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MULTIPLAYER – ONLINE GAMING AND NETWORKING

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ABSTRACT

This paper delves into the pivotal role of networking within multiplayer computer games, emphasizing its significance in facilitating seamless interactions among players. Through a comprehensive review of existing techniques, we aim to shed light on advancements geared towards enhancing networking in distributed interactive real-time applications. Our survey focuses on literature pertaining to various domains, notably military simulations, networked virtual environments, and multiplayer computer games, offering insights into the diverse research efforts within these fields. Central to our discussion are key themes such as resource management, consistency, responsiveness, and networking at the application level. By examining these aspects, we strive to provide a nuanced understanding of the complexities involved in optimizing networking performance for interactive gaming experiences. Through this exploration, we aim to elucidate the challenges faced in ensuring smooth and reliable communication between game clients and servers. Furthermore, we highlight emerging trends and innovative approaches that have emerged to tackle these challenges, offering a glimpse into the evolving landscape of networking technologies within the gaming industry. Overall, our paper serves as a valuable resource for researchers, developers, and enthusiasts alike, seeking to delve deeper into the intricacies of networking in multiplayer gaming environments.

Keywords- computer games, networked virtual environments, online entertainment, distributed interactive simulation**.**

[1] INTRODUCTION

Over the past two decades, the landscape of distributed interactive real-time applications has undergone significant evolution, prominently featuring three distinct categories: military simulations, networked virtual environments (NVEs), and multiplayer

computer games (MCGs). This shift in focus from military simulations in the 1980s to NVEs in the 1990s and presently to MCGs illustrates the dynamic nature of scientific research in this field, with MCGs emerging as a primary area of interest. Notably, the entertainment industry has demonstrated substantial investment in MCGs, mobile gaming, and online gaming, underscoring their growing prominence.

Terminology within the literature is diverse, reflecting the evolving nature of these applications. For instance, what were once referred to as distributed virtual environments (DVEs) transitioned to collaborative virtual environments (CVEs) before settling on the term NVE, which encompasses both DVEs and CVEs. In military contexts, the preference for the term 'simulation' is evident due to their broader scope beyond NVEs, such as logistical simulations.

Understanding the relationship between games and simulations is crucial. While some games serve as simulations, such as football manager games, others are distinctly situated within virtual environments, like flight simulators or first-person shooters. However, as games become more abstracted, their simulation elements tend to diminish.

Networking assumes a paramount role in determining the playability of MCGs. The physical platform introduces inherent limitations, including bandwidth and latency, influenced by underlying infrastructure factors like cabling and hardware. While improvements in hardware can mitigate some of these limitations, the logical platform, which builds upon the physical infrastructure, plays a crucial role in MCG design. It encompasses architecture for communication, data management, and control. Communication architecture delineates the logical connections between network nodes. For instance, peer-to-peer architecture interconnects equal nodes, while client/server architecture designates one node as a server, handling all node-to-node communication. Data and control architecture governs how information is stored and updated within nodes, with centralized architectures concentrating data in one node and replicated architectures featuring node-specific data replicas. In summary, this paper explores the evolving landscape of distributed interactive real-time applications, with a particular focus on MCGs, examining the interplay between physical and logical platforms and the crucial role of networking therein.

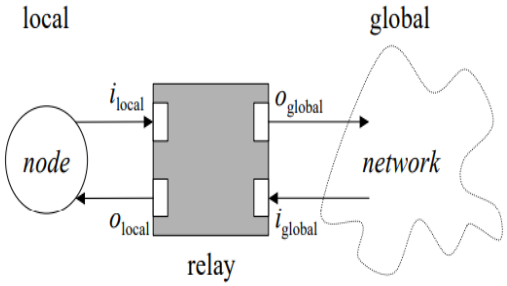
[2] BACKGROUND STUDY

The evolution of distributed interactive real-time applications, spanning military simulations, networked virtual environments (NVEs), and multiplayer computer games (MCGs), reflects the progression of technology and the changing landscape of user demands and preferences. Understanding the background of these applications involves examining their historical development, key concepts, and the underlying technological infrastructure that supports them.

Military simulations have a longstanding history, dating back to the early days of computing. The use of simulations for military training and strategic planning predates the widespread availability of networked computing, with early efforts focused on creating

realistic virtual environments to simulate combat scenarios. These simulations often relied on standalone systems or local area networks (LANs) for communication and interaction.

