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WEB3 TECHNOLOGIES IN AFFILIATE MARKETING SYSTEMS

Abstract: The paper examines the shortcomings of centralized affiliate marketing systems and proposes Web3 technologies as an alternative. Research questions are formulated regarding methods and models of integrating Web3 into affiliate marketing systems. The research methodology is outlined.

Keywords: Web3, blockchain, affiliate marketing, smart contracts.

Introduction

Affiliate marketing, another name for partner marketing, is an important component of modern digital business models that unites the interests of marketplaces, merchants, advertisers, and independent partners, webmasters, publishers, other names of affiliates into a single ecosystem. This marketing model allows companies to pay for specific consumer actions (sales, clicks, registrations, etc.), which makes it an effective performance marketing tool: affiliates receive rewards only when they achieve a predetermined result, and advertisers can optimally allocate budgets by investing in channels with proven effectiveness [1]. This approach stimulates healthy competition between different web resources, bloggers, and other participants in the digital ecosystem as they strive to increase traffic attendance and performance. Thanks to the development of tracking and analytics technologies, affiliate programs can be easily scaled: global platforms, affiliate marketing systems, another name for affiliate networks, have appeared, capable of simultaneously serving thousands of partners and managing huge data sets, tracking user behavior. This ensures the rapid growth of the global affiliate marketing market, and the annual dynamics in billions of dollars are shown in Figure 1 [2].

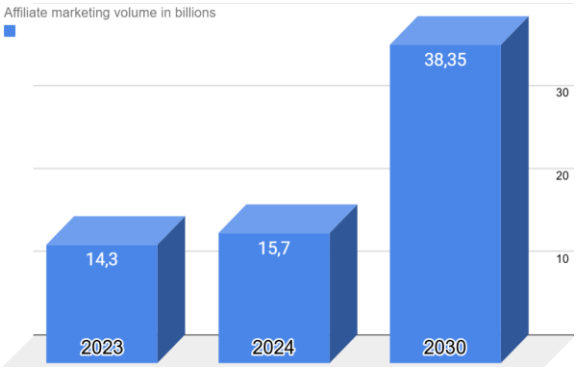

Figure 1. Dynamics of the affiliate marketing market volume in billions of dollars

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This dynamic is driven by brands' desire to attract a loyal audience through recommendations from famous bloggers, influencers, thematic sites, and other digital channels, which builds consumer trust and significantly increases the rate of receiving targeted action from Internet users, i.e., conversion. Eighty-one percent of global and local brands represented on the Internet use affiliate marketing approaches to increase awareness and attract new customers [3]. At the same time, affiliate marketing plays an important role in stimulating innovation in the field of analytical tools, CRM solutions, automation platforms, and payments. Its impact on the digital economy is manifested in the creation of demand for affiliate services, which leads to the emergence of new jobs (specialized marketing agencies and freelance marketers) and also contributes to the development of small and medium-sized businesses that gain access to scalable advertising channels, strengthening the e-commerce ecosystem as a whole [2]. Trust, transparency, and automation are becoming key factors in the growth of this market, especially with the spread of fintech solutions and new tracking technologies that allow for more effective control of financial flows and guarantee transparency of transactions between advertisers and affiliates.

At the same time, such rapid development requires in-depth scientific research to identify optimal models and methods for integrating technologies, managing large amounts of data, and building long-term strategies that will ensure stable and sustainable growth of the industry. In this context, this article will consider the integration of Web3 technologies into affiliate marketing systems, analyze existing research in this area, and outline the issues and research questions for further research.

Characteristics of Traditional Affiliate Marketing Systems

The rapid development of the affiliate marketing market, in particular its impact on the formation of brand awareness and trust and the effectiveness of digital advertising campaigns, necessitates the need for effective and transparent technological platforms - affiliate marketing systems. These platforms not only act as an “intermediary” between advertisers and affiliates, aggregating requests and offers from both sides, but also provide a complex infrastructure for tracking, analytics, commission management, and fraud prevention [4]. Affiliate marketing systems function as technological platforms that combine several key components and provide a full cycle of interaction between the advertiser and the affiliate [4]. A list of the main modules of an affiliate network is given in Figure 2.

