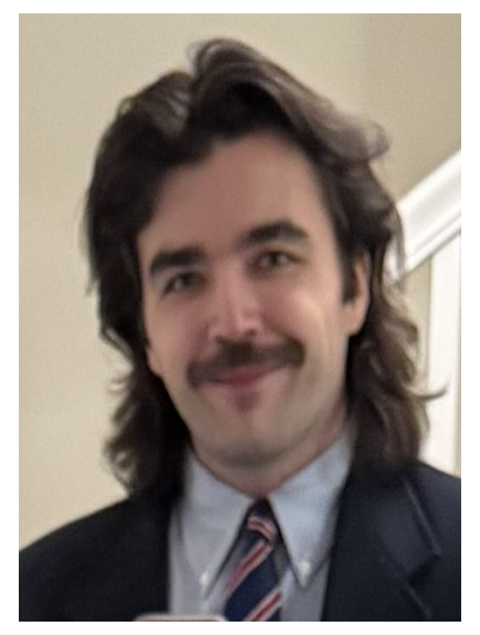
University of Cincinnati

SWISSBOT

A Reinforcement Learning Framework for TF2 AI



Tristan McGinnis (CS)

Dr. Fred S. Annexstein (Advisor)

ABSTRACT

Swissbot is a reinforcement learning framework designed to control bots inside Team Fortress 2. The goal is to create a system where an AI agent can learn basic actions like walking or aiming through real-time interaction with the game environment.

GOALS

- **Build an AI framework that teaches itself to play Team Fortress 2**
- **Use reinforcement learning to reward "smart" in-game behavior**
- **Create a bot that navigates and aims without hardcoded scripts**
- **Leverage SourceMod and RCBot2 to translate AI decisions into in-game actions**

