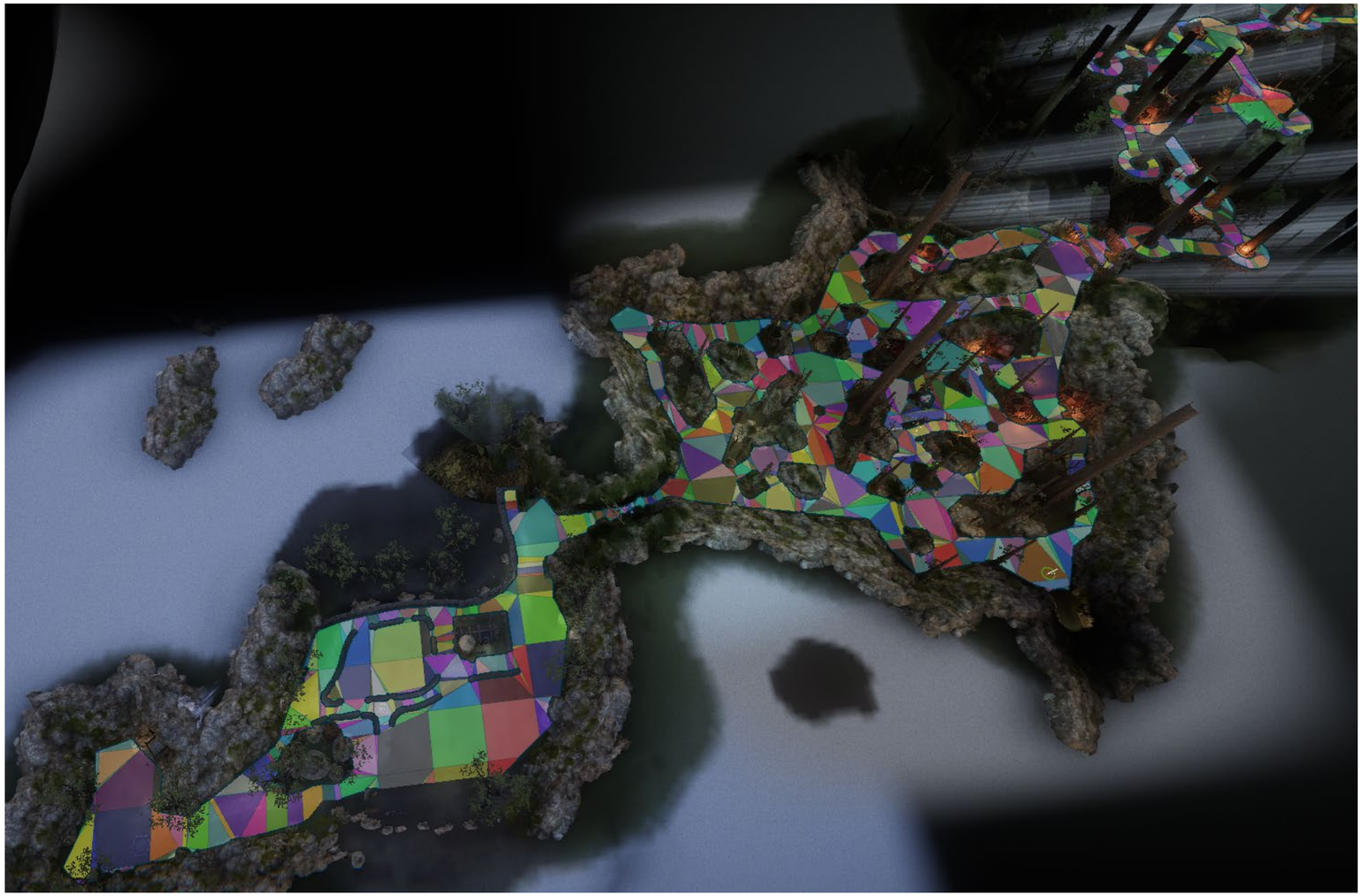


Formations - templates



Formations - path planning

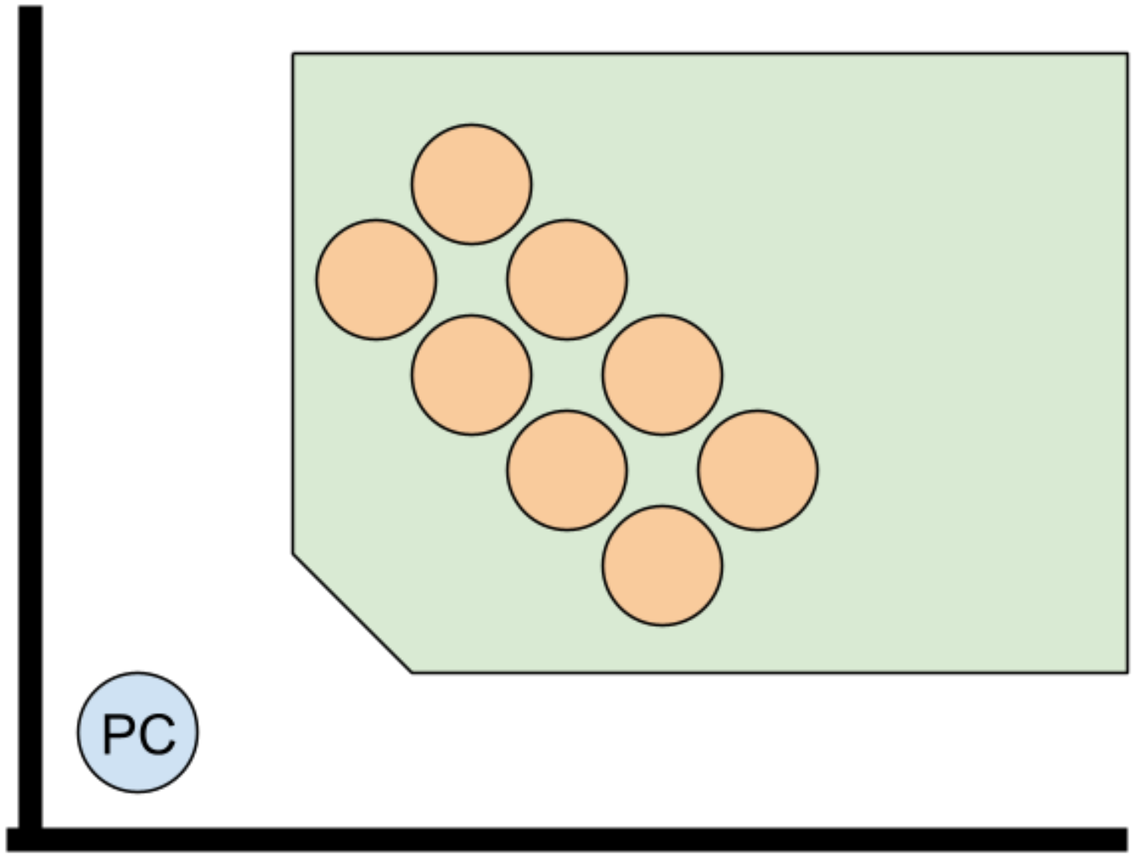
- Big blocks of infantry, not one agent
- Variable size
- We have a dynamic navmesh pipeline!
- We can just make a new navmesh with huge agent radius... right?



