

Preventing multiplayer cheating

CMSC425.01 Spring 2019

Administrivia

- Final homework (Hw3)
 - Errata: Question 2(a) has a bad heuristic.
 - Corrected homework posted
- Final midterm
 - Prep material on web site
 - Monday will do review
 - Thursday May 8th

Today's question

How to prevent cheating

Cheating ...

- Frustrates players
- Reduces in game purchases
- Causes players to quit
- Impacts paid player leagues

- Your experiences?

Consider more generally ...

- Always good to consider security
- How are games like
 - Online banking
 - Online retail
 - Social media
 - Anything networked

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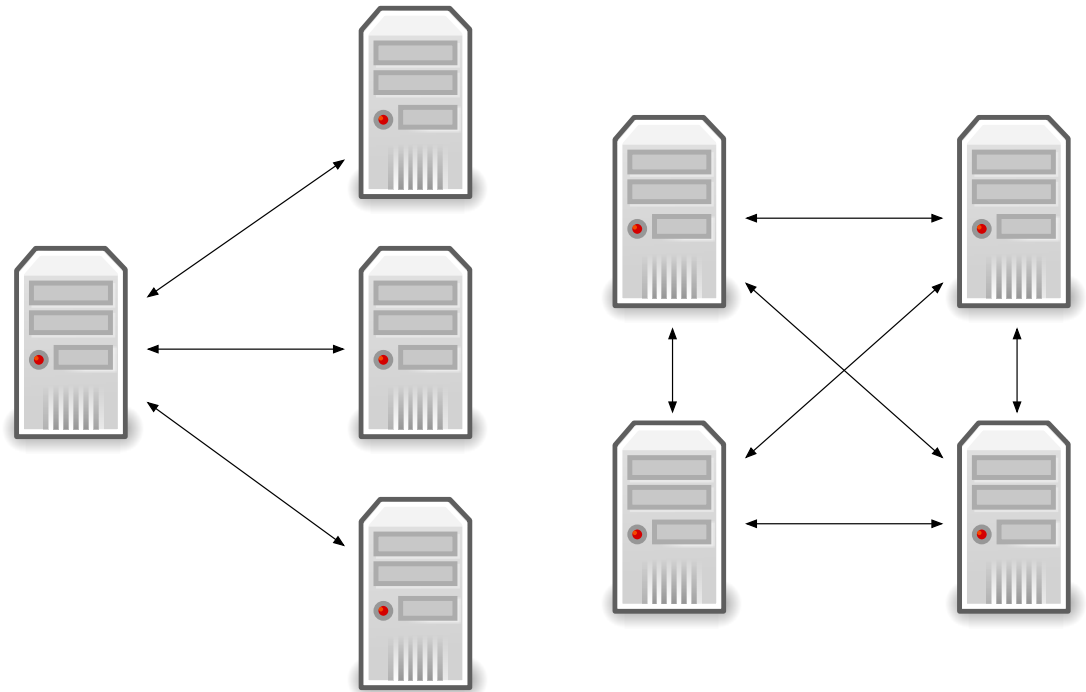
<https://www.aimforest.com/cheat-detail/call-of-duty-ghosts-hacks-aimbots-and-other-cheats>

Pritchard on Gamasutra

- If you build it, they will come to hack and cheat
- Hacking attempts increase as a game becomes more successful
- Cheaters actively try to control knowledge of their cheats
- Your game, along with everything on the cheater's computer, is not secure—not memory, not files, not devices and networks
- Obscurity is not security
- Any communication over an open line is subject to interception, analysis and modification
- There is no such thing as a harmless cheat
- Trust in the server is everything in client-server games
- Honest players would like the game to tip them off to cheaters

Network game models

- Client server
 - Client software
 - Server software
- Peer to peer
 - Identical vs. different clients
 - With or without lockstep
- Question
 - How is computation shared?