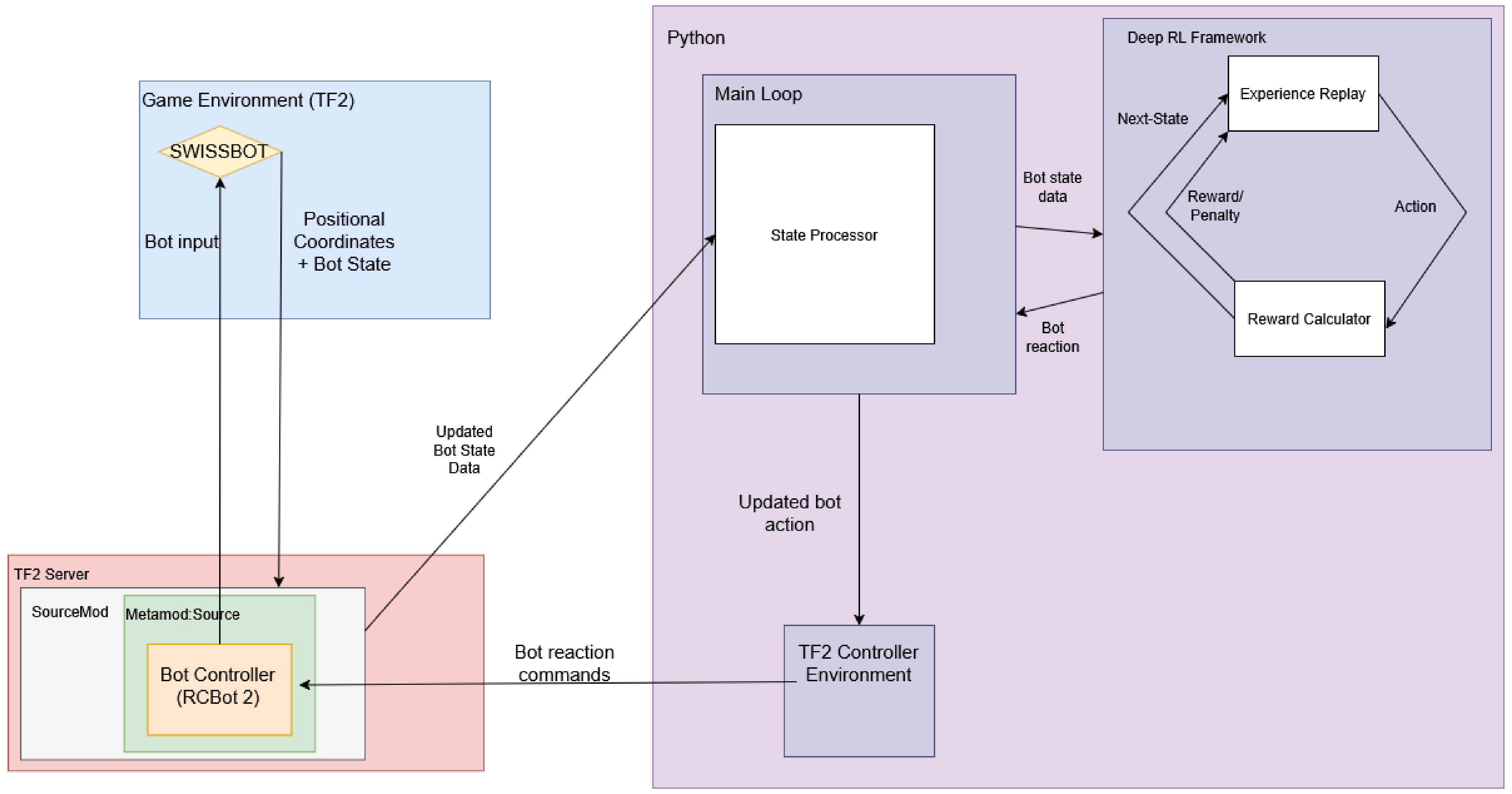
64-BIT UPDATE

In mid-2024, Team Fortress 2 was updated to run as a 64-bit application. This change caused legacy 32-bit plugins to break, halting progress on the original training implementation. To continue, the project required manually updating and recompiling a fork of Metamod:Source for 64-bit compatibility. This included building custom DLLs from Source using outdated SDKs and patching plugin paths. This delay shifted focus towards getting core systems working before training could begin.

SYSTEM DESIGN

Project Name: SWISSBOT

Goal Statement: Deep reinforcement learning platform for in-game bots



D2: Upon entering the Game Environment, the bot begins sending state data for the State Processor within the Main Loop to process and send to the Deep RL learning model. The reward system compares the current bot's state data to it's current objective incentive and provides a score, which based on previous states will return adjusted bot commands back to the main loop. The main loop sends the updated bot action to the TF2 Controller Environment, which converts the action into inputs that will be carried out by the Bot Controller.

TECHNOLOGIES

RCBot2
Team Fortress 2 / Day of Defeat:Source / Half-life 2 Death-match
RCBot1 for Sven-coop 4.8, Natural Selection, Rocket Crowbar

