Have Fun Storming the Castle!
Siege Battle AI in Total War: Warhammer

Andre Arsenault
Lead Battle AI Programmer
Creative Assembly

About Me

- 21 years in games
- Gameplay programmer on MMO & RTS
- Project leadership & production
- Responsible for Battle AI on Total War

TOTAL WAR™

- Award-winning strategy series for 15 years
- Set in various historical time periods
- Turn-based campaign with real-time battles
- Control thousands of men
- Many different battle types

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TOTAL WAR: WARHAMMER

- First non-historical setting for Total War
- New challenges for Battle AI:
  - Individual heroes, flying units and others
  - Different unit rosters per faction
  - Incredible variety of unit capabilities
  - Dramatic new spell system

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About This Talk

- Context of Siege Battles in TW: Warhammer
- Total War Battle AI architecture
- AI-related level design data
- ➤ Attacking Siege AI details
- Collaboration, advice, and conclusions

SIEGE BATTLES

What Is a Siege Battle?

How Do You Start a Siege Battle?

Siege Battle Fundamentals

- Attacking army with siege equipment
- Defender always has garrison units
- Defender may also have an army
- Each side can bring reinforcements
- Attacker deploys outside of the city walls
- Defender deploys on or inside the city walls

Siege Battle Fundamentals

- Victory conditions:
  - Kill or rout the enemy armies
  - Attacker can capture the city's Victory Point

Historical Siege Goals

- Historical authenticity
- Surrounding the city
- Deliberate bombardment phase
- Intricate street battles within the city

Execution: Single tactic controls army with one FSM

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Warhammer Siege Goals

- Fast, high-intensity battles
- Single attack direction
- Focus the battle on the city walls
- Quick resolution once past the walls
- Press the defender quickly and broadly

Execution: Many specialized tactics simultaneously

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BATTLE AI ARCHITECTURE

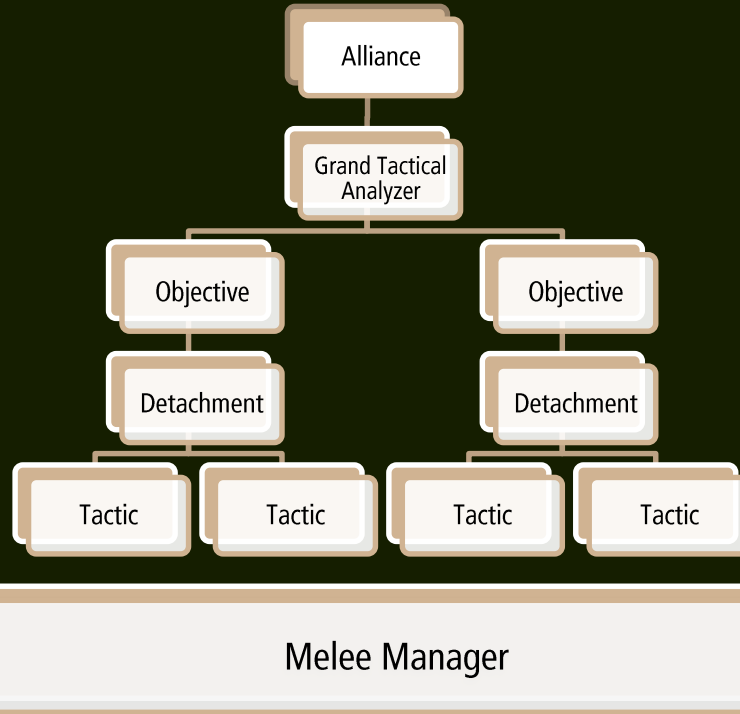# Battle Fundamentals

- Entity
- Squad
- Unit
- Army
- Alliance

"Battle AI" for Total War

- Battle AI team implements logic equivalent to player decisions, executed by the same orders
- Orders are implemented by the Battle team
  - If a player can do it, it's handled by the Battle team
  - Ex: Pathfinding, visibility, combat simulation
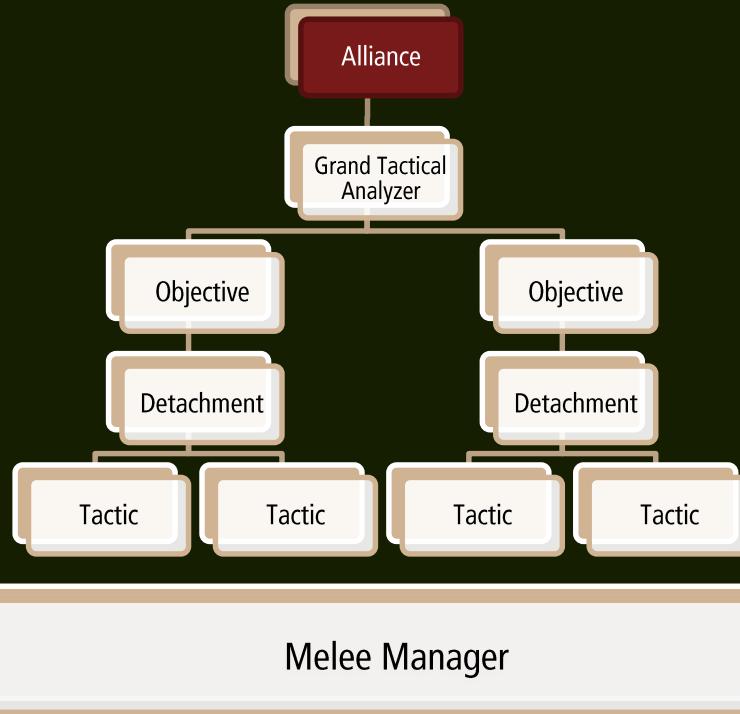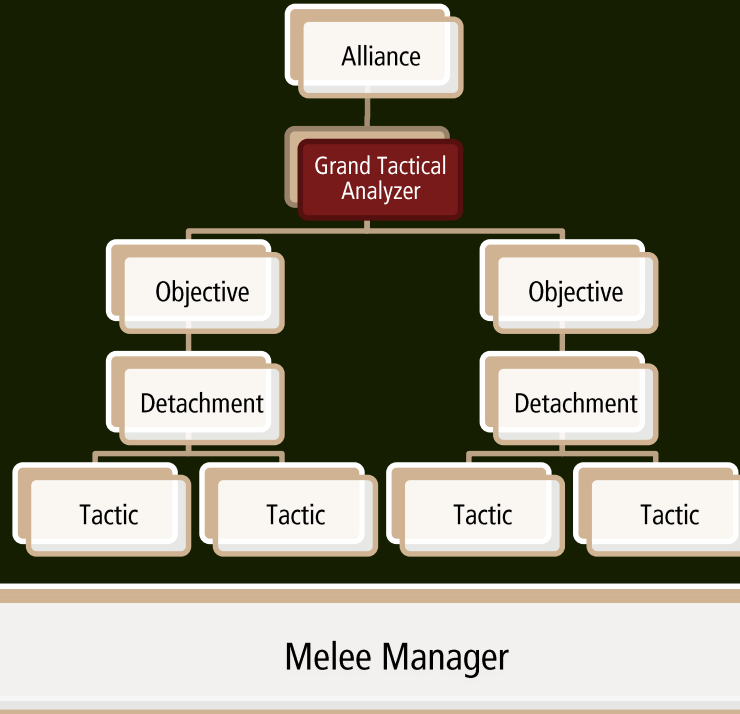- Different team for campaign gameplay and AI