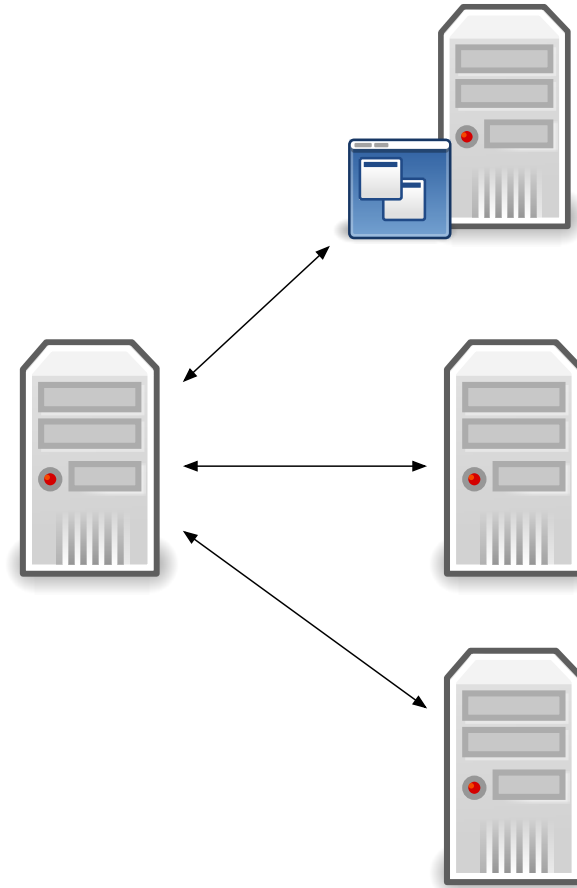
https://developer.valvesoftware.com/wiki/Source_Multiplayer_Networking

Cheating attacks

- **Reflex Augmentation:** Improve physical performance, such as the firing rate or aiming
- **Information Exposure:** Clients obtain/modify information that should be hidden.
- **Protocol cheats:** Clients capture and modify or delay packets
- **Authoritative Clients:** Although the server should have full authority, some online games grant clients authority over game execution for the sake of efficiency. Cheaters then modify the client software.
- **Compromised servers:** A hacked server that biases game-play towards the group that knows of the hacks.
- **Bugs and Design Loopholes:** Bugs and design flaws in the game are exploited. Infrastructure Weaknesses: Differences or problems with the operating system or network environment are exploited.
- https://en.wikipedia.org/wiki/Cheating_in_online_games

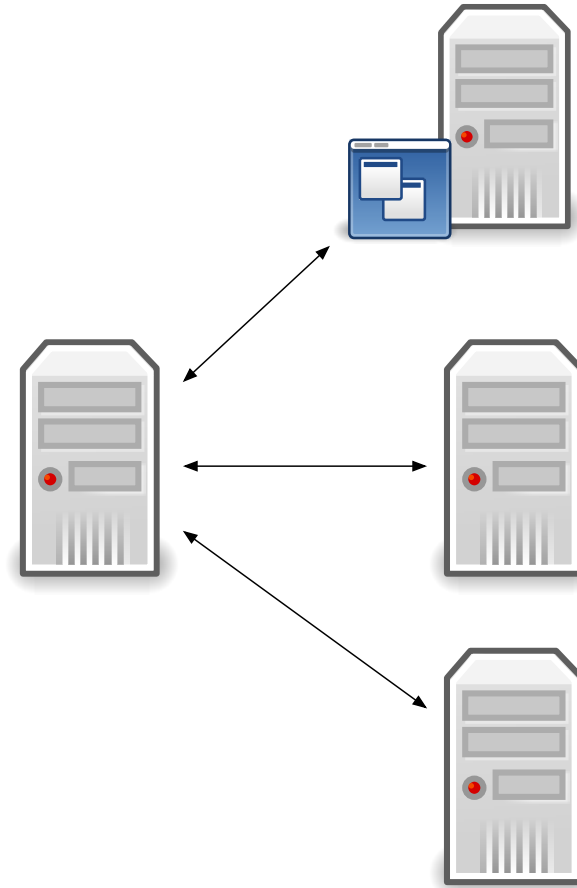
Reflex Augmentation

- Enhance client software
 - Externally capture packets
 - Modify client code
- Aimbot
- Reflex enhancer
- How detect?



Reflex Augmentation

- Enhance client software
 - Externally capture packets
 - Modify client code
- Aimbot
- Reflex enhancer
- How detect?
 - Check client executable
 - Analyze packet traffic



Information Exposure

- Access and use information not entitled to
 - Infrastructure-level cheats
- What might a cheat use?

Information Exposure

- Access and use information not entitled to
- What might a cheat use?
 - Key variables
 - Graphics hacks
 - Item properties
 - Physics behavior
 - Time (speed hack)
 - Ghosting

Key variables

- Lives, strength, health, etc.
- You have the executable – how find these variables?