Tianshou

SOURCEMOD

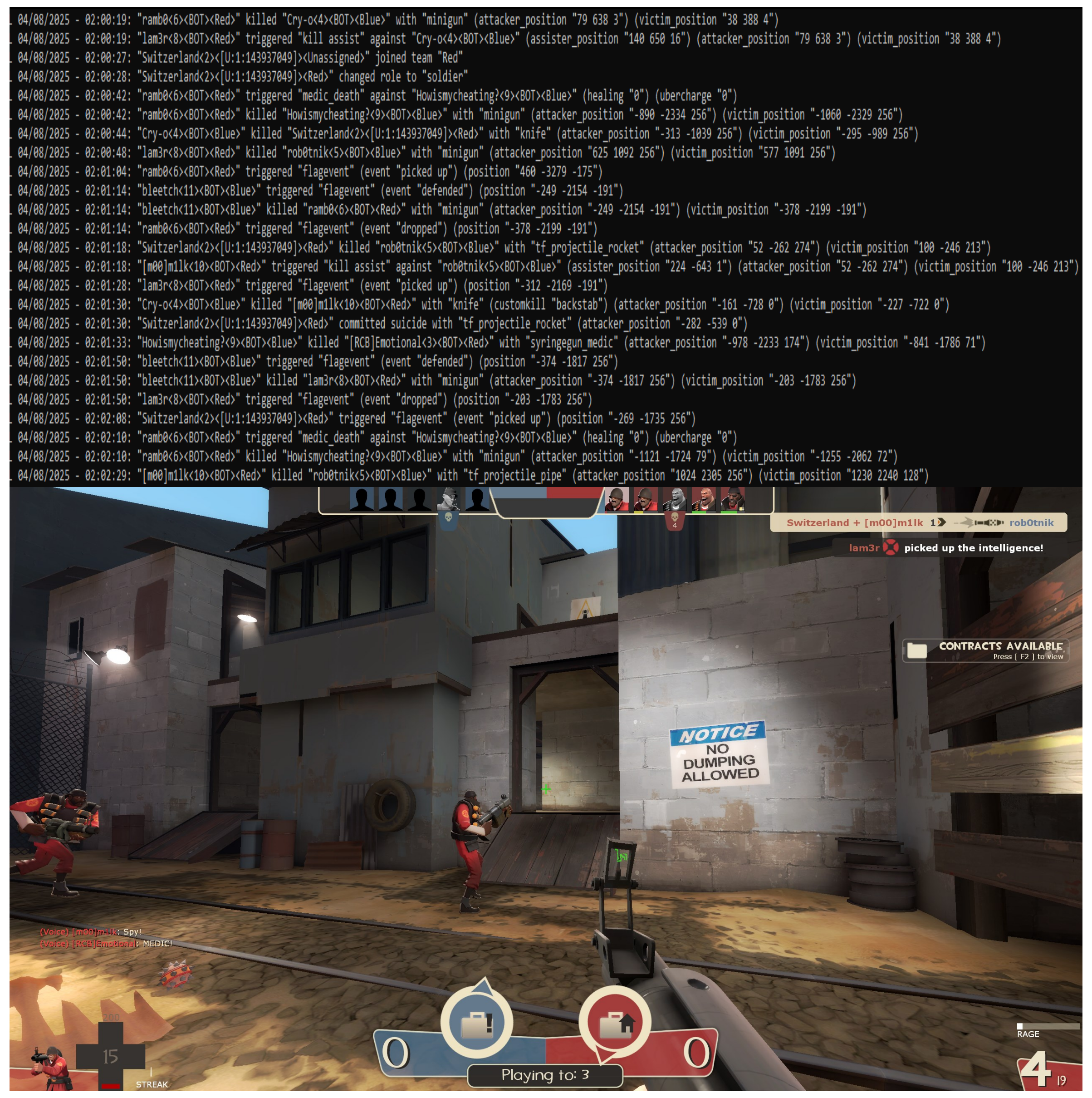
METAMOD SOURCE

C++

SP S

source

SAMPLE OUTPUT



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04/08/2025 - 02:00:19: "ramb0<6><BOT><Red>" killed "Cry-o<4><BOT><Blue>" with "minigun" (attacker_position "79 638 3") (victim_position "38 388 4")
04/08/2025 - 02:00:19: "lam3r<8><BOT><Red>" triggered "kill assist" against "Cry-o<4><BOT><Blue>" (assister_position "140 650 16") (attacker_position "79 638 3") (victim_position "38 388 4")
04/08/2025 - 02:00:27: "Switzerland<2><[U:1:143937049]><Unassigned>" joined team "Red"
04/08/2025 - 02:00:28: "Switzerland<2><[U:1:143937049]><Red>" changed role to "soldier"
04/08/2025 - 02:00:42: "ramb0<6><BOT><Red>" triggered "medic_death" against "Howismycheating?<9><BOT><Blue>" (healing "0") (ubercharge "0")
04/08/2025 - 02:00:42: "ramb0<6><BOT><Red>" killed "Howismycheating?<9><BOT><Blue>" with "minigun" (attacker_position "-890 -2334 256") (victim_position "-1060 -2329 256")
04/08/2025 - 02:00:44: "Cry-o<4><BOT><Blue>" killed "Switzerland<2><[U:1:143937049]><Red>" with "knife" (attacker_position "-313 -1039 256") (victim_position "-295 -989 256")
04/08/2025 - 02:00:48: "lam3r<8><BOT><Red>" killed "rob0tnik<5><BOT><Blue>" with "minigun" (attacker_position "625 1092 256") (victim_position "577 1091 256")
04/08/2025 - 02:01:04: "ramb0<6><BOT><Red>" triggered "flagevent" (event "picked up") (position "460 -3279 -175")
04/08/2025 - 02:01:14: "bleetch<11><BOT><Blue>" triggered "flagevent" (event "defended") (position "-249 -2154 -191")
04/08/2025 - 02:01:14: "bleetch<11><BOT><Blue>" killed "ramb0<6><BOT><Red>" with "minigun" (attacker_position "-249 -2154 -191") (victim_position "-378 -2199 -191")
04/08/2025 - 02:01:14: "ramb0<6><BOT><Red>" triggered "flagevent" (event "dropped") (position "-378 -2199 -191")
04/08/2025 - 02:01:18: "Switzerland<2><[U:1:143937049]><Red>" killed "rob0tnik<5><BOT><Blue>" with "tf_projectile_rocket" (attacker_position "52 -262 274") (victim_position "100 -246 213")
04/08/2025 - 02:01:18: "[m00]m1lk<10><BOT><Red>" triggered "kill assist" against "rob0tnik<5><BOT><Blue>" (assister_position "224 -643 1") (attacker_position "52 -262 274") (victim_position "100 -246 213")
04/08/2025 - 02:01:28: "lam3r<8><BOT><Red>" triggered "flagevent" (event "picked up") (position "-312 -2169 -191")