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Battle AI Architecture

Battle Model

Alliance
→ Grand Tactical Analyzer
→ Objective / Objective
→ Detachment / Detachment
→ Tactic / Tactic / Tactic / Tactic
→ Melee Manager

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Battle AI Architecture

Battle Model

Alliance

Grand Tactical Analyzer

Objective — Objective

Detachment — Detachment

Tactic — Tactic — Tactic — Tactic

Melee Manager

Battle AI Architecture

Battle Model

Alliance

Grand Tactical Analyzer

Objective

Objective

Detachment

Detachment

Tactic

Tactic

Tactic

Tactic

Melee Manager

Battle AI Architecture

Battle AI Architecture

Battle Model

Alliance → Grand Tactical Analyzer → Objective / Objective → Detachment / Detachment → Tactic, Tactic, Tactic, Tactic → Melee Manager

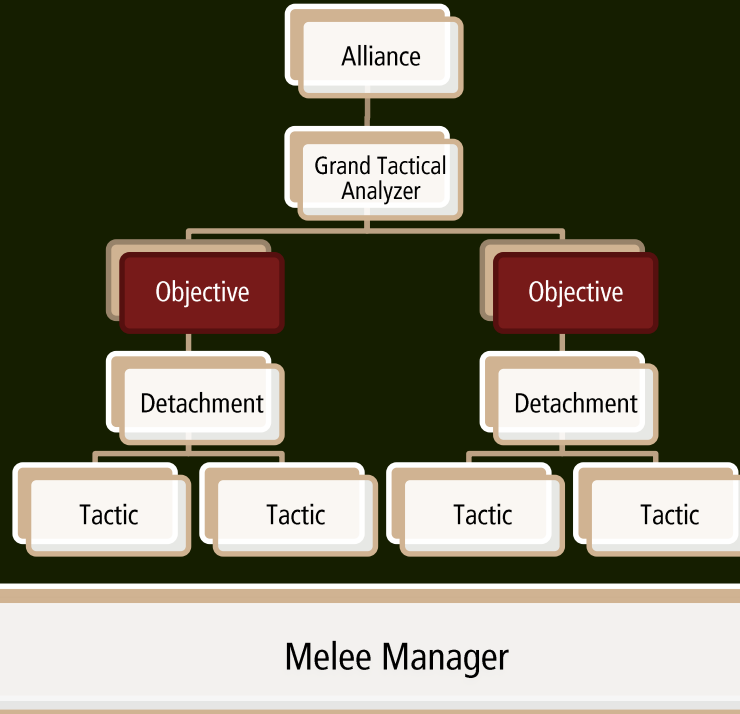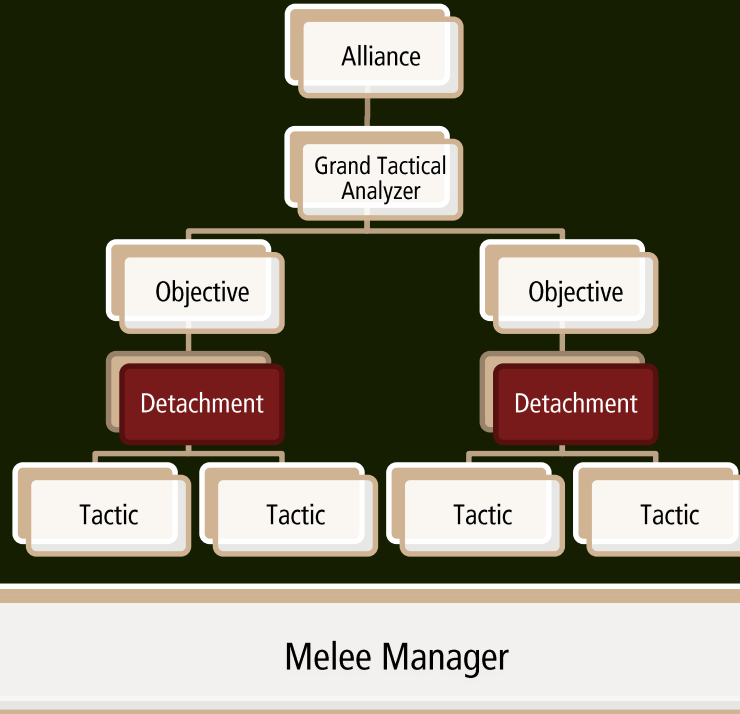# Battle AI Architecture