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 - Get killed, find one that just decreased
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- Run program.
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 - Get killed, find one that just decreased
- How prevent?
 - Encrypt or protect key variables

Graphics hacks (removal of game elements)

- Change local graphics rendering
- Turn off rendering elements
- Eliminate fog, walls, etc



Item hacks

- Modify item properties
- Firing rate, accuracy, portion action, item frequency



Physics and speed hacks

- Change collider behavior
- Change physics engine behavior

- Control game clock

Ghosting

- Cooperation between two players
- One runs as spectator
- Informs actual player of location of other players, etc

Protocol cheats

- Interfere with network packets
 - Packets may be inserted, destroyed, duplicated, or modified
- *Suppressed update:*
 - Accept opponent packets, suppress own, to get advantage
 - Uses server policy of interpolating and backwinding
 - Prevent by monitoring patterns of packet delay

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- *Fixed delay:*
 - Delay all packets
 - Local players see info faster
 - Prevent by lockstep, analysis, sliding pipelines

Protocol cheats

- Interfere with network packets
 - Packets may be inserted, destroyed, duplicated, or modified
- Inconsistency: corrupt packets
- Time-stamp: post date packets
- Spoofing: sent out packets masquerading as other player

Detecting Cheating

- Signature detection - Detecting of certain patterns of bytes in memory, checked against a database (whitelist)
- Heuristic analysis - Statistical analysis of behavior
- User reports - Information provided by other users

- 1. Metrics for best path on map
- 2. Navmesh process (R_D_P algorithm, triangulation)
- 3. Walkable terrain
- 4. Find paths on triangulated space
- **5. Configuration spaces**
- 6. Quality of path
- **7. C-obstacles**
- **8. Minkowski sums**
- 9. Navmesh grid, multiresolution grid
- 10. Visibility graph
- 11. Medial axis
- 12. Randomized placement
- 13. Rapidly expanded Random Trees (RRTs)
- **14. L-system plus turtle**
- **15. Fractal dimension**
- 16. Randomized and 3D L-systems
- 17. Particle systems
- **18. Flocking**
- 19. Mandelbrot sets
- 20. Constructive solid geometry
- 21. Shading equation
- 22. Bump mapping
- 23. Polygonal meshes - basics, Euler's formula
- **24. DECL data structures**
- 25. Perlin noise
- **26. A***
- 27. Admissible heuristic
- 28. Multiplayer cheating attacks
- 29. Forbidden velocities for crowd motion
- 30. Fitting cubic curves to data points

Problem 3. (20 points) Consider the collection of shaded rectangular obstacles shown in the figure below, all contained within a large enclosing rectangle. Also, consider the triangular robot, whose reference point is located at a point s . (You may take s to be the origin.)

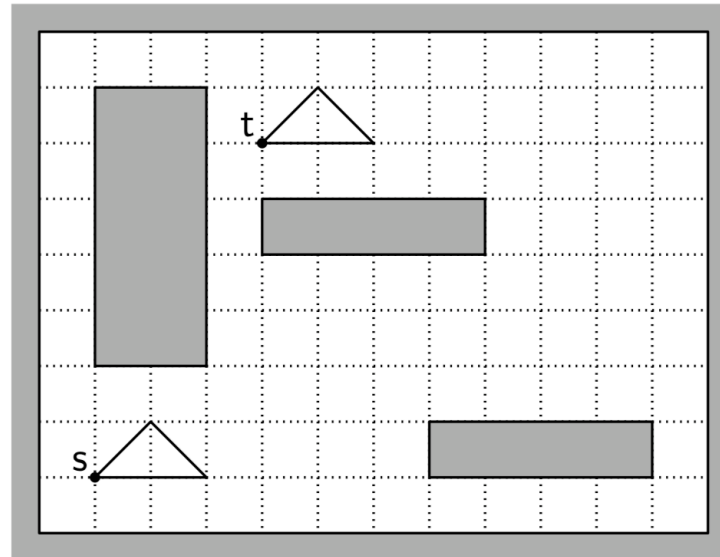


Figure 2: Problem 3.

- Draw the C-obstacles for the three rectangular obstacles, including the C-obstacle from region lying outside the large enclosing rectangle.
- Either draw an obstacle-avoiding path for the robot from s to t , or explain why it doesn't exist.