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DECODING THE STRUCTURE OF MULTI-AGENT SYSTEM COMMUNICATION: A COMPARATIVE ANALYSIS OF PROTOCOLS AND PARADIGMS

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Introduction. Multiagent systems have gained significant attention in various fields, such as robotics, autonomous vehicles, and distributed computing, where multiple agents cooperate and communicate to achieve complex tasks [1]. Efficient communication among agents is a crucial aspect of these systems, as it directly impacts their overall performance and scalability. This scholarly work provides an exploration of essential communication elements and conducts a comparative assessment of diverse protocols utilized in multiagent systems. The emphasis lies in scrutinizing the strengths, weaknesses, and applicability of these protocols across various scenarios. The research also sheds light on emerging trends within communication protocols for multiagent systems, including the incorporation of machine learning methods and the adoption of blockchain-based solutions to ensure secure communication. These trends provide valuable insights into the evolving landscape of multiagent systems and their communication protocols.

Main part. We present an overview of multiagent systems and their fundamental characteristics, emphasizing the significance of communication among agents. Then identify a range of commonly used communication paradigms, including message-passing, publish-subscribe, and peer-to-peer, and provide an in-depth exploration of their key features and operational principles [2]. This examination includes an assessment of their communication patterns, overhead, message delivery guarantees, scalability, and fault tolerance. Finally, this research paper offers a comparative analysis of communication protocols such as AMQP, CoAP, and MQTT revealed the nuanced strengths and considerations associated with each, providing researchers and practitioners with a valuable resource for selecting the most suitable protocol for their specific applications. The findings contribute to a better understanding of the trade-offs and considerations involved in designing effective communication strategies for multiagent systems.

Conclusion. From the analysis results, AMQP is well-suited for scenarios demanding robust message queuing and high reliability, offering a sophisticated framework for complex communication patterns. However, its intricate nature and resource-intensive requirements may be excessive for simpler communication needs. CoAP shines in efficiency and simplicity, making it ideal for resource-constrained environments where lightweight communication is crucial. Nevertheless, it may encounter scalability challenges in highly complex scenarios. MQTT stands out for its efficiency and versatility, particularly in real-time communication scenarios. Yet, its dependency on a centralized broker poses a potential single point of failure, and robust security implementation requires careful consideration.

References:

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