Battle AI Architecture

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Battle Model

Alliance → Grand Tactical Analyzer → Objective / Objective → Detachment / Detachment → Tactic / Tactic / Tactic / Tactic → Melee Manager
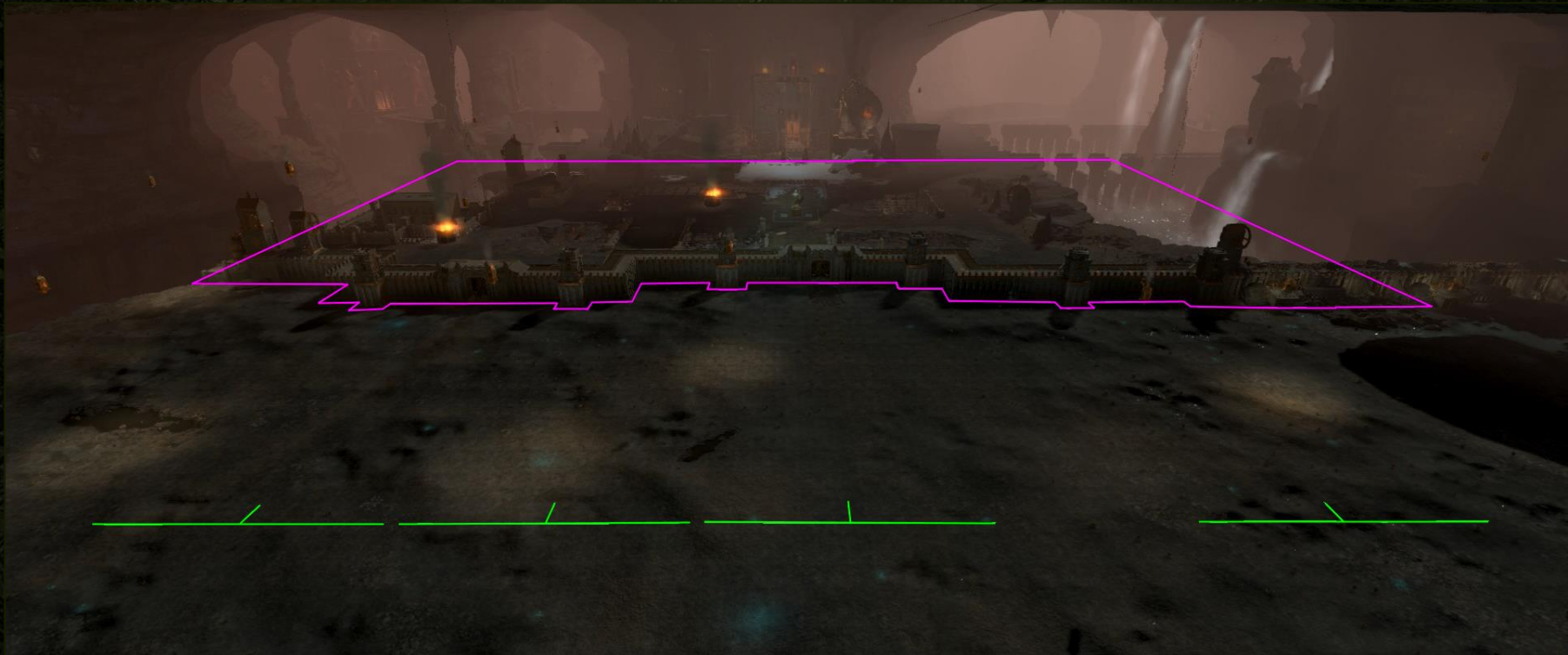
Siege Battle AI Architecture

AI DATA AND LEVEL DESIGN

AI Hints: Settlement Perimeter

AI Hints: Deployment Lines

AI Hints: Assault Designation
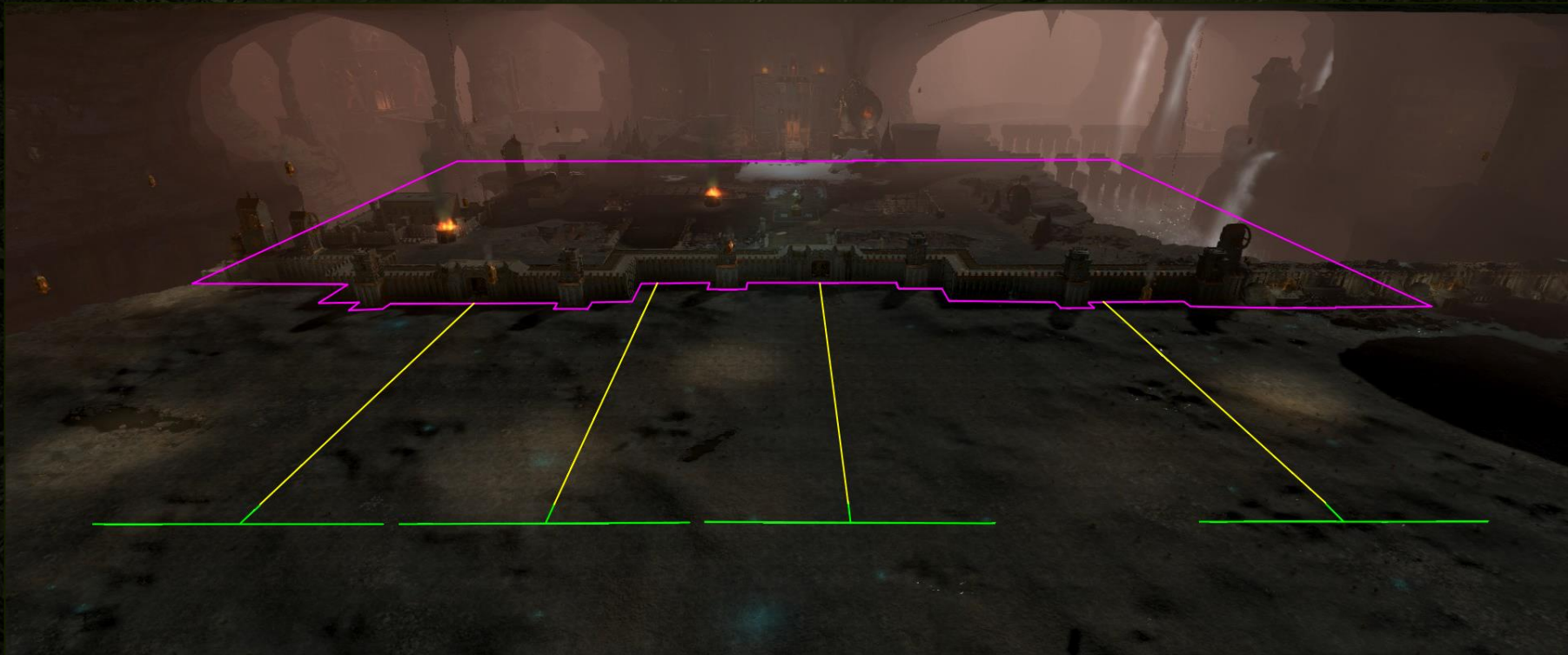
AI Hints: Attack Focus