Formations - Large Radius Navmesh

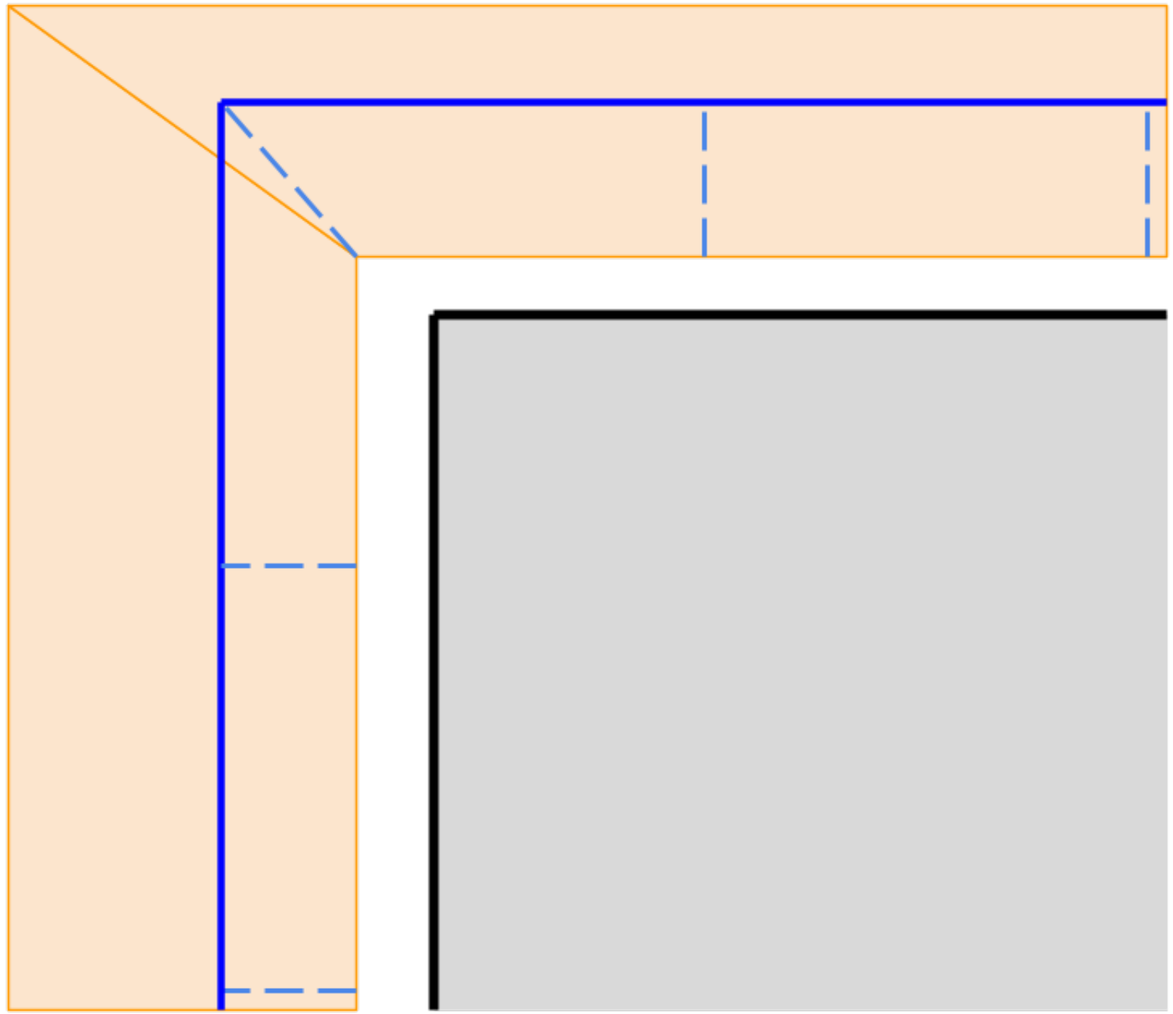
Why not a navmesh with large radius?

- Player can hide from formation in a corner
- Levels need to direct the player- can’t just be a golf course
- Unable to get through choke points



Formations - path planning

- Pathfind on existing navmesh
- **When we can** - push out the navpath from the navmesh edge
- **When we can't** - path through the centre of gaps



Formations - narrow gaps

- Tried “clever” solutions, but didn’t work out
- Just turn slots on and off!
- Navmesh raycasts
  - Is slot reachable?
  - If not, disable slot
- Troops follow behind, and rejoin when they can
- Simple, but looks pretty good

Formations - Conclusions

- Formations on a navmesh is tricky
- Distinctive identity for Republic soldiers
- Formations still “squishy”
- Improvements
  - Formation Skills
  - Formation Shape swap
  - Strafing