First of all, such a system contains a high-performance tracking and analytics collection mechanism, thanks to which each transition, click, or other targeted user action is recorded. Since real-time tracking requires precise fixation of parameters (traffic source identifier, promotional code, unique cookie, etc.), the system implements complex attribution algorithms and distribution of traffic attracted by affiliates between advertisers.

The following essential component is the analytics and statistics block, where the accumulated data is processed and segmented to provide the advertiser and affiliate with detailed reports on clicks, sales, conversion rates, or average cost of customer acquisition. From there, participants get the opportunity to adjust marketing strategies, change advertising materials, or redistribute budgets.

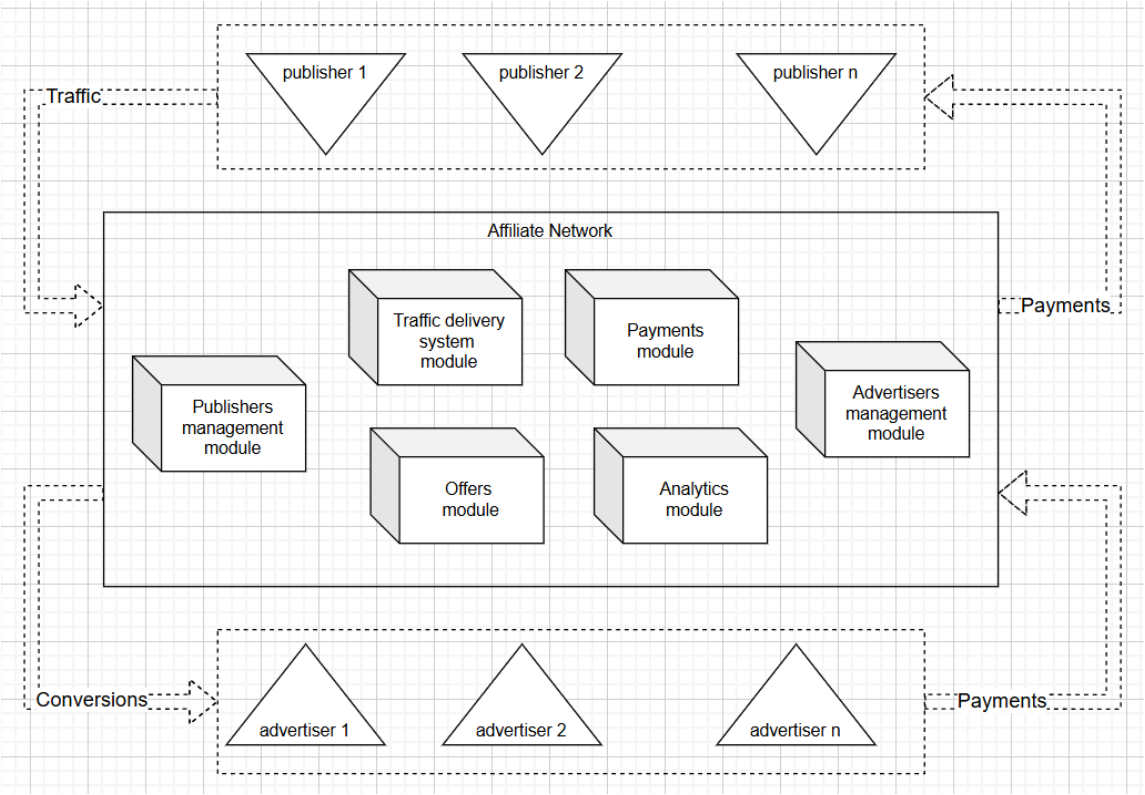

Figure 2. Diagram of key modules of the affiliate network

A commission management mechanism works in parallel with tracking and analytics. It defines the model of interaction between the advertiser and the affiliate: a fixed cost per action (CPL/CPA), a percentage of sales (CPS), or a mixed approach [5]. Then, the affiliate marketing system automatically or semi-automatically charges affiliates commissions as soon as the fact of a successful conversion is confirmed or after the established period for returns and cancellations has passed. All this is accompanied by built-in validation procedures: the system can track repetitive click patterns and anomalous behavior, contact external fraud monitoring services to detect possible cheating, and stop payments for illegitimate traffic. An important component is also the billing module, which ensures the smooth payment of due commissions: accrual data comes from tracking and verified conversions, after which integrated payment gateways allow you to transfer funds to publishers' accounts or electronic wallets while simultaneously registering all these transactions in the advertiser's financial registers. The final stage includes the generation of

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regular and custom analytical reports, which contain a detailed breakdown of total costs, profits, and aggregate coefficients; this allows all stakeholders to identify budget overspending on certain channels timely or, conversely, to highlight the most productive sources of traffic. Thus, the main processes in affiliate marketing systems — from setting up an advertising campaign and creating unique affiliate links to deep analytics and payments to publishers — are organized in a single platform, which allows you to scale the business model, ensure transaction transparency, and maintain effective interaction between the advertiser and the publisher.

Problem statement

Since traditional affiliate marketing systems are often based on a centralized structure, where the main controlling role belongs to one platform or network, which sets the rules and norms of interaction between advertisers and affiliates, the dependence of participants on the intermediary is created, which can affect the availability and terms of cooperation. For example, the platform can unilaterally change the commission policy, introduce new restrictions, delay payments, or give preference to specific partners. All these actions lead to a lack of transparency and raise concerns about the fairness of revenue distribution [6].