Assault Designation Scoring

Attack focus

Attack focus

Attack focus

Attack focus

Assault Walls: 0.4
Assault Gates: 1.0
Breach Walls: 0.6

Assault Walls: 0.647853
Assault Gates: 0.0
Breach Walls: 0.319895

Assault Walls: 0.444643
Assault Gates: 1.0
Breach Walls: 0.428571

Assault Walls: 0.776787
Assault Gates: 0.0
Breach Walls: 0.554848

Settlement Graph

Influence Graphs
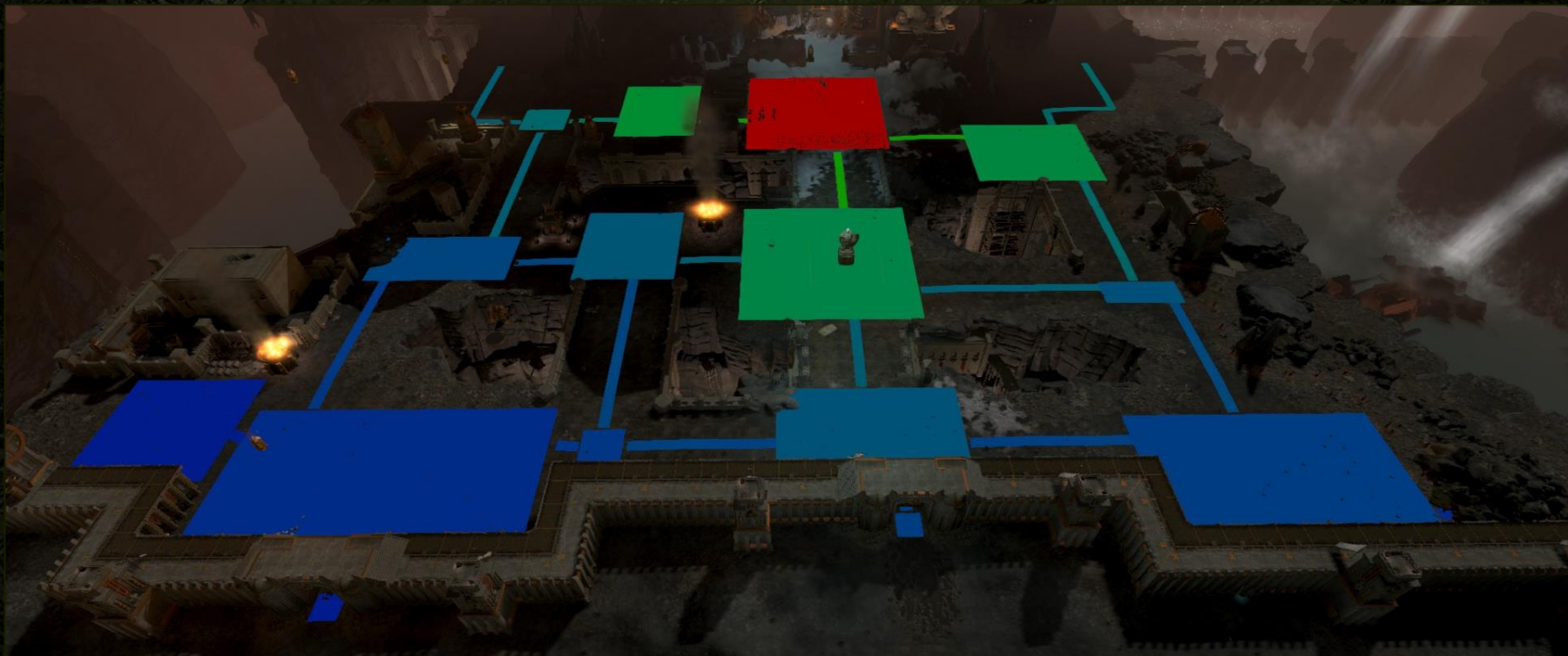
Logic Prefabs

ATTACKING SIEGE AI DETAILS

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Attacking AI Strategy

1. Force your way past the walls
2. Capture the Victory Point

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1. Force your way past the walls
2. Capture the Victory Point

Both steps of this strategy execute in parallel

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Getting Into the City

- Destroy the walls
- Climb over the walls
- Destroy the gates (always possible)

Entry Points

Type: Wall Assault Vehicle
Fulfillment: 1.00/2.00 (50.0%)
Progress: 28.6%
ETA: 78.3 secs

Type: Gate
Fulfillment: 5.25/6.00 (87.5%)
Progress: 12.6%
ETA: 124.5 secs

Choosing the Right Tactics

Choosing the Right Tactics

1. Build a set of ideal groups
2. Match the ideal groups to the AI hints
3. Send the rest to the Reserves

Gate Assault Tactic

- Goal: Destroy a specific gate!

