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Comparative study of cryptography algorithms and its’ applications

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#### **Abstract**

#### This study undertakes a comprehensive empirical evaluation and comparison of prominent symmetric and asymmetric cryptographic algorithms, including prominent block ciphers, public-key ciphers, and cryptographic hash functions. The research aims to quantify the real-world performance of these algorithms on critical metrics such as encryption/decryption throughput, computational efficiency, and resource utilization.

#### To facilitate reproducible experimental benchmarking, the study implements a modular software framework employing standard cryptographic libraries. The framework encompasses algorithms including AES, DES, RSA, ECC, SHA-2, SHA-3, and Blowfish. Rigorous benchmarking examines the impact of parameters including key size, data size, and hardware optimizations on performance.

#### The results demonstrate the superior throughput and computational efficiency of AES for bulk symmetric encryption. Public-key algorithms ECC and RSA exhibit an exponential gap, with ECC delivering substantially higher performance for signatures and key exchange. Newer hash functions provide significant gains, while legacy algorithms display vulnerabilities.

#### In summary, the quantitative benchmarks offer insights into optimal cryptographic configurations for security engineers and researchers. The experimental data largely confirms established complexity analysis of the cryptographic primitives. Further opportunities exist to expand the evaluation to additional algorithms and real-world applications.

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#### **Table of Contents**

#### Abstract 2

#### Acknowledgements 3

#### List of Figures 4

#### List of Tables 5

#### 1 Introduction 6

#### 1.1 Background 6

#### 1.2 Purpose and Scope 7

#### 1.3 Report Structure 8

#### 2 Literature Review 9

#### 2.1 Cryptography Overview 9

#### 2.2 Symmetric Key Algorithms 12

#### 2.3 Asymmetric Key Algorithms 15

#### 2.4 Hash Functions 18

#### 2.5 Prior Benchmarking Studies 20

#### 3 Research Methodology 25

#### 3.1 Selection of Algorithms 25

#### 3.2 Software Libraries and Tools 27

#### 3.3 Hardware Platforms 29

#### 3.4 Performance Metrics 30

#### 3.5 Limitations and Assumptions 32

#### 4 Implementation and Results 35

#### 4.1 Test Environment Setup 35

#### 4.2 AES Benchmarks 37

#### 4.3 ECC Benchmarks 40

#### 4.4 RSA Benchmarks 43

#### 4.5 Comparative Analysis 46

#### 5 Conclusions 49

#### 5.1 Summary of Findings 49

#### 5.2 Recommendations and Limitations 51

#### 5.3 Future Work 53

#### 6 Ethical, Legal and Social Issues 55

#### 6.1 Cryptographic Research Ethics 55

#### 6.2 Laws and Regulations 58

#### 6.3 Societal Impacts 62

#### References 65

#### Appendices 70

#### **List of Figures**

#### **List of Tables**