Monster Movement

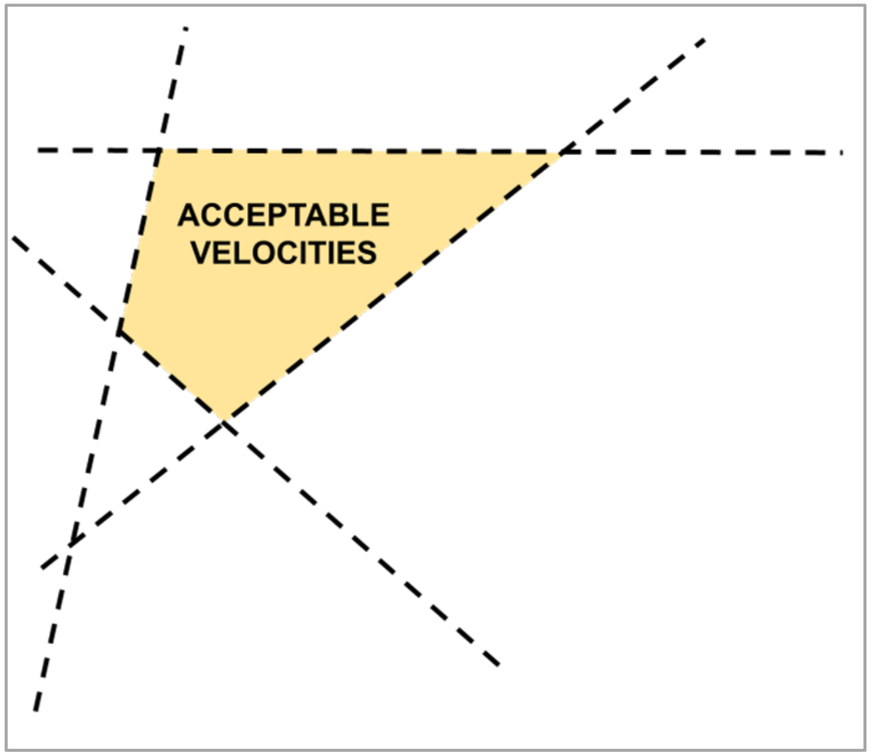
Give identity to a swarming faction

- **Svriir** – lizard-like enemies
- Attack the players in large swarms
- Avoid each other, spread all around, ”be one threat”
- Flow around complex level geometry
- Need to look natural

Monster Movement

We already have ORCA(*) - why not use that?

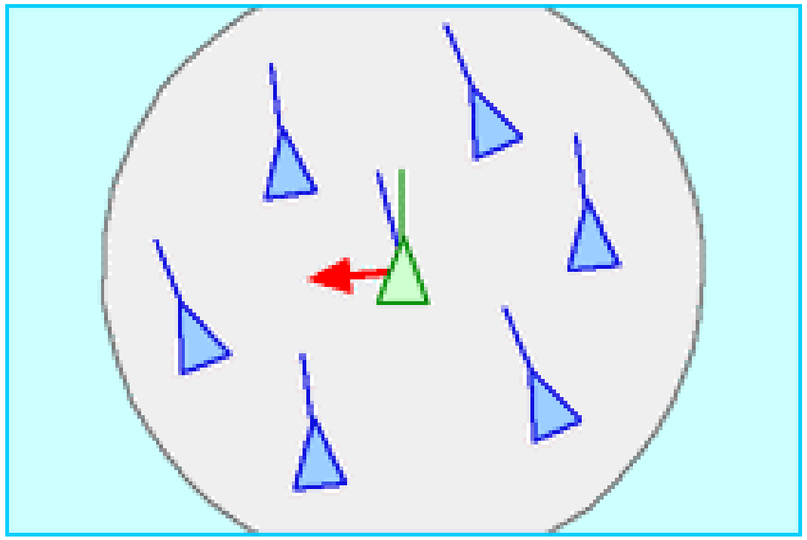
- ORCA requires hard constraints
- Only “fine” or “impossible” - no in between
- Doesn’t handle walls very well
- More constraints, more problems
- Not a good fit for artistic effects



* ORCA = **O**ptimal **R**eciprocal **C**ollision **A**voidance

Monster Movement - Steering Forces

- Lots of monsters swarming, natural movement, flowing…
- How about Steering Forces?
- Made a Kythera Steering Forces implementation
- Various different steering forces (collision avoidance, wall avoidance, flocking force, follow-pathfinding force)