- Target: Gate nearest to the Attack Focus

- Tools:
  - Battering rams (excellent)
  - Monstrous creatures (?)

Aside: What Is This Unit?

Historical

- Sword infantry
- Spear infantry
- Missile infantry
- Cavalry
- Artillery

Fantasy

- All of that plus…
- Flying units
- War machines
- Monstrous creatures
- Individual characters

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Better: How Should the AI Use It?

- We were asking the wrong question
- It doesn't matter what it *is*, it matters how the AI should *use* it
- Data-driven "AI Usage Flags"

Gate Assault Tactic

- Goal: Destroy a specific gate!

- Target: Gate nearest to the Attack Focus

- Tools:
  - Battering rams (excellent)
  - ~~Monstrous creatures~~ Gate crushers (excellent)
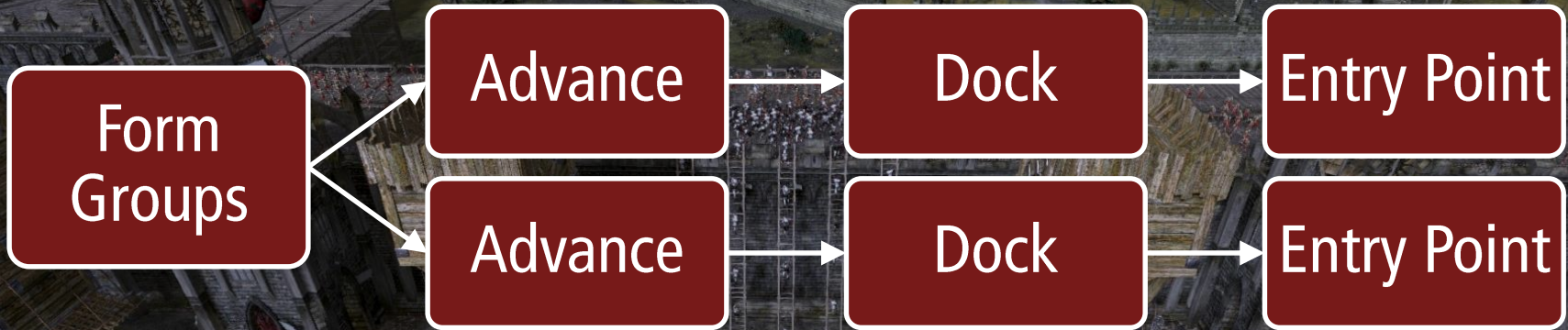 - Any other unit (last resort)

Gate Assault Tactic

Form Up → Advance → Attack → Entry Point

Advance → Relinquish → Entry Point

Wall Assault Tactic

- Goal: Create a way to scale the walls!

- Targets: Walls near the Attack Focus

- Tools:
  - Siege towers (excellent)
  - Ladders (good)

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Wall Assault Tactic

Form Groups → Advance → Dock → Entry Point

Form Groups → Advance → Dock → Entry Point

Wall Breach Tactic

- Goal: Destroy a section of the walls!

- Target: Wall near the Attack Focus

- Tools:
  - Missile units that destroy buildings
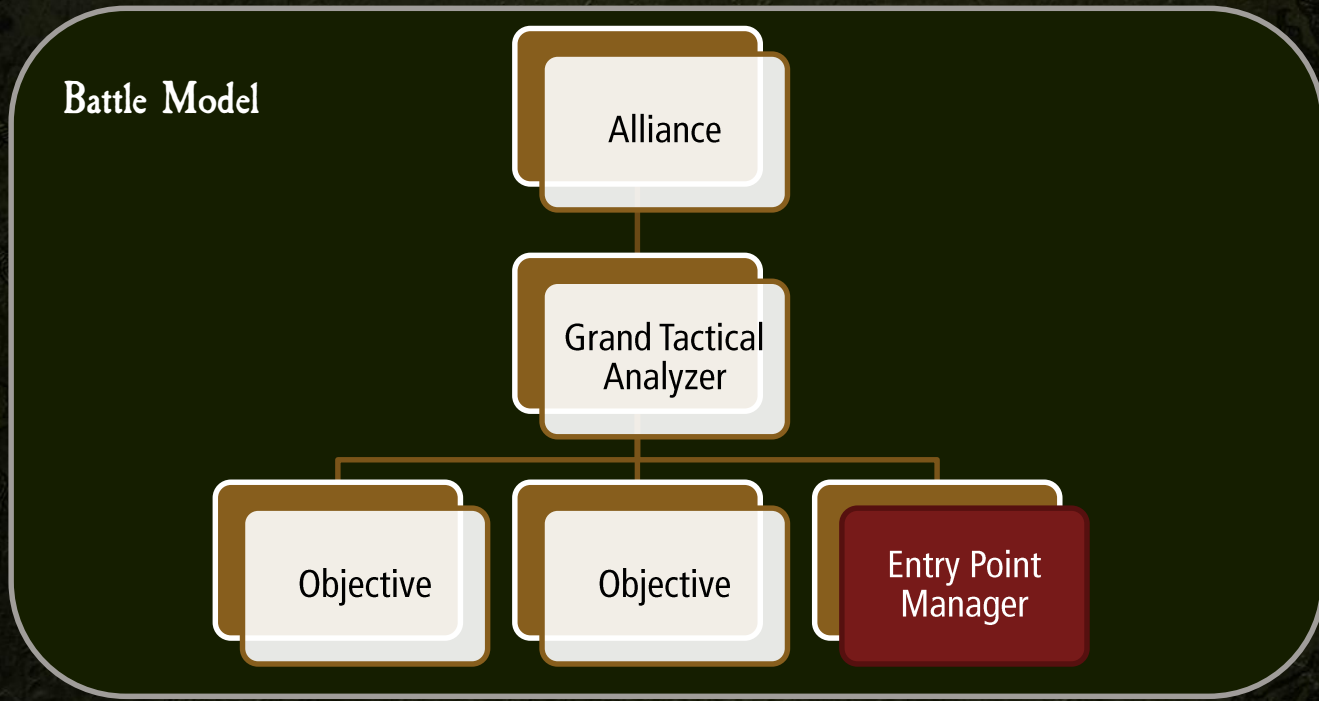
Wall Breach Tactic

Form Up → Advance → Fire → Entry Point

Storm Entry Points Tactic

- Now that we know about the Entry Points, we're ready to storm the city!

