|  |  |  |  |
| --- | --- | --- | --- |
| **Metric** | **Centralized Database** | **Decentralized Database (Blockchain & IPFS)** | **Difference** |
| Average Upload Time (ms) | ~50-70 ms | ~300-500 ms | +567.7% |
| Average Retrieval Time (ms) | ~30-60 ms | ~150-250 ms | +344.4% |
| Storage Redundancy | Limited. Relies on manual backups and replication | High. Data is automatically replicated across nodes | Decentralized networks reduce SPOF risks but require robust synchronization. |
| Availability | High if managed well; can suffer from Single Point of Failure (SPOF) | High, depends on active nodes and network quality | Decentralized systems minimize the risk associated with centralized failures, though maintaing synchronization and a robust network is still a challenage |
| Data Integrity | Ensured via internal controls | Very high. Achieved via hashing and digital signatures | Blockchain ensures stronger integrity through immutability and cryptography |
| Security and Immutability | Strong but vulnerable to tampering if breached | Very high. Data becomes nearly immutable once recorded | Decentralized systems offer superior resistance to fraud and tampering. |

TABLE 4

Storage Performance Comparison.