One common drawback is hidden or seemingly unaccounted-for commissions, which can include service fees, payment gateway fees, or other additional costs. For affiliates, this often comes as an unpleasant surprise when the payouts received turn out to be lower than expected, and advertisers face inflated costs for customer acquisition. The high degree of opacity regarding the actual commission structure prevents participants from planning budgets accurately and can lead to inefficient use of resources, with individual partners under-rewarded and advertisers overpaid.

Distrust in payments also arises from the lack of a clear system of guarantees and independent verification of the actions performed. When all information about clicks, purchases, or registrations is stored on central servers, service providers can manipulate data or delay payments for various reasons - technical, financial, or even intentional. Participants cannot quickly check the commission calculation's accuracy and its provision's legality or, conversely, its rejection. This gives rise to a feeling of insecurity in the reliability and objectivity of the platform and in some cases, leads to refusal of cooperation [6].

In addition, traditional systems create a rather complex chain of interaction, where tracking, validation of actions, formation of payments, and data transfer to accounting systems can go through several intermediate tools and services. Such a multi-stage process complicates auditing and requires coordination of data format configuration of numerous APIs and integration modules. The result is increased operating costs and the risk of errors, as well as an

extension of the time required for publishers to receive rewards. All this reduces the overall flexibility and transparency of business processes, hampering the development of affiliate programs themselves and reducing the efficiency of cooperation between participants.

In view of these challenges, the integration of Web3 technologies in affiliate marketing systems appears as a promising alternative to centralized approaches. In particular, blockchain provides an open and immutable transaction register in which each transition or other targeted action is automatically recorded and accessible to all interested parties. This eliminates the need for trust in a single central intermediary: advertisers and affiliates can independently verify the transparency of data and the fairness of commissions [5]. In addition, smart contract mechanisms make it possible to program the payment process so that funds are transferred to affiliates only if predefined conditions are met, eliminating the possibility of unilateral manipulation or delays [7]. In such conditions, hidden fees and service charges to the intermediary are excluded since the mechanism for determining the remuneration is laid down in the open code of the contract, which all participants can verify. In addition, the Web3 architecture allows you to avoid a complex chain of integrations and numerous intermediate tools: instead of transferring data about clicks and targeted actions from one service to another, all operations can be reflected in the blockchain, which acts as a single source of truth and audit. This simplifies the process of information reconciliation, reduces the likelihood of errors and allows affiliates to quickly track the stage of their payments. The result is improved transparency and reduced operating costs since there is no data duplication and no need for additional external services.

