

**UNIVERSIDAD TÉCNICA DE MACHALA**

Maestría en Software

**Asignatura:**  
Titulación II  
  
  
**Tema:**

**Taller N° 2: Análisis de la Literatura Línea-base**

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**Estudiante:**

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**Marco teórico**

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| **Conceptos** | **Razones para selección** | **Contribuciones para el estudio** |
|  | Google Cloud Platform es un conjunto de servicios e infraestructura que se pueden aplicar a muchos procesos empresariales [1]. | Gracias a todas las herramientas ofrecidas por Google Cloud Platform se puede diseñar arquitecturas de software más seguras y escalables y fáciles de testear y deployar [2]. |
|  | Son un conjunto de pequeños servicios granulares que son integrados a través de API Restful permitiendo el desarrollo y despliegue de aplicaciones de software [3]. | Permite crear una arquitectura con servicios distribuidos funcionando independientemente sin la necesidad de estar en un mismo sitio, aumentando el rendimiento, escalabilidad y seguridad de las aplicaciones [4]. |
|  | Express es el framework más popular y utilizado para aplicaciones backend con nodejs y creación de APIs [5]. | Permite la creación de endspoints restful robustas y seguras para ser utilizado en aplicaciones de software. |
|  | Es una interfaz de programación que permite la interacción con los servicios web de RESTful [6]. | Se implementa en conjunto con los microservicios y servirán para el intercambio de información entre clientes. |
|  | Iota es un DLT de código abierto que nació para solucionar los múltiples inconvenientes del blockchain como son problemas de rendimiento, medio ambiente y alto costos en comisiones [7]. | Con IOTA no existe la dependencia de mineros, alta escalabilidad, cero costos en comisiones y descentralización. Estos aspectos son convenientes para ser utilizados en aplicaciones Fintech [8]. |
|  | IoTex es una infraestructura de blockchain cuya principal característica es su protocolo de consenso en tiempo real llamado Roll-DPoS [9] la cual le permite una comunicación rápida y eficaz entre la blockchain y los millones de dispositivos conectados debido a que este protocolo utiliza un sistema de votación de minería de entre 21 a 50 delegados dentro de la blockchain y a su vez cada blockchain interactúa con diferentes dispositivos [10]. | Gracias a este protocolo se obtiene una red con un rendimiento significativamente más alta y el costo por cada transacción es mucho menor en comparación a otras blockchain [11], haciéndola perfecta para ser utilizado para smart contracts por su rapidez y bajo costo en comisiones. |
|  | Solidity es un lenguaje de programación considerada de alto nivel que hizo posible la creación de las Dapps [12]. | Lenguaje mayormente utilizado para la programación de los smart contracts que generalmente se las utiliza con el EVM de Ethereum. |
|  | Es una plataforma opensource para simplificar el desarrollo de aplicaciones DLT soportando más de 40 protocolos de blockchain y activos digitales en una misma API [13]. | Brinda beneficios como facilidad de utilizar sus apis, prueba del futuro y escalabilidad en el desarrollo de aplicaciones [14]. |
|  | Librería open-source utilizado para proteger cualquier secreto digital de posibles hackers, como contraseñas, privates key etc [15]. | Aumentaría la seguridad al momento de trabajar con contraseñas, llaves privadas o información sensible generadas en transacciones financieras. |
|  | La metodología ABCDE considera dos tipos de integraciones, la del software entre los componentes de los DLT (smart contracts, biblioteca, estructura de datos etc) y los componentes fuera de los DLT como microservicios y aplicaciones web o móvil, naciendo de aquí un completo sistema DApp | Se utilizará la metodología ABCDE porque quedó demostrado que son adecuadas para ser implementadas en aplicaciones basadas en DLT donde los requerimientos varían constantemente por la volatibilidad de los DLT y también porque ofrece una metodología para la correcta utilización de los contratos inteligentes en Dapps. |
|  | Las aplicaciones Fintech gestionan información tanto personal como financiera de los usuarios, por tal motivo, se recomienda que toda información sensible viaje a través de la red, de manera cifrada utilizando algún algoritmo de cifrado ya sea simétrico o asimétrico como puede ser el AES, RSA o un híbrido, desde las aplicaciones cliente hasta los servidores [18]. | Dependiendo del caso, la utilización de cifrados simétricos y asimétricos ayudaría a aumentar la seguridad en aplicaciones clientes. |

**Revisión sistemática de Literatura**

* 1. Preguntas de investigación.

