This design creates a dynamic, engaging, and highly replayable learning environment where knowledge itself is the key resource, combining PvE learning with competitive PvP strategic hacking.

8. Experience, Mission Logic, and Network Generation

The core of the game is a dynamic, persistent, and player-influenced virtual network.

A. Network and Target Generation Logic

The game world is composed of two primary environments:

1. **Static PvE Mission Blocks:** Fixed, pre-designed networks (e.g., "Level 3 Data Center") controlled by the AI. These are the primary source of early-game **Credits (\mathbb{C})** and **Knowledge Fragments**. The difficulty is constant and scales by mission level.
2. **Dynamic PvP Lan Zones:** Temporary, session-based networks where players or teams face off. The architecture of these networks is dynamically generated based on the **average Player Level and VC Hardware rating** of the participating teams.

Target Parameter	Generation Logic	Player Influence/Learning
IP Addresses/Subnets	Randomly assigned within a set block (e.g., 10.x.x.x) to ensure no memorization.	Requires players to use **scan** and **ping** for reconnaissance every match.
Open Ports/Services	Determined by the **Complexity Level** of the mission. Higher levels expose more diverse and obscure services.	Forces players to utilize a wider array of **Service_Object** methods and **Exploit_Object** types.
Firewall/Defense	Based on the **Difficulty Tier** and the **Defending Team's** setup rules. Simple missions have basic DROP rules; advanced missions use IDS/Honeypots.	Teaches **Evading Detection** and **Log Analysis** (using target_log read).
Exploits	The AI system logically checks player **Exploit_Object** attempts against the target's simulated vulnerability version (e.g., if target runs "FTP v2.1," "Exploit V2.1" works).	Rewards players for accurate and targeted use of their exploit arsenal.

B. Mission Types and Victory Logic (Boolean Goals)

Missions are defined by their **Boolean Goal**, a server-side flag that, when set to **TRUE**, ends the round and awards the victor.

1. Team vs Team (PvP) — Resource Acquisition

Setup: Two teams (Alpha and Bravo) are spawned on a dedicated LAN. Critical mission files are scattered across the filesystems of the opposing team's players (e.g., one file on Player A, one on Player B, one on Player C).

Mission Goal: **\text{WINNER} = (\text{ACQUIRED_FILES} \ge 3)**
Offense: A team wins the round by hacking members of the opposing team's VC, locating the file, and using the **copy** command to exfiltrate **3** unique files.
Defense: Teams must proactively detect incoming attacks, deploy their defense modules (using vc.auto_defend or manual scripts), and even counter-attack to **recover** their own stolen files. A recovery is treated as an acquisition for the winning goal.
Logic Advancement: Rounds proceed over time. If the time limit is hit, the team with the most acquired/recovered files wins.

2. Team vs Target (PvE/PvP) — Capture The Flag (CTF)

Setup: Multiple teams (Alpha, Bravo, Charlie) compete to be the first to hack a single, highly fortified AI-controlled target.

Mission Goal: **\text{WINNER} = (\text{TARGET_ROOT} \land \text{FLAG_EXFILTRATED})**
Objective: The target is protected by multiple layers (e.g., Firewall \rightarrow Proxy Server \rightarrow Web Server \rightarrow Database). Each layer requires a unique set of skills (scanning, tunneling, SQL injection).
\text{ROUND 1 GOAL} = \text{PROXY_SERVER_COMPROMISED} (First team to pivot off the Proxy Server wins the first **knowledge fragment**).
\text{ROUND 2 GOAL} = \text{DATABASE_ACCESS} (The database contains the final **Flag File**).
Logic Advancement: The server controls the difficulty by dynamically patching vulnerabilities between rounds. A successful exploit in Round 1 may be patched in Round 2, forcing teams to develop new exploit modules.

C. Team Collaboration and Reward System

1. **Shared Knowledge:** A critical function is the ability to share hard-won **Knowledge Fragments**. A team member who finds a new fragment can use the **share $fragment @team** command. This instantly integrates the fragment into their teammates' **K-Map**, allowing all members to work on the command's **Synthesis** stage simultaneously.
2. **Specialized Roles (LAN Setup):**
    - **Offense Specialist:** Focuses on developing and using **Exploit_Object** and **raw** commands to breach the perimeter.
    - **Recon Specialist:** Focuses on efficient **scan** and **pivot** modules to map the enemy LAN.
    - **Defense Specialist:** Focuses on **Firewall** and **vc.auto_defend** to secure their team's local environment.
3. **Bonus Reward:** The winning team in any mission (PvP or CTF) receives a guaranteed **Bonus Knowledge Fragment** that is not available in standard PvE play (e.g., a fragment for a new **Zero-Day Exploit Object**). This encourages high-stakes competition and accelerates the winners' progression.