At the same time, the question of optimal methods and models for integrating Web3 technologies into affiliate marketing systems remains open, since each platform or business environment may have its own characteristics and requirements. Therefore, conducting targeted research aimed at developing formal approaches, prototyping and evaluating the effectiveness of decentralized solutions is a necessary step for the widespread and successful implementation of these technologies in the industry.

Analysis of existing research

Web3 is a relatively new paradigm, and many companies and researchers are still learning the basic concepts of distributed ledger, smart contracts, and decentralized data storage, so research into integrating Web3 technologies into affiliate marketing is only just beginning. One such study is Marten Weijer’s «Providing Trust in Affiliate Marketing through Blockchain Technology» [8].

The author, having conducted a preliminary analysis of the literature and studied existing solutions in affiliate marketing, formed a number of key problems (Pain Points) that most often arise in the interaction between a merchant and a publisher. Among the most serious challenges were the lack of transparency of operations, frequent delays in payments

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of affiliate commissions, and significant risks of fraud. To check how relevant these problems are and how they are directly reflected in real practice, the author conducted a number of semi-structured interviews with industry experts. During these conversations, respondents confirmed that the listed Pain Points significantly affect the work of affiliate platforms, as they complicate control over traffic and cash flows and also reduce the level of trust between market participants. The results of the interviews allowed the author to clarify and supplement the initial list of Pain Points, identifying only those that truly reflect the main problems of modern centralized affiliate solutions. The final list of confirmed problems is shown in Table 1, which provides a focused picture of the key shortcomings of the system and serves as a basis for further research into methods and models for integrating Web3 technologies into affiliate marketing systems [8].

Table 1.

Pain Points for Affiliate Marketing Industry

Pain point number	Description
PP1	There is a lack of transparency from the affiliate network toward both the publisher and the merchant
PP2	There is a lack of trust between the merchant and the publisher
PP3	There is a lack of communication between the merchant and the publisher
PP4	There is a lack of external monitoring validation
PP5	The entry barriers are unknown
PP6	Unable to detect dishonest merchants
PP7	Unable to detect invalid tracking code
PP8	Unable to detect dishonest affiliate networks
PP9	Vulnerable to publisher cookie stuffing
PP10	Vulnerable to publisher click spamming
PP11	Negative impact on the brand
PP12	The payments for the publishers are delayed
PP13	The payment cycle is inefficient
PP14	Unable for the publisher to verify the rejected transactions
PP15	The affiliate network as a single point of failure

The research began with a review of existing approaches to blockchain technologies and affiliate marketing, after which a methodological framework was formed using Design Science, which combined literature analysis, validation through semi-structured interviews, and building a system architecture (iStar 2.0, Data Flow Diagram). As a result, the author proposed a conceptual solution in the System Blueprint format, which contains a description of user stories, use case diagrams, and a functional model that reflects the interaction between the main participants - merchant, publisher, and customer [8].

This work is quite abstract: it demonstrates, at the level of global modules, how Web3 technologies can be integrated to increase transparency and automate processes. However, the author does not delve into specific methods or models for integrating Web3 technologies into affiliate marketing systems, limiting himself to a general description of the structure and focusing on the potential of blockchain solutions without detailed consideration of cryptographic protocols, smart contracts, optimization methods, or deployment aspects.

Formulation of new research questions

The lack of a thorough analysis of methods and models for integrating Web3 technologies into affiliate marketing systems and the focus mainly on the high-level potential of blockchain prompts the formulation of more specific research questions:

1. How can blockchain, decentralized storage (IPFS, Filecoin, DHT), and data management methods be integrated into affiliated platforms to provide reliable, secure, and scalable traffic management and associated metadata?

2. How can the use of modern cryptographic methods, in particular zero-knowledge protocols, protect participant data (advertiser/affiliate) and at the same time, verify the correctness of transactions without disclosing confidential information?

3. What existing affiliate marketing processes can be optimized or redesigned through systems analysis and design based on Web3 technologies, and how will this impact the transparency and efficiency of the industry?