Se elaboraron las siguientes preguntas para la búsqueda de información acerca de las tecnologías de registros distribuidos y su aplicación en las aplicaciones Fintech, la tabla 1 detalla el resultado:

|  |  |
| --- | --- |
| **Preguntas** | **Dimensiones** |
| ¿Qué tecnologías de registros distribuidos se han aplicado en las Fintech para disminuir casos de delitos informáticos? | Técnicas DLT, implementaciones de DLT en Fintech, delitos informáticos |
| ¿Cómo se implementa una arquitectura de microservicios en Google Cloud basado en el estándar de seguridad X.805 para garantizar la seguridad de extremo a extremo en aplicaciones de software? | Estándar de seguridad X.805, microservicios cloud. |
| ¿Cómo se implementa microservicios para registros transaccionales de coste cero con IOTA Tangle e identidad digital mediante verificación biométrica y NFT con Tatum para incrementar la probabilidad de ganar disputas financieras en casos de fraudes en transacciones financieras? | IOTA Tangle, identidad digital con NFT, Tatum. |
| ¿Cómo se implementa smarts contracts en microservicios con IOTEX blockchain para disminuir el porcentaje de casos de estafas en transacciones financieras? | Smarts contracts, IOTEX blockchain. |

Tabla 1: Preguntas de investigación para el SLR

***Fuente:*** *Elaboración propia*

* 1. Proceso de búsqueda.

Dentro del proceso de búsqueda, se seleccionaron las siguientes bases de datos propuestas por el instructivo de titulación de la maestría:

* IEEE Xplore
* Science Direct
* Taylor and Francis.
* Springer
  1. Criterios de inclusión y exclusión.

Dentro de los criterios de exclusión se consideraron los siguientes parámetros:

* Estudios duplicados.
* Estudios que no se incluyeron en las bases de datos de selección.
* Resultados de libros, cursos-

Dentro de los criterios de inclusión se consideraron los siguientes parámetros:

* Solo estudios primarios.
* Solo investigaciones con resultados.
* Escritos en inglés y español.
* Estudios de los últimos 5 años.
* Estudios de aplicación de DLT en aplicaciones financieras o Fintech.
* Deben ser journals o conference paper.
* Temas principales: DLT y ciberseguridad.
  1. Cadena de búsqueda.

La cadena de búsqueda se elaboró en base a las preguntas de investigación y se tomó en cuenta operadores lógicos como AND y OR y se seleccionó filtrando por aspectos como el título, palabras claves, metadatos etc, quedando de la siguiente manera:

*“Cybersecurity in Fintech” and (“Distributed Ledger Technologies” or “Blockchain” or “Tangle” or “Smart Contracts” or “IOTA” or “IOTEX”)*

* 1. Selección de estudios y fase de revisión.

Para la selección de estudios se usó las bases de datos y cadena de búsqueda previamente seleccionadas y formada, la tabla 2 muestra el resultado de este proceso.

|  |  |
| --- | --- |
| **Bases de datos** | **Total de artículos encontrados** |
| IEEE Xplorer | 354 |
| Science Direct | 188 |
| Springer | 16 |
| Taylor and Francis | 72 |
| **Total** | 630 |

Tabla 2: Total de artículos encontrados

***Fuente:*** *Elaboración propia*

En base a la tabla anterior se realizó el siguiente cuadro estadístico.