- Actually, we only know about the ones the AI created…

- What about when the AI is reinforcing a player army?

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Entry Point Manager

Storm Entry Points Tactic

- *Now* we're ready to storm the city!

- Form a storming group for each Entry Point:
  - Queue up in front of the Entry Point
  - Send one unit through at a time

- This tactic is new to Warhammer
  - "Assault" tactics *create* entry points
  - Storm Entry Points tactic *uses* entry points

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Settlement Interior
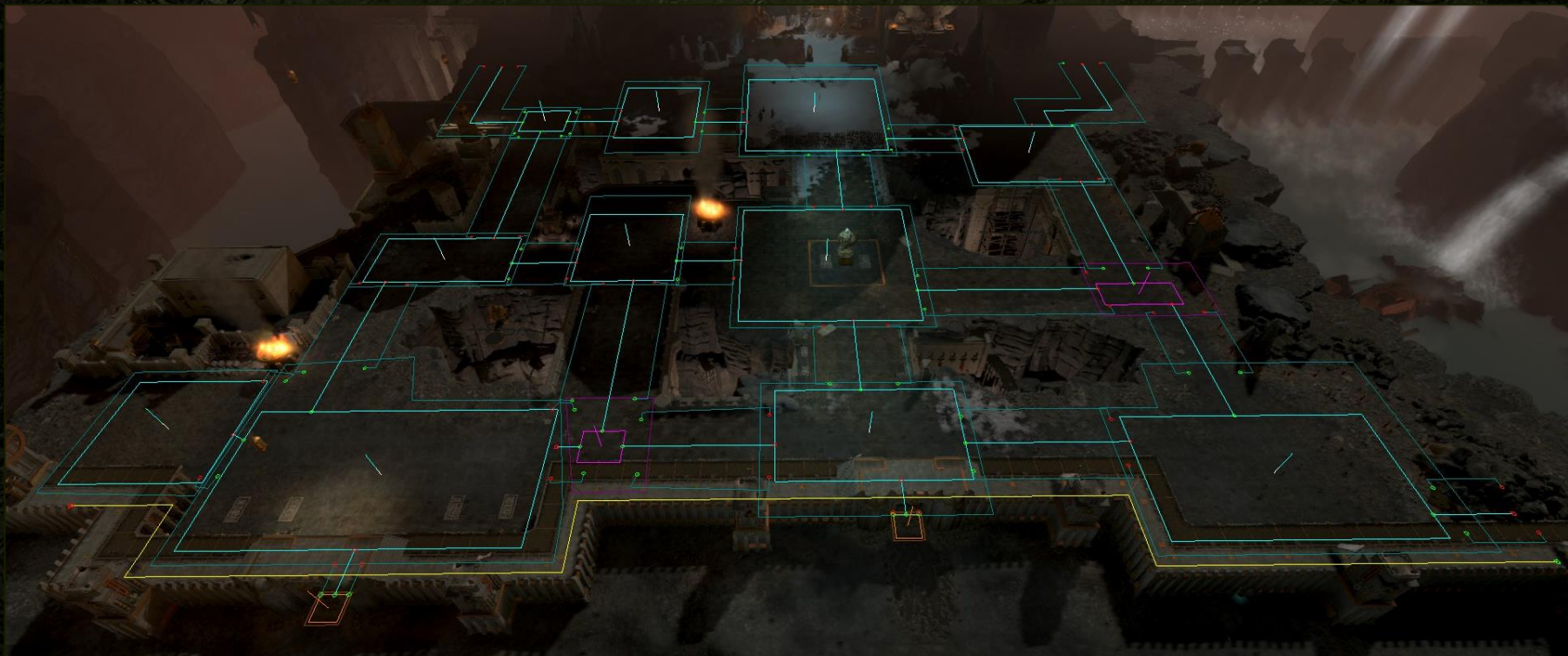
How Do the Reserves Fit In?

- If a tactic can no longer accomplish its goal, we abandon it and reallocate its units elsewhere