4. What existing processes of affiliate marketing systems can be optimized or redesigned through systems analysis and design based on Web3 technologies, and how will this affect the transparency and efficiency of the industry?

5. What design and formal verification approaches (TLA+, Alloy) can be applied to create smart contracts that implement affiliate payout logic while avoiding errors and vulnerabilities during the design phase?

6. What optimization algorithms (queuing theory, mathematical programming) are most efficient for generating payout schedules in a multi-participant network, minimizing delays and operational costs?

7. How can object-oriented (OO) modeling be integrated into decentralized application (dApp) development to unify affiliate marketing systems' data structure and business processes?

In order to consistently answer these questions, it becomes necessary to define and implement specific research tasks:

1. Analysis of existing affiliate marketing models and Web3 characteristics. This stage examines existing affiliate marketing systems solutions, identifies key shortcomings of centralized approaches, and assesses the potential of decentralized technologies to increase system reliability and scalability.

2. In-depth literature review. The goal is to decompose the main research objective into sub-objectives and formulate specific decentralized data storage tools, cryptographic

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methods, smart contract design approaches, and optimization mechanisms that will respond to the outlined research questions.

3. Development of a Web3-based traffic processing and management system. This stage integrates decentralized storage technologies (IPFS, Filecoin, DHT) with graph analysis methods to detect fraudulent patterns and increase network reliability.

4. Development of financial process automation tools. This includes the development of smart contracts using zero-knowledge protocols, the application of formal verification methods (TLA+, Alloy), and the integration of optimization algorithms (queuing theory, mathematical programming) for effective planning and distribution of payments.

5. Optimization of communication processes of the affiliate platform. Conducting a systematic analysis of existing interaction flows and developing OO models to unify the data structure and increase the transparency of business processes will increase trust and mutual understanding among participants.

6. Testing and implementation of developed solutions. The created concepts and prototypes are tested on test blockchain networks, and the results are compared with traditional centralized approaches, allowing the identification of the system's advantages and preparing recommendations for further implementation.

Conclusions

Summarizing the above, we can conclude that traditional affiliate systems built on centralized platforms exhibit a number of significant shortcomings, from a lack of transparency in interactions and unpredictable commissions to distrust in payments and an overly complex chain of integrations. This leads to a decrease in the effectiveness of affiliate marketing as a whole and slows down the implementation of innovations. The proposed alternative in the form of Web3 technologies (blockchain, smart contracts, decentralized data storage) makes it possible to eliminate a number of the problems mentioned above: first, blockchain creates an open and immutable transaction database that makes it impossible to manipulate results; second, smart contracts provide automated payments and increase trust between participants; third, distributed data storage simplifies auditing and reduces the costs of integrating and verifying information.

At the same time, an analysis of existing research, including Marten Weijer's work, «Providing Trust in Affiliate Marketing through Blockchain Technology» shows that the scientific space still lacks detailed methodological and model developments on how to implement Web3 components in affiliate platforms. The authors mainly focus on the high-level potential of the blockchain without considering in-depth cryptographic mechanisms, the possibility of optimizing payouts, or the nuances of OO modeling of decentralized applications (dApps).

In this regard, the article formulates a number of specific research questions covering both cryptographic aspects and prospects for the development and formal verification of

smart contracts, interaction analysis using graph theory, payment process optimization, and object-oriented design. For their phased solution, a methodological approach is proposed, which includes:

- analysis of existing models;
- in-depth literature review;
- development of a Web3-based system with decentralized storage tools and graph analysis mechanisms;
- implementation of cryptographic algorithms and formal verification methods.

Thus, further integration of Web3 technologies into affiliate marketing systems requires comprehensive scientific and applied research, which will be based on an integrated approach, from defining the theoretical foundations of decentralization and cryptography to developing and testing real prototypes. In the future, the potential results obtained can significantly expand the capabilities of the industry, offering more transparent payment mechanisms, increased trust, and optimized processes, which, ultimately, will contribute to the sustainable development and scaling of affiliate programs in the modern digital economy.

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