***Fuente:*** *Elaboración propia*

En base al total de artículos encontrados en las diferentes bases de datos científicas, se realizó la fase de revisión partiendo del total de artículos, seguido de los filtrados de remover artículos duplicados, leer abstracts y títulos, aplicar criterios de exclusión e inclusión y finalmente leer el texto completo, la tabla 3 muestra el resultado de esta fase de revisión.

Tabla 3: Fase de revisión del SLR

***Fuente:*** *Elaboración propia*

* 1. Presentación de resultados.

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| --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Título | Ref. | Base de datos | Tipo de artículo | SJR Cuartil | Año | País |
| 1 | A $10 million question and other cybersecurity-related ethical dilemmas amid the COVID-19 pandemic | [3] | Science Direct | Jorunal | Q1 | 2021 | United Kingdom |
| 2 | División financiera del trabajo en sistemas de pagos en Argentina y Brasil | [1] | Redalyc | Journal | Q4 | 2019 | Venezuela |
| 3 | Distributed Ledger Technology (DLT): The Beginning of a Technological Revolution for Blockchain | [5] | IEEE | Conferences paper | Q1 | 2020 | United States |
| 4 | Examining factors that boost intention and loyalty to use Fintech post-COVID-19 lockdown as a new normal behavior | [8] | Science Direct | Journal | Q1 | 2021 | Netherlands |
| 5 | The effect of COVID-19 on long memory in returns and volatility of cryptocurrency and stock markets | [9] | Science Direct | Journal | Q1 | 2021 | United Kingdom |
| 6 | Did COVID-19 change spillover patterns between Fintech and other asset classes? | [10] | Science Direct | Journal | Q2 | 2021 | Netherlands |
| 7 | Cybercrime in a time of coronavirus | [11] | Science Direct | Journal | Q2 | 2020 | United Kingdom |
| 8 | Cybersecurity Vulnerabilities in FinTech | [12] | Springer | Book | ------- | 2021 | Switzerland |
| 9 | Cybersecurity Threats in FinTech | [13] | Springer | Book | ------- | 2021 | Switzerland |
| 10 | Managing IoT devices using blockchain platform | [14] | IEEE | Conferences paper | Q2 | 2017 | United States |
| 11 | Investing during a Fintech Revolution: Ambiguity and return risk in cryptocurrencies, | [15] | Science Direct | Journal | Q1 | 2021 | Netherlands |
| 12 | Smart contracts vulnerabilities: a call for blockchain software engineering? | [16] | IEEE | Conferences paper | Q1 | 2018 | United States |
| 13 | Blockchain-enabled fraud discovery through abnormal smart contract detection on Ethereum | [17] | Science Direct | Journal | Q1 | 2021 | Netherlands |
| 14 | To Blockchain or Not to Blockchain: That Is the Question | [19] | IEEE | Journal | Q2 | 2018 | United States |
| 15 | Affordances, experimentation and actualization of FinTech: A blockchain implementation study | [20] | Science Direct | Journal | Q1 | 2019 | Netherlands |
| 16 | Problems of Using Redactable Blockchain Technology | [21] | Science Direct | Journal | Q2 | 2021 | Netherlands |
| 17 | The market for bitcoin transactions | [22] | Science Direct | Journal | Q1 | 2021 | Journal of International Financial Markets |
| 18 | Renewable Energy Will Not Solve Bitcoin’s Sustainability Problem | [25] | Science Direct | Journal | Q1 | 2019 | United States |
| 19 | The impact of the shutdown policy on the asymmetric interdependence structure and risk transmission of cryptocurrency and China’s financial market | [26] | Science Direct | Journal | Q2 | 2021 | United States |
| 20 | A survey on applications and security issues of blockchain technology in business sectors | [27] | Science Direct | Journal | Q2 | 2021 | United Kingdom |
| 21 | Securing Logs of a System - An IoTA Tangle Use Case | [28] | IEEE | Conferences paper | Q2 | 2020 | United States |