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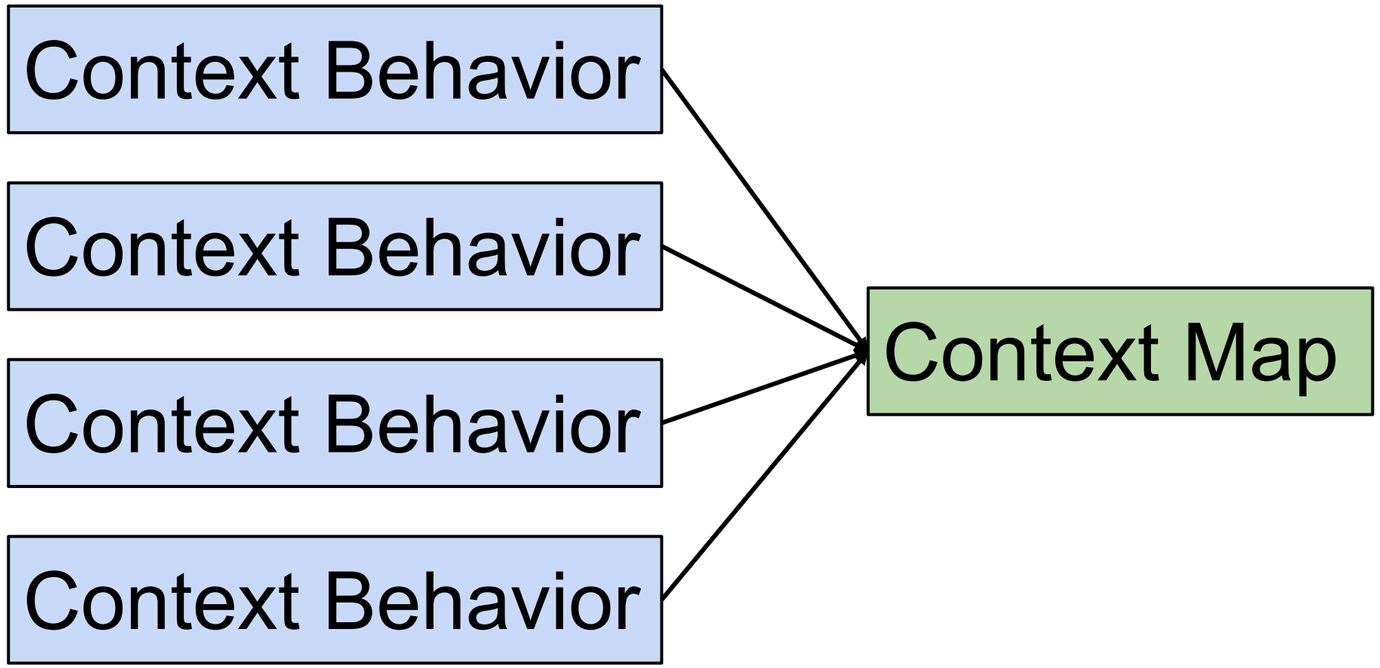
Z: 32
XYZ
Speed: 1
AI/Physics
No Sync Player
Goto position
Mute Audio
Idle(Failed: 25)
GameFolder: 'Game' - GameDLL: 'CryGameSDK.dll'

Context Steering

- Inspired by Andrew Fray's 2013 GDC talk
- (Go watch it, it's a great talk!)