- Where? To the *Reserves*

Reserves Tactic

- A pool of units held back to see how the battle unfolds before committing them

- Effectively, the mechanism used to transfer units between tactics

Reserves Tactic

Reserves Tactic

- Must consider each unit's capabilities and the currently available options

- Pass the assignment up to the Detachment for execution

Coordination Between Tactics

- In general:
  - Tactics should be encapsulated and modular
  - Limited coordination by the Detachment
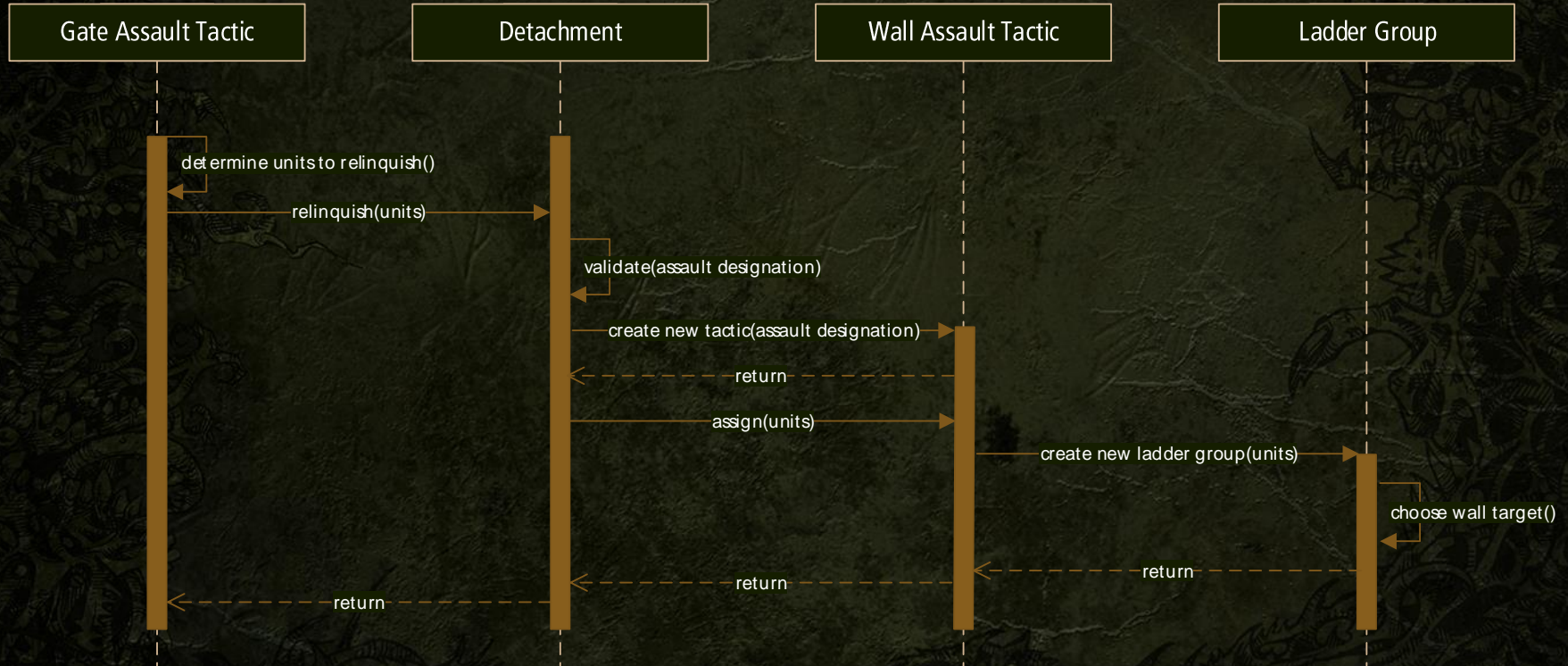 - Detachment allocates units to tactics using a prioritized bidding process

Coordination Between Tactics

- Attack Settlement Detachment:
  - Quite a lot of coordination
  - Accomplished via direct unit allocation

Ex 1: Gate Assault Using Ladders

Ex 1: Gate Assault Using Ladders

Gate Assault Tactic	Detachment	Wall Assault Tactic	Ladder Group

determine units to relinquish()

relinquish(units)

validate(assault designation)

create new tactic(assault designation)

return

assign(units)

create new ladder group(units)

choose wall target()

return

return

return

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Ex 2: Wall Assault Docking a Tower

Ex 2: Wall Assault Docking a Tower

Wall Assault Tactic	Detachment	Storm Entry Points Tactic

mark entry point accessible()

relinquish(units, entry point)

assign(units, entry point)

assign(units, entry point group)

return

destroy tactic if empty()

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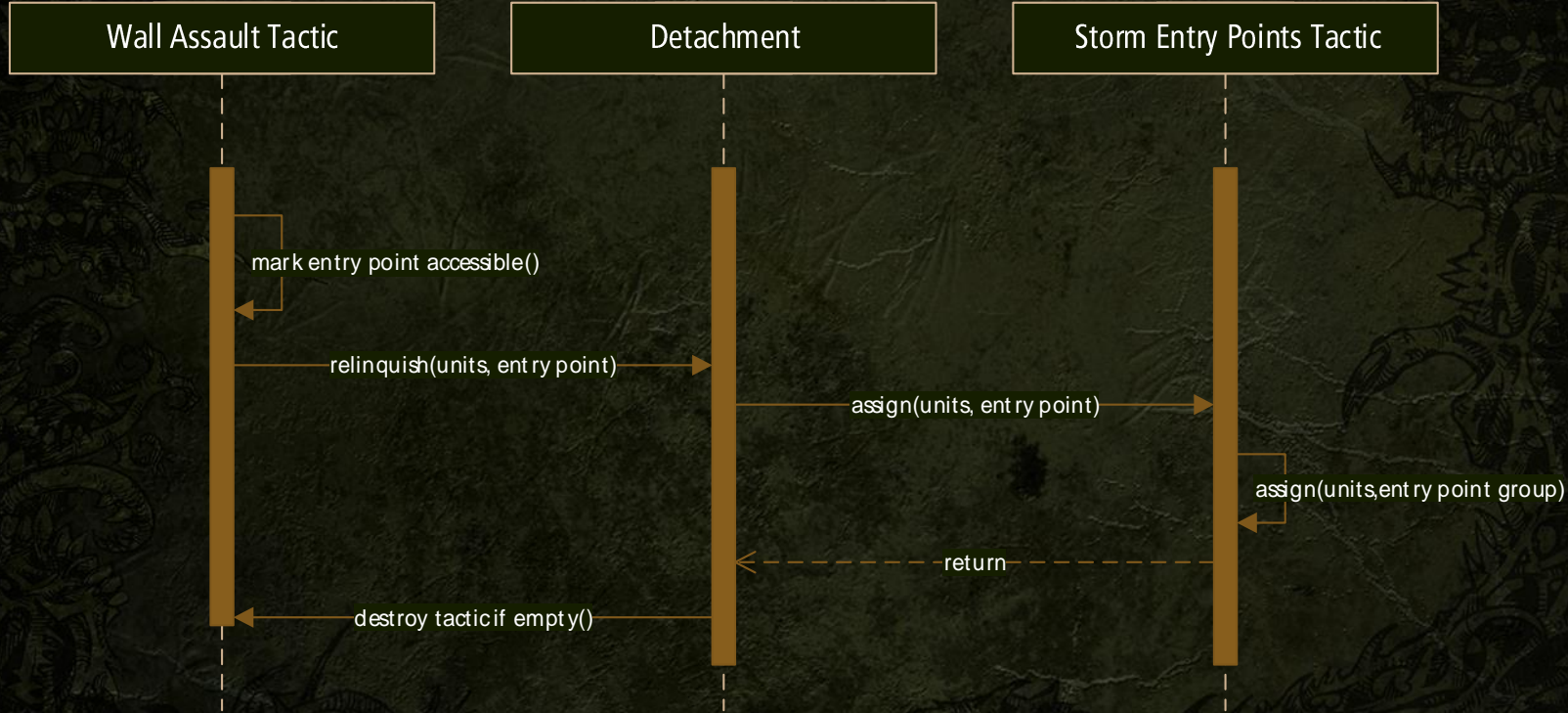
Ex 3: Allocating the Reserves