| 22 | Blockchain and the built environment: Potentials and limitations | [30] | Science Direct | Journal | Q1 | 2019 | Netherlands |
| 23 | Blockchain technology: Business, strategy, the environment and sustainability | [31] | Science Direct | Journal | Q1 | 2019 | United Kingdom |
| 24 | Evaluation of Performance and Security of Proof of Work and Proof of Stake using Blockchain | [32] | IEEE | Conferences paper | Q1 | 2021 | India |
| 25 | Evaluation of Proof of Work (POW) Blockchains Security Network on Selfish Mining | [33] | IEEE | Conferences paper | Q2 | 2018 | United States |
| 26 | Proof of Contribution: A Modification of Proof of Work to Increase Mining Efficiency | [34] | IEEE | Conferences paper | Q1 | 2018 | United States |
| 27 | Analysis of information security in the PoW (Proof of Work) and PoS (Proof of Stake)blockchain protocols as an alternative for handling confidential nformation in the public finance ecuadorian sector | [35] | IEEE | Conferences paper | Q1 | 2021 | United States |
| 28 | An Analysis of Routing Attacks Against IOTA Cryptocurrency | [36] | IEEE | Conferences paper | Q2 | 2020 | United States |
| 29 | A Blockchain Solution based on Directed Acyclic Graph for IoT Data Security using IoTA Tangle | [37] | IEEE | Conferences paper | Q1 | 2020 | United States |
| 30 | Iota Tangle: A cryptocurrency to communicate Internet-of-Things data | [38] | Science Direct | Journal | Q1 | 2020 | Netherlands |
| 31 | Characterizing IOTA Tangle with Empirical Data | [39] | IEEE | Conferences paper | Q1 | 2020 | United States |
| 32 | Iota vs. Ripple: A Comparison Inside An Economy of Things Architecture for Industry 4.0 | [40] | IEEE | Conferences paper | Q1 | 2020 | United States |
| 33 | A systematic literature review of blockchain cyber security | [42] | Science Direct | Journal | Q1 | 2020 | China |
| 34 | The state of play of blockchain technology in the financial services sector: A systematic literature review | [43] | Science Direct | Journal | Q1 | 2020 | United Kingdom |
| 35 | Blockchain technology in the future of business cyber security and accounting | [44] | Taylor and Francis | Journal | Q1 | 2020 | United Kingdom |
| 36 | An Overview of the Artificial Intelligence Applications in Fintech and Regtech | [51] | Springer | Book | ------ | 2021 | Shingapore |
| 37 | Emergence of Fintech and cybersecurity in a global financial centre: Strategic approach by a regulator | [52] | Taylor and Francis | Journal | Q3 | 2017 | United Kingdom |
| 38 | Bitcoin Concepts, Threats, and Machine-Learning Security Solutions | [56] | IEEE | Journal | Q1 | 2018 | United States |
| 39 | Fintech and Sustainability: Do They Affect Each Other? | [57] | Science Direct | Journal | Q2 | 2021 | Switzerland |
| 40 | A systematic review of blockchain | [58] | Springer | Journal | Q2 | 2019 | Germany |
| 41 | Ethereum smart contracts: Analysis and statistics of their source code and opcodes | [60] | Science Direct | Journal | Q1 | 2020 | United States |
| 42 | A security framework for Ethereum smart contracts | [61] | Science Direct | Journal | Q1 | 2021 | Netherlands |
| 43 | Performance evaluation of permissioned blockchains for financial applications: The ConsenSys Quorum case study | [63] | Science Direct | Journal | Q1 | 2021 | United States |
| 44 | A survey of breakthrough in blockchain technology: Adoptions, applications, challenges and future research | [64] | Science Direct | Journal | Q1 | 2021 | Netherlands |
| 45 | Permissioned blockchain frameworks in the industry: A comparison | [65] | Science Direct | Journal | Q1 | 2021 | South Korea |