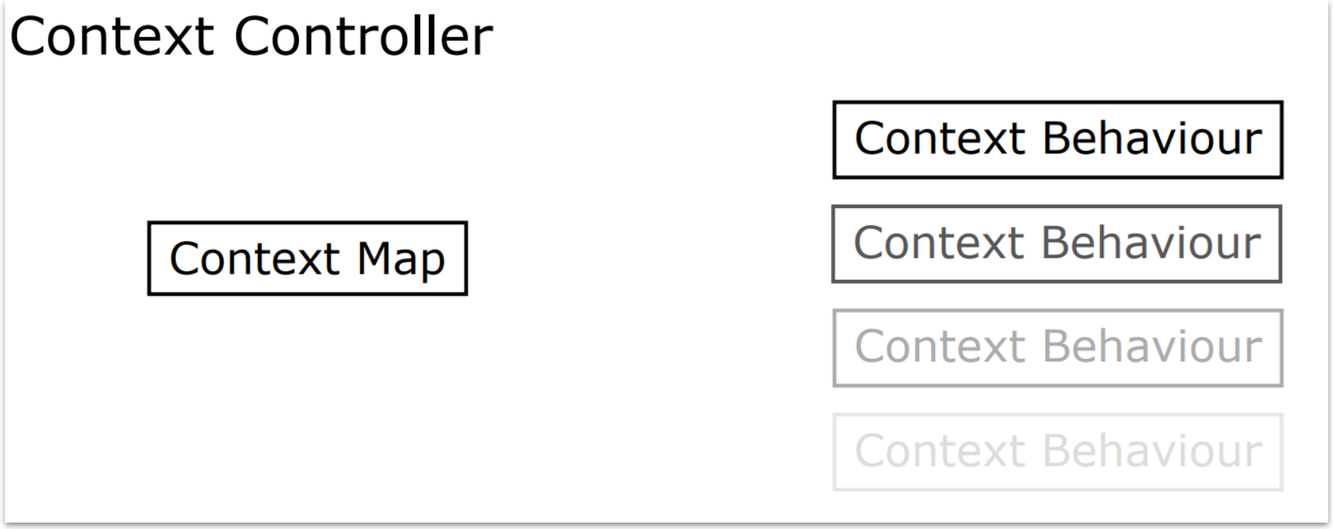
Context Steering

- Multiple Context Behaviors
- Each Behavior builds up context map about your decision space
- Then make a decision based on the overall context

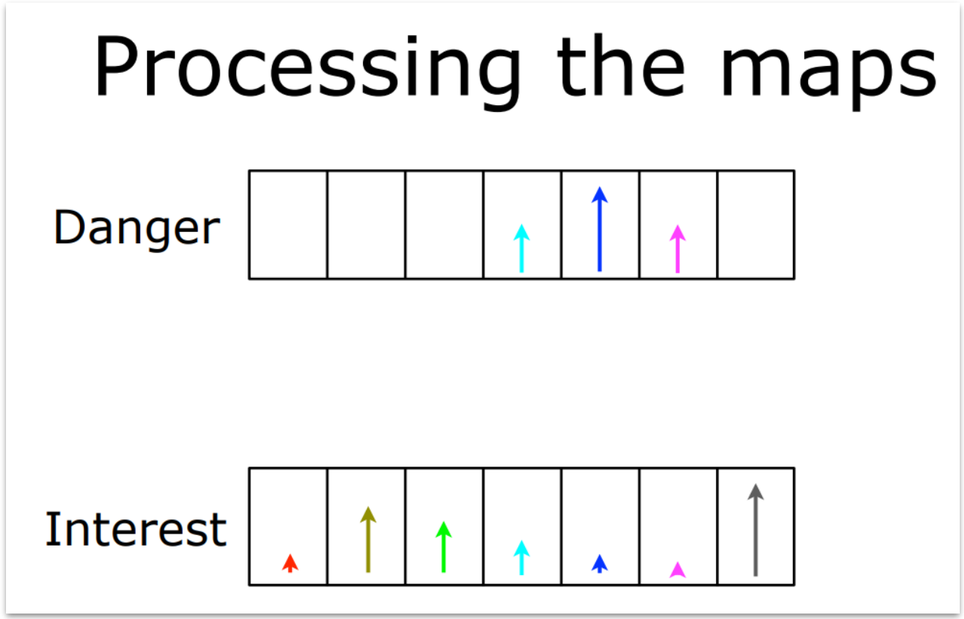


Context Steering

Andrew's approach:



- Context Behaviors writing into a 1D Context Map
- Each slot in the map represents a potential choice- a radial direction, or a lane on road
- Once all Behaviors have written into the map, combine and process to make a choice



Context Steering

What do we do differently?

- Search over a 2D velocity space
- Gradient descent search
- Calculate “awkwardness” as we search, not up front
- Want to experiment with other sampling approaches

Context Steering

Some of our Context Behaviors:

- Avoid walls
- Avoid other agents
- Maintain minimum spacing
- Run in the right direction!
- *Plus some more Boids-inspired ones- currently unused*

Monster Movement - Conclusions

- Performance was tricky
- Didn’t quite get full “Zerg-rush” look
  - … and enemies dies too quickly anyway
- Better results than Boids or ORCA
- Character got stuck in swarm!

Overall takeaways

What worked?

- (Ab)using navpaths to create interesting routes
- Different AI personality through movement styles
- Don’t be afraid to experiment with your systems!

What didn’t work?

- Swarms caused game design problems
- Your players can ruin great design ideas

Wolcen out on Steam -
now with content update
BLOODSTORM PART II

KYTHERA AI

wolcengame.com/bloodtrail
kythera.ai/gdc21

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