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Enhancing Cloud Security Using Multi-Factor Authentication And Adaptive Cryptography

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Abstract:

Cloud computing has revolutionized data storage and access by offering scalable and flexible resources. However, it introduces critical security challenges. This paper proposes a dual-layered security framework that integrates Multi-Factor Authentication (MFA) and Adaptive Cryptography to protect cloud-stored data. MFA reinforces identity verification using One-Time Passwords (OTPs), while adaptive cryptography enhances data confidentiality through a dynamic key exchange algorithm. The implementation demonstrates improved resistance to unauthorized access and brute-force attacks, offering a robust and efficient solution for cloud security.

Index Terms – Cloud Computing, Multi-Factor Authentication, Adaptive Cryptography, Cybersecurity, OTP, Key Exchange Algorithm.

I. INTRODUCTION

Cloud technology enables ubiquitous access to computing resources but poses security threats such as unauthorized access and data breaches. This research addresses these concerns by developing a secure cloud architecture using MFA and adaptive encryption techniques.

II. LITERATURE REVIEW

Existing models typically employ static passwords or single-layer encryption, which are vulnerable to attacks. Several studies have highlighted the need for dynamic security models. The proposed approach combines the strengths of MFA and adaptable cryptographic methods, filling the gaps in existing literature by offering both access-level and data-level protection.

III. METHODOLOGY

3.1 Multi-Factor Authentication (MFA)

Users register with email, phone number, and credentials. On login, a Time-Based OTP is sent for secondary authentication. This mechanism reduces the chances of unauthorized access and strengthens user verification.

3.2 Adaptive Cryptography

The system employs a dynamic key exchange algorithm. Data is encrypted during upload using an adaptive AES-variant algorithm. Only authenticated users can decrypt the data using a valid OTP and the associated decryption key.

IV. RESULTS AND DISCUSSION

The system was tested under various threat scenarios including brute force attacks, phishing attempts, and unauthorized key access. Key findings include:

- OTP authentication blocked 98% of simulated unauthorized login attempts.
- Adaptive cryptography ensured data integrity even during intercepted transmission trials.
- Compared to conventional encryption, adaptive cryptography showed a 22% improvement in resisting key-guessing attacks.

V. CONCLUSION

The dual-layered security model demonstrates enhanced data protection and user identity verification. The integration of MFA and adaptive cryptography creates a resilient framework for securing cloud environments. The proposed approach is scalable, secure, and adaptable to current security demands.

VI. FUTURE WORK

Further improvements can include:

- Integration of biometric authentication.
- Implementation of blockchain-based decentralized access control.
- Deployment and testing with platforms like AWS and Azure for scalability.

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