| 46 | Blockchain technology - Is it hype or real in the construction industry | [67] | Science Direct | Journal | Q1 | 2020 | Netherlands |
| 47 | Banking with blockchain-ed big data | [68] | Taylor and Francis | Journal | Q2 | 2018 | United Kingdom |
| 48 | Recent advances in consensus protocols for blockchain: a survey | [69] | Springer | Journal | Q2 | 2020 | Netherlands |
| 49 | Blockchain 3.0 applications survey | [71] | Science Direct | Journal | Q1 | 2020 | United States |
| 50 | Privacy aware IOTA ledger: Decentralized mixing and unlinkable IOTA transactions, | [73] | Science Direct | Journal | Q1 | 2019 | Netherlands |
| 51 | Applicability and Appropriateness of Distributed Ledgers Consensus Protocols in Public and Private Sectors | [74] | IEEE | Journal | Q1 | 2019 | United States |
| 52 | A survey on consensus methods in blockchain for resource-constrained IoT networks | [75] | Science Direct | Journal | Q1 | 2020 | United States |
| 53 | Unification of Blockchain and Internet of Things (BIoT): requirements, working model, challenges and future directions | [76] | Springer | Journal | Q2 | 2021 | Netherlands |
| 54 | Blockchain for IoT-based smart cities: Recent advances, requirements, and future challenges | [77] | Science Direct | Journal | Q1 | 2021 | United States |
| 55 | Ethereum smart contract security research: survey and future research opportunities | [78] | Springer | Journal | Q2 | 2021 | United States |
| 56 | FinTech payments in the era of COVID-19: Factors influencing behavioral intentions of “Generation X | [79] | Science Direct | Journal | Q2 | 2021 | Netherlands |
| 57 | Cybersecurity Attacks During COVID-19: An Analysis of the Behavior of the Human Factors and a Proposal of Hardening Strategies | [83] | Springer | Journal | Q1 | 2021 | United States |
| 58 | A Multivocal Literature Review on Growing Social Engineering Based Cyber-Attacks/Threats During the COVID-19 Pandemic: Challenges and Prospective Solutions | [84] | IEEE | Journal | Q1 |  | United States |
| 60 | Blockchain adoption: A value driver perspective | [85] | Science Direct | Journal | Q1 | 2019 | United Kingdom |
| 61 | Survey on IoT security: Challenges and solution using machine learning, artificial intelligence and blockchain technology | [86] | Science Direct | Journal | Q1 | 2020 | United States |
| 61 | Blockchain for Industry 4.0: A Comprehensive Review | [87] | IEEE | Journal | Q1 | 2020 | United States |
| 63 | 20 years of research in microfinance: An information management approach | [88] | Science Direct | Journal | Q1 | 2019 | United Kingdom |
| 64 | Agile development in the cloud computing environment: A systematic review | [90] | Science Direct | Journal | Q2 | 2018 | Netherlands |
| 65 | Blockchain-based identity management systems: A review | [91] | Science Direct | Journal | Q1 | 2020 | United States |
| 66 | Construction quality information management with blockchains | [92] | Science Direct | Journal | Q1 | 2020 | Netherlands |
| 67 | Distributed ledger technology: Its evolutionary path and the road ahead | [93] | Science Direct | Journal | Q1 | 2021 | Netherlands |
| 68 | Distributed ledger technology as a catalyst for open innovation adoption among small and medium-sized enterprises | [94] | Science Direct | Journal | Q2 | 2021 | United Kingdom |
| 69 | Blockchain for Cybersecurity in Smart Grid: A Comprehensive Survey | [95] | IEEE | Journal | Q1 | 2021 | United States |
| 70 | A critical review on using blockchain technology in education domain, | [96] | Springer | Book | ----- | 2021 | Singapore |
| 71 | The convergence of IoT and distributed ledger technologies (DLT): Opportunities, challenges, and solutions | [97] | Science Direct | Journal | Q1 | 2021 | United States |