The emergence of networked virtual environments (NVEs) in the 1990s marked a significant shift in interactive computing. With advancements in networking technology and the internet, developers began exploring ways to create shared virtual spaces where users could interact in real-time from remote locations. These environments encompassed a wide range of applications beyond military training, including collaborative workspaces, social platforms, and educational simulations.



The transition from NVEs to multiplayer computer games (MCGs) as the primary focus of research and development reflects the growing popularity of online gaming and the increasing demand for immersive, interactive experiences. MCGs leverage the same networking principles as NVEs but are tailored specifically for entertainment purposes, often incorporating elements of competition, cooperation, and narrative storytelling.

[3] RELATED WORK

Until recently, scientific literature has only marginally addressed the challenges encountered in multiplayer computer games (MCGs) and online gaming, with most papers focusing on simpler games and constrained problem settings. One notable early form of MCGs, Multi-User Dungeons (MUDs), emerged in the early 1980s as text-based environments where players interacted within a shared database comprising various elements such as rooms, exits, and artifacts. Players navigated through rooms via exits, with the ability to add new elements and communicate with each other in real-time, facilitated by an embedded programming language.

In the game Amaze, players navigate a 2D maze and aim to shoot missiles at each other. Each node utilizes point-to-point communication to transmit position and velocity updates every second, facilitating dead reckoning. Players have the flexibility to join or leave at any time, and the system supports computer-controlled players to maintain activity levels. Similarly, XPilot, a 2D dogfight game, employs a simple client/server architecture without dead reckoning, making network latency a determining factor for responsiveness.

Artery, on the other hand, utilizes the Distributed Interactive Simulation (DIS) protocol for networking and aims to reduce traffic by leveraging application-specific semantic knowledge. It also supports dead reckoning, message aggregation, and interest management to optimize performance.

MiMaze introduces a 3D maze environment where players attempt to shoot each other. Employing a distributed architecture, MiMaze requires a server only for initialization. To address transmission delays, it utilizes a bucket synchronization mechanism, evaluating delays between hosts using wallclock time. Messages are delayed according to measured transmission delays to ensure synchronized gameplay, resorting to dead reckoning if necessary.The Distributed Entertainment Environment (DEE) architecture segregates the game world into conceptual, dynamic, and visual models to manage network traffic efficiently. The conceptual and dynamic models are stored on a server, while clients maintain their instances of the visual model. This approach minimizes network overhead by distributing computational tasks appropriately.

A generic model for MCGs is outlined, where game data resides on a server and is transferred to a CPU server for each game session. Front-end servers act as proxies, managing level data and transmitting session data to clients for rendering and computation. Analyzing and modeling user behavior in MCGs is explored through the examination of real-world network traffic from first-person shooter games within a client/server architecture.

Additionally, efforts to address network security and cheating prevention in MCGs are discussed. Researchers and practitioners in the entertainment industry have begun sharing ideas and solutions more openly through trade magazines and conferences, reflecting a growing interest and recognition of the importance of these topics in the gaming community.

[4] CONCLUSION AND FUTURE WORK

The research conducted on distributed interactive real-time applications has provided valuable insights into the networking challenges inherent in multiplayer computer games (MCGs). Techniques for reducing network traffic have been presented and extensively surveyed in relevant literature. Moreover, key factors impacting networking at physical, logical, and application levels have been summarized. Looking ahead, it is natural to anticipate ongoing improvements in hardware and the introduction of novel techniques, potentially even encompassing new media. The entertainment industry is poised to continue its investments in the development of online and mobile gaming, driven by evolving consumer preferences and technological advancements.

Similar to other software projects, the next logical step in the evolution of networking lies in encapsulation. This trajectory has already been observed in graphics rendering, where developers leverage off-the-shelf 3D engines to streamline development processes. It is

foreseeable that a similar trend will emerge in networking, whereby developers seek to encapsulate networking functionalities to enhance efficiency and scalability. However, achieving successful encapsulation in networking necessitates a thorough analysis of underlying concepts and their interrelationships to garner consensus among stakeholders. Therefore, it is imperative to value the lessons learned from past experiences, leveraging historical insights to inform future developments effectively.

In essence, the future of networking in multiplayer computer games holds promise for continued innovation and advancement. As hardware capabilities evolve and new techniques emerge, the landscape of online and mobile gaming is poised for transformation. Encapsulation is likely to play a pivotal role in streamlining networking processes, enabling developers to deliver seamless and immersive gaming experiences to players worldwide. By building upon past learnings and embracing emerging technologies, the gaming industry can navigate future challenges and capitalize on new opportunities for growth and innovation.

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