04/08/2025 - 02:01:30: "Cry-o<4><BOT><Blue>" killed "[m00]m1lk<10><BOT><Red>" with "knife" (customkill "backstab") (attacker_position "-161 -728 0") (victim_position "-227 -722 0")
04/08/2025 - 02:01:30: "Switzerland<2><[U:1:143937049]><Red>" committed suicide with "tf_projectile_rocket" (attacker_position "-282 -539 0")
04/08/2025 - 02:01:33: "Howismycheating?<9><BOT><Blue>" killed "[RCB]Emotional<3><BOT><Red>" with "syringegun_medic" (attacker_position "-978 -2233 174") (victim_position "-841 -1786 71")
04/08/2025 - 02:01:50: "bleetch<11><BOT><Blue>" triggered "flagevent" (event "defended") (position "-374 -1817 256")
04/08/2025 - 02:01:50: "bleetch<11><BOT><Blue>" killed "lam3r<8><BOT><Red>" with "minigun" (attacker_position "-374 -1817 256") (victim_position "-203 -1783 256")
04/08/2025 - 02:01:50: "lam3r<8><BOT><Red>" triggered "flagevent" (event "dropped") (position "-203 -1783 256")
04/08/2025 - 02:02:08: "Switzerland<2><[U:1:143937049]><Red>" triggered "flagevent" (event "picked up") (position "-269 -1735 256")
04/08/2025 - 02:02:10: "ramb0<6><BOT><Red>" triggered "medic_death" against "Howismycheating?<9><BOT><Blue>" (healing "0") (ubercharge "0")
04/08/2025 - 02:02:10: "ramb0<6><BOT><Red>" killed "Howismycheating?<9><BOT><Blue>" with "minigun" (attacker_position "-1121 -1724 79") (victim_position "-1255 -2062 72")
04/08/2025 - 02:02:29: "[m00]m1lk<10><BOT><Red>" killed "rob0tnik<5><BOT><Blue>" with "tf_projectile_pipe" (attacker_position "1024 2305 256") (victim_position "1230 2240 128")
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RESULTS + ACCOMPLISHMENTS

- **Successfully integrated Metamod:Source, SourceMod, and RCBot2 into a workingTF2 environment**
- **Built a custom 64-bit version of Metamod to adapt to TF2's engine update**
- **Established a communication pathway between the game server and external Python scripts for future AI control**
- **Project currently functions as a proof of concept, demonstrating system interoperability and plugin control**

CHALLENGES

- **Adapting to TF2's shift from 32-bit to 64-bit architecture**
- **Building Metamod:Source from source due to lack of updates**
- **Limited documentation and outdated plugin resources**
- **Coordinating communication between C++ game plugins and Python scripts**
- **Time constraints for implementing full learning pipeline**