| 72 | A systematic review of blockchain scalability: Issues, solutions, analysis and future research, | [98] | Science Direct | Journal | Q1 | 2021 | United States |
| 73 | A survey of Blockchain consensus algorithms: mechanism, design and applications | [99] | Springer | Journal | Q1 | 2020 | China |
| 74 | Security and blockchain convergence with Internet of Multimedia Things: Current trends, research challenges and future directions | [100] | Science Direct | Journal | Q1 | 2021 | United States |
| 75 | The blockchain: State-of-the-art and research challenges | [101] | Science Direct | Journal | Q1 | 2019 | Netherlands |
| 76 | A survey on privacy protection in blockchain system | [102] | Science Direct | Journal | Q1 | 2019 | United States |
| 77 | Blockchain for Internet of Things: A Survey | [103] | IEEE | Journal | Q1 | 2019 | United States |
| 78 | Blockchain Security by Design Framework for Trust and Adoption in IoT Environment | [104] | IEEE | Conferences Journal | Q1 | 2019 | United States |
| 79 | Public and private blockchain in construction business process and information integration | [105] | Science Direct | Journal | Q1 | 2020 | Netherlands |
| 80 | Integration of Blockchain and Cloud of Things: Architecture, Applications and Challenges | [107] | IEEE | Journal | Q1 | 2020 | United States |
| 81 | Analysis of smart contracts balances | [110] | Science Direct | Journal | Q1 | 2021 | Netherlands |
| 82 | Tokenization of sukuk: Ethereum case study | [111] | Science Direct | Journal | Q2 | 2022 | Netherlands |
| 83 | A Comprehensive Survey on Attacks, Security Issues and Blockchain Solutions for IoT and IIoT | [117] | Science Direct | Journal | Q1 | 2020 | United States |
| 84 | IOTA: Feeless and Free, | [118] | IEEE | Journal | Q1 | 2019 | United States |
| 85 | Issues and Trends in Information Security Policy Compliance | [124] | IEEE | Conferences Journal | Q1 | 2019 | United States |
| 86 | Information Security in the Management of Personnel in a Modern Organization | [125] | IEEE | Conferences Journal | Q1 | 2020 | United States |
| 87 | Problems of Implementing Information Security Management Systems | [126] | IEEE | Conferences Journal | Q1 | 2020 | United States |
| 88 | Information Security Protection in Software Testing | [127] | IEEE | Conferences Journal | Q1 | 2018 | United States |
| 89 | A survey on cybersecurity awareness concerns, practices and conceptual measures | [129] | IEEE | Conferences Journal | Q1 | 2019 | United States |
| 90 | Internet of Things (IoT) Cybersecurity Research: A Review of Current Research Topics | [130] | IEEE | Journal | Q1 | 2019 | United States |
| 91 | Cyber Security Threats and Vulnerabilities: A Systematic Mapping Study | [132] | Springer | Journal | Q2 | 2020 | Germany |
| 92 | On cloud security requirements, threats, vulnerabilities and countermeasures: A survey | [134] | Science Direct | Journal | Q1 | 2019 | Ireland |
| 93 | Data Security and Privacy Protection for Cloud Storage: A Survey | [135] | IEEE | Journal | Q1 | 2020 | United States |
| 94 | Forty years of attacks on the RSA cryptosystem: A brief survey | [136] | Taylor and Francis | Journal | Q3 | 2019 | United Kingdom |
| 95 | Development of modified AES algorithm for data security | [137] | Science Direct | Journal | Q2 | 2016 | Germany |
| 96 | Microservices: The Evolution and Extinction of Web Services | [142] | Springer | Book | ------- | 2019 | Italy |
| 97 | Information security maturity model: A best practice driven approach to PCI DSS compliance | [146] | IEEE | Conferences Journal | Q1 | 2016 | United States |

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