Data Summary for Quantum Computing and Bitcoin Mining Research

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Date: July 2024

Introduction

This document provides a detailed overview of the data used in the research project analyzing the impact of quantum computing on Bitcoin mining. The data includes metrics related to Bitcoin mining using classical computing methods and estimated theoretical performance under quantum algorithms. The data is sourced from mining statistics, hardware specifications, and energy consumption reports, as well as theoretical models for quantum computing performance.

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1. Classical Bitcoin Mining Data

1.1 Hash Rates of Classical Miners

Miner Model	Hash Rate (TH/s)	Power Consumption (W)	Efficiency (J/TH)
Antminer S19 Pro	110	3250	29.5
Whatsminer M30S++	112	3472	31.0
Antminer T19	84	3150	37.5
Whatsminer M31S+	80	3360	42.0
AvalonMiner 1246	90	3420	38.0

Explanation:

- **Hash Rate (TH/s)**: Number of hashes computed per second (in trillions) by the mining hardware.
- **Power Consumption (W)**: Power used by the miner, measured in watts.

- **Efficiency (J/TH)**: Energy efficiency, calculated as joules required to compute one terahash.

1.2 Bitcoin Network Metrics (Historical Data)

Date	Total Network Hash Rate (EH/s)	Bitcoin Price (USD)	Mining Difficulty	Block Time (minutes)
Jan 2021	150	30,000	20.61 T	10.0
Jan 2022	200	42,000	24.37 T	9.9
Jan 2023	250	16,500	34.09 T	10.3
Jan 2024	320	28,000	47.87 T	9.7

Explanation:

- **Total Network Hash Rate (EH/s)**: The total computational power of the Bitcoin network, measured in exahashes per second.
- **Bitcoin Price (USD)**: Price of Bitcoin at the given date.
- **Mining Difficulty**: A measure of how hard it is to mine a new block. The higher the difficulty, the more computational power is required.
- **Block Time (minutes)**: Average time taken to mine a new block.

1.3 Profitability Analysis

Miner Model	Electricity Cost (USD/kWh)	BTC Mined per Day	Daily Profit (USD)
Antminer S19 Pro	0.05	0.00035	10.50
Whatsminer M30S++	0.06	0.00037	8.75
Antminer T19	0.07	0.00026	5.50
Whatsminer M31S+	0.05	0.00023	3.50
AvalonMiner 1246	0.06	0.00028	4.75

Explanation:

- **Electricity Cost (USD/kWh)**: The cost of electricity used by the miner.
- **BTC Mined per Day**: Bitcoin mined per day based on the miner's hash rate and the network difficulty.
- **Daily Profit (USD)**: Profit made after subtracting electricity costs.

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2. Quantum Computing Performance Estimates

2.1 Grover's Algorithm Applied to Bitcoin Mining

Hashing Algorithm	Classical Complexity (bits)	Quantum Complexity (bits)	Time Improvement Factor
SHA-256	128	64	~2x

Explanation:

- **Classical Complexity**: The security level of SHA-256 under classical computing (128 bits).
- **Quantum Complexity**: The reduced complexity under Grover's algorithm, which reduces security to 64 bits.
- **Time Improvement Factor**: The estimated speedup quantum computers could provide over classical computers in solving mining puzzles.

2.2 Estimated Mining Time Reduction with Quantum Computing

Classical Miner Model	Mining Time (minutes)	Quantum-Enhanced Mining Time (minutes)
Antminer S19 Pro	10	5
Whatsminer M30S++	9.9	4.95
Antminer T19	10.3	5.15
Whatsminer M31S+	9.8	4.9
AvalonMiner 1246	10.1	5.05

Explanation:

- **Mining Time (minutes)**: The average time taken to mine a block under classical computing methods.

- **Quantum-Enhanced Mining Time (minutes)**: The theoretical reduced mining time with quantum algorithms.

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3. Energy Consumption Comparison

Computation Type	Total Hash Rate (EH/s)	Power Consumption (MW)	Total Energy Used (GWh)
Classical Mining (2024)	320	20,000	4,800
Quantum Mining (Est.)	320	10,000	2,400

Explanation:

- **Total Hash Rate (EH/s)**: The total computational power of the Bitcoin network in exahashes per second.
- **Power Consumption (MW)**: The total power consumed by all miners combined, measured in megawatts.
- **Total Energy Used (GWh)**: The total energy consumed over a certain period, measured in gigawatt-hours.

Conclusion

This data provides the foundation for analyzing both classical and quantum Bitcoin mining methods. It highlights the efficiency, profitability, and computational power of classical mining, while also estimating the potential impact quantum computing might have in terms of speedup and energy consumption. The comparison of classical and quantum approaches helps demonstrate the potential future risks that quantum computers could pose to the Bitcoin ecosystem.