Ex 3: Allocating the Reserves

Reserves Tactic   Detachment   Gate / Wall / Storm Tactic(s)

scan for matches()

relinquish(unit entry point pairs)

loop for each pair

assign(unit, entry point)

return

return
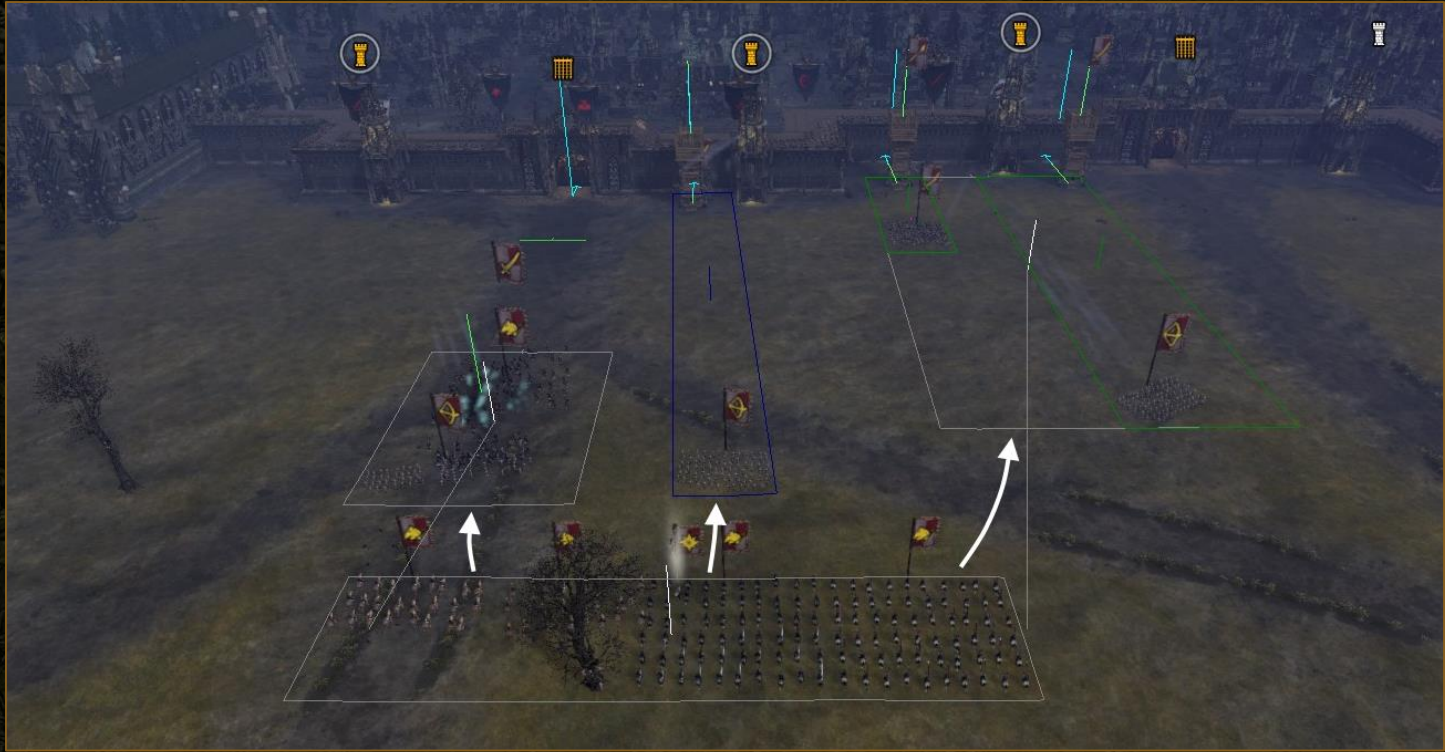
Reinforcements

- Enter after the battle has begun
- Player- or AI-controlled
- Not necessarily the same faction

Reinforcements have arrived!

Reinforcements

- Reinforcing army has no siege equipment
- Added to the Reserves
- Fed into the city using the normal process

COLLABORATION, ADVICE, CONCLUSIONS

Siege AI Team Process

- Daily stand-ups

- Weekly 1-hour meeting
  - Represented: Battle AI, siege design, AI design, battle programming, QA, production, game director

Siege AI Team Process

- Daily stand-ups

- Weekly 1-hour meeting
  - Represented: Battle AI, siege design, AI design, battle programming, QA, production, game director
  - Agenda: Review action points, demonstrate progress, discuss new developments, list future tasks

- Mutual understanding of challenges, prevented surprises

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Advice

- Play your game
- Be the champion
- Be the expert
- Be organized

Advice

- Show your work
- Invest in tools
- Don't take it personally

Summary

- Siege AI is remarkably different from previous games in the series

- Started with proven functionality, iterated on gameplay in collaboration with other teams

- Variety in behaviour is accomplished through army depth

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Summary

- First: Holding back some Reserves
- First: Follow the player's lead

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@andre_arsenault

andre.arsenault@